

BIDDING AND CONTRACT DOCUMENTS

FOR

SOM ED1 DATA CENTER RENOVATION

PROJECT NO. 950590

CONTRACT NO. 950590-LF-2021-94



**City of Riverside, County of Riverside
California**

December 21, 2021

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CERTIFICATION

SOM ED 1 Data Center Renovation

Bidding Documents Prepared By:

Company Name: Moreto Mathison & Associates
1315 S. Grand Ave. #202
(Street Address)
Glendora, CA 91740
(City, State & Zip Code)

Signed:  Date: 10/26/21
(Signature of an Officer of the Firm Named Above)
David Mathison, Vice President
(Print Name & Title)

Certification:



(Affix professional registration stamp of the person named above with signature and expiration date.)

ADVERTISEMENT FOR BIDS

Subject to conditions prescribed by the University of California, Riverside, sealed bids for a lump sum contract are invited for the following Project:

SOM ED1 DATA CENTER RENOVATION
PROJECT NO. 950590
CONTRACT NO. 950590-LF-2021-94
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CALIFORNIA

In the Data Center, at the School of Medicine Education 1 Building, this project will make tenant improvements that will facilitate adding users and new equipment to the space. Upgrades include changes to the infrastructure, IT equipment and physical conditions of the room. Infrastructure upgrades to the electrical and mechanical systems are aimed at improving efficiency and providing more capacity. New IT equipment includes a cable tray system and technology racks installed in newly designed layout. Upgrade interior finishes are to the flooring and ceiling. Because some of the networks located in this data center are critical to campus, the work for this project will need to happen concurrently while keeping the critical networks online. This project partners with the ITS (Information Technology Solutions) department for assistance and guidance through this process.

Bidding and Contract Documents will be available at **2:00 PM**, on **Tuesday, December 21, 2021**, upon request by sending an email to kara.longtin@ucr.edu. Interested parties must use the following in the subject header:

950590 SOM ED1 Data Center Renovation – Request for Bid Documents

PRE-BID CONFERENCE & SITE VISIT

A mandatory Pre-Bid Zoom conference call will take place on **Tuesday, January 4, 2022** beginning promptly at **1:00 PM**. Only bidders who participate in the Pre-Bid conference will be allowed to bid on the Project as prime contractors. For further information, including the Zoom Meeting ID, interested bidders must contact the Project's Contract Administrator, **Kara Longtin** via email, at kara.longtin@ucr.edu and must use the project's number and name in the subject header to request the Zoom information.

At this time, there are no plans for a site visit, if a bidder would like access to the site, this will be done by appointment only and through the coordination of the Contract Administrator noted above. Do not contact the project manager directly.

Any bidder who enters the Pre-Bid Conference after 1:05 PM will be precluded from bidding as a prime contractor and may only bid as a subcontractor. Subcontractors are not required to attend; however we encourage their attendance.

BID DEADLINE

Bids must be received at or before **2:00 PM, Friday, January 21, 2022** for furnishing all labor, materials, services, and equipment to complete the Work described below in accordance with the enclosed Bidding Documents. Due to COVID-19 restrictions, all bids will be received electronically only at the email address above; the low bidder must produce the original bid, bid bond, notary acknowledgement and surety notice within 24 hours of making an announcement of who the low bidder is.

Bids are to be submitted to The Regents of the University of California ("University") **via email only** at:

Email: kara.longtin@ucr.edu

Immediately following the Bid Deadline, bids will be opened and posted on the University's website. Bids will be made available to be reviewed by bidders shortly after bids have been validated. Efforts will be made to accommodate and observe all typical procedures during COVID-19 restrictions.

Bid Security in the amount of 10% of the Lump Sum Base Bid shall accompany each Bid. The Surety issuing the Bid Bond shall be, on the Bid Deadline, an admitted surety insurer (as defined in California Code of Civil Procedure Section 995.120).

The successful Bidder and its subcontractors will be required to follow the nondiscrimination requirements set forth in the Bidding and Contract Documents and to pay prevailing wage rates at the location of the Work.

Every effort will be made to ensure that all persons have equal access to contracts and other business opportunities with the University within the limits imposed by law or University policy. Each Bidder may be required to show evidence of its equal employment opportunity policy. The successful Bidder and its subcontractors will be required to follow the nondiscrimination requirements set forth in the Bidding Documents and to pay prevailing wage at the location of the work.

The successful Bidder must have the following State of California Contractor's license current and active at the time of submission of the Bid: **B, General Building**.

The work described in the contract is a public work subject to section 1771 of the California Labor Code.

The successful Bidder shall pay all persons providing construction services and/or any labor on site, including any University location, no less than the UC Fair Wage (defined as \$13 per hour as of 10/1/15, \$14 per hour as of 10/1/16, and \$15 per hour as of 10/1/17) and shall comply with all applicable federal, state and local working condition requirements.

Estimated construction cost: **\$800,000.00**

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
University of California, Riverside
Publication Dates: 12/17/2021 – 12/31/2021

PROJECT DIRECTORY

Project Name: **SOM ED1 Data Center Renovation**

Project Number: **950590**

Location: **University of California, Riverside**

University: **The Regents of the University of California**

University's Representative: **Tameesha Hayes**
Project Manager
Planning, Design & Construction
University of California, Riverside
1223 University Avenue, Suite 240
Riverside, CA 92521

Tel: (951) 827-1412
Email: Tameesha.hayes@ucr.edu

Kara longtin
Contract Administrator
Planning, Design & Construction
University of California, Riverside
1223 University Avenue, Suite 240
Riverside, CA 92521

Tel: (951) 827-2610
Email: kara.longtin@ucr.edu

Carlos Madrid
Senior Construction Inspector
Planning, Design & Construction
University of California, Riverside
1223 University Avenue, Suite 240
Riverside, CA 92521

Tel: (951) 827-2657
Email: carlos.madrid@ucr.edu

Design Professional: **David Mathison**
Architect
Moreto, Mathison & Associates, Architects Inc.
1315 S. Grand Avenue, Suite 202
Glendora, CA. 91740

Tel: (626) 594-0307
Email: dmathison@mmaarchitects.net

Address for Stop Notices: University of California, Riverside
Accounting Office -002
Riverside, CA 92521-0123

Address for Demand for Arbitration: Western Case Management Center
6795 N. Palm Avenue, 2nd Floor
Fresno, CA 93704

A copy of the Demand for Arbitration must be sent to: University of California
Office of the General Counsel
1111 Franklin Street, 8th Floor
Oakland, CA 94607-5200

END OF PROJECT DIRECTORY

INSTRUCTIONS TO BIDDERS

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ARTICLE 1

DEFINITIONS

- 1.1 Except as otherwise specifically provided, definitions set forth in the General Conditions or in other Contract Documents are applicable to all Bidding Documents.
- 1.2 The term “Addenda” means written or graphic instruments issued by University prior to the Bid Deadline which modify or interpret the Bidding Documents by additions, deletions, clarifications, or corrections.
- 1.3 The term “Alternate” means a proposed change in the Work, as described in the Bidding Documents which, if accepted, may result in a change to either the Contract Sum or the Contract Time, or both.
- 1.4 The term “Bid Deadline” means the date and time on or before which Bids must be received, as designated in the Advertisement for Bids and which may be revised by Addenda.
- 1.5 The term “Bidder” means a person or firm that submits a Bid.
- 1.6 The term “Bidding Documents” means the construction documents prepared and issued for bidding purposes including all Addenda thereto.
- 1.7 The term “Estimated Quantity” means the estimated quantity of an item of Unit Price Work.
- 1.8 As used in these Instructions to Bidders, the term “Facility” means the University's Facility office issuing the Bidding Documents.
- 1.9 The term “Lump Sum Base Bid” means the sum stated in the Bid for which Bidder offers to perform the Work described in the Bidding Documents, but not including Unit Price items or Alternates.
- 1.10 The term “Planholder” means a person or entity known by the Facility to have received a complete set of Bidding Documents and who has provided a street address for receipt of any written pre-bid communications.
- 1.11 The term “Unit Price” means an amount stated in the Bid for which Bidder offers to perform an item of Unit Price Work for a fixed price per unit of measurement.
- 1.12 As used in these Instructions to Bidders, the term “Business Day” means any day other than a Saturday, a Sunday, and the holidays specified herein, and to the extent provided herein, if the Facility or applicable office of the University is closed for the whole of any day, insofar as the business of that office is concerned, that day shall be considered as a holiday for the purposes of computing time in these Instructions to Bidders. Holidays include January 1st, the third Monday in January, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, November 11th, Thanksgiving Day, December 25th, and every day designated by the University as a holiday.

ARTICLE 2

BIDDER'S REPRESENTATIONS

- 2.1 Bidder, by making a Bid, represents that:
- 2.1.1 Bidder has read, understood, and made the Bid in accordance with the provisions of the Bidding Documents.

2.1.2 Bidder has visited the Project site and is familiar with the conditions under which the Work is to be performed and the local conditions as related to the requirements of the Contract Documents.

2.1.3 The Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception.

2.1.4 At the time of submission of the Bid, Bidder and all Subcontractors, regardless of tier, have the appropriate current and active licenses issued by the State of California Contractors State License Board for the Work to be performed and any licenses specifically required by the Bidding Documents. If Bidder is a joint venture, at the time of submission of the Bid, Bidder shall have the licenses required by the preceding sentence in the name of the joint venture itself. The State of California Business and Professions Code, Division 3, Chapter 9, known as the "Contractor's License Law," establishes licensing requirements for contractors.

2.1.5 Bidder has read and shall abide by the nondiscrimination requirements contained in the Bidding Documents.

2.1.6 Bidder has the expertise and financial capacity to perform and complete all obligations under the Bidding Documents.

2.1.7 The person executing the Bid Form is duly authorized and empowered to execute the Bid Form on behalf of Bidder.

2.1.8 Bidder is aware of and, if awarded the Contract, will comply with Applicable Code Requirements in its performance of the Work.

ARTICLE 3

BIDDING DOCUMENTS

3.1 COPIES

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement for Bids for the sum stated therein, if any. Documents are only available in full sets and shall not be returned.

3.1.2 Bidders shall use a complete set of Bidding Documents in preparing Bids.

3.1.3 University makes copies of the Bidding Documents available, on the above terms, for the sole purpose of obtaining Bids for the Work and does not confer a license or grant permission for any other use of the Bidding Documents.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

3.2.1 Bidder shall, before submitting its Bid, carefully study and compare the components of the Bidding Documents and compare them with any other work being bid concurrently or presently under construction which relates to the Work for which the Bid is submitted; shall examine the Project site, the conditions under which the Work is to be performed, and the local conditions; and shall at once report to University's Representative errors, inconsistencies, or ambiguities discovered. If Bidder is awarded the Contract, Bidder waives any claim arising from any errors, inconsistencies or ambiguities, that Bidder, its subcontractors or suppliers, or any person or entity under Bidder on the Contract became aware of, or reasonably should have become aware of, prior to Bidder's submission of its Bid.

3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be addressed only to the person or firm designated in the Supplementary Instructions to Bidders.

3.2.3 Clarifications, interpretations, corrections, and changes to the Bidding Documents will be made by Addenda issued as provided in Article 3.5. Clarifications, interpretations, corrections, and changes to the Bidding Documents made in any other manner shall not be binding and Bidders shall not rely upon them.

3.3 PRODUCT SUBSTITUTIONS

3.3.1 No substitutions will be considered prior to award of Contract. Substitutions will only be considered after award of the Contract and as provided for in the Contract Documents.

3.4 SUBCONTRACTORS

3.4.1 Each Bidder shall list in the Bid Form all first-tier Subcontractors that will perform work, labor or render such services as defined in Article 9 of the Bid Form. The Bid Form contains spaces for the following information when listing Subcontractors: (1) portion of the Work; (2) name of Subcontractor; (3) city of Subcontractor's business location. The failure to list, on the Bid Form, any one of the items set forth above will result in the University treating the Bid as if no Subcontractor was listed for that portion of the Work and Bidder will thereby represent to University that Bidder agrees that it is fully qualified to perform that portion of the Work and shall perform that portion of the Work.

3.4.2 Subcontractors listed in the Bid Form shall only be substituted after the Bid Deadline with the written consent of University and in accordance with the State of California "Subletting and Subcontracting Fair Practices Act."

3.5 ADDENDA

3.5.1 Addenda will be issued only by University and only in writing. Addenda will be identified as such and will be mailed or delivered to all Planholders. At its sole discretion, the University may elect to deliver Addenda via facsimile to Planholders who have provided a facsimile number for receipt of Addenda.

3.5.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for inspection.

3.5.3 Addenda will be issued such that Planholders should receive them no later than 3 full business days prior to the Bid Deadline. Addenda withdrawing the request for Bids or postponing the Bid Deadline may be issued anytime prior to the Bid Deadline.

3.5.4 Each Bidder shall be responsible for ascertaining, prior to submitting a Bid, that it has received all issued Addenda.

3.6 BUILDER'S RISK PROPERTY INSURANCE

3.6.1 University will provide builder's risk property insurance subject to the deductibles in the policy as required by the General Conditions if the Contract Sum exceeds \$200,000 at the time of award and the requirements of the Project are not excluded by such coverage. A summary of the provisions of the policy is included as an Exhibit to the Contract; the policy may be reviewed at the Facility's office. Bidder agrees that the University's provision of builder's risk property insurance containing said provisions meets the University's obligation to provide builder's risk property insurance under the Contract and, in the event of a conflict between the provisions of the policy and any summary or description of the provisions contained herein or otherwise, the provisions of the policy shall control and shall be conclusively presumed to fulfill the University's obligation to provide such insurance.

ARTICLE 4

PRE-BID CONFERENCE

4.1 Bidder shall attend the Pre-Bid Conference at which the requirements of the Bidding Documents are reviewed by University, comments and questions are received from Bidders, and a Project site visit is conducted. University requires all Pre-Bid Conference attendees to arrive for the meeting on time and to sign an attendance list, which in turn is used to determine if Bidders meet this requirement. Any Bidder not attending the Pre-Bid Conference in its entirety will be deemed to have not complied with the requirements of the Bidding Documents and its Bid will be rejected.

ARTICLE 5

BIDDING PROCEDURES

5.1 FORM AND STYLE OF BIDS

5.1.1 Bids shall be submitted on the Bid Form included with the Bidding Documents. Bids not submitted on the University's Bid Form shall be rejected.

5.1.2 The Bid Form shall be filled in legibly in ink or by typewriter. All portions of the Bid Form must be completed and the Bid Form must be signed before the Bid is submitted. Failure to comply with the requirements of this Article 5.1.2 will result in the Bid being rejected as nonresponsive.

5.1.3 Bidder's failure to submit a price for any Alternate or Unit Price will result in the Bid being considered as nonresponsive. If Alternates are called for and no change in the Lump Sum Base Bid is required, indicate "No Change" by marking the appropriate box.

5.1.4 Bidder shall make no stipulations on the Bid Form nor qualify the Bid in any manner.

5.1.5 The Bid Form shall be signed by a person or persons legally authorized to bind Bidder to a contract. Bidder's Representative shall sign and date the Declaration included in the Bid Form. Failure to sign and date the declaration will cause the Bid to be rejected.

5.2 BID SECURITY

5.2.1 Each Bid shall be accompanied by Bid Security in the amount of 10% of the Lump Sum Base Bid as security for Bidder's obligation to enter into a Contract with University on the terms stated in the Bid Form and to furnish all items required by the Bidding Documents. Bid Security shall be a Bid Bond on the form provided by University and included herein, or a certified check made payable to "The Regents of the University of California." When a Bid Bond is used for Bid Security, failure to use University's Bid Bond form will result in the rejection of the Bid. Bidder must use the Bid Bond form provided by the University or an exact, true and correct photocopy of such form. The Bid Bond form may not be retyped, reformatted, transcribed onto another form, or altered in any manner except for the purpose of completing the form.

5.2.2 If the apparent lowest responsible Bidder fails to sign the Agreement and furnish all items required by the Bidding Documents within the time limits specified in these Instructions to Bidders, University may reject such Bidder's Bid and select the next apparent lowest responsible Bidder until all Bids have been exhausted or University may reject all Bids. The Bidder whose Bid is rejected for such failure(s) shall be liable for and forfeit to University the amount of the difference, not to exceed the amount of the Bid Security, between the amount of the Bid of the Bidder so rejected and the greater amount for which University procures the Work.

5.2.3 If a Bid Bond is submitted, the signature of the person executing the Bid Bond must be notarized. If an attorney-in-fact executes the Bid Bond on behalf of the surety, a copy of the current power of attorney

bearing the notarized signature of the appropriate corporate officer shall be included with the Bid Bond. Additionally, the surety issuing the Bid Bond shall be, on the Bid Deadline, an admitted surety insurer (as defined in the California Code of Civil Procedure Section 995.120).

5.2.4 Bid Security will be returned after the contract has been awarded. Notwithstanding the preceding, if a Bidder fails or refuses, within 10 days after receipt of notice of selection, to sign the Agreement or submit to University all of the items required by the Bidding Documents, the University will retain that Bidder's Bid Security. If the Bid Security is in the form of a Bid Bond, the Bid Security will be retained until the University has been appropriately compensated; if the Bid Security is in the form of certified check, the University will negotiate said check and after deducting its damages, return any balance to Bidder.

5.3 SUBMISSION OF BIDS

5.3.1 The Bid Form, Bid Security, and all other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the office designated in the Supplementary Instructions to Bidders for receipt of Bids. The envelope shall be identified with the Project name, Bidder's name and address, and, if applicable, the designated portion of the Project for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

5.3.2 Bids shall be deposited at the designated location on or before the Bid Deadline. A Bid received after the Bid Deadline will be returned to Bidder unopened.

5.3.3 Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

5.3.4 Oral, telephonic, electronic mail (e-mail), facsimile, or telegraphic Bids are invalid and will not be accepted.

5.4 MODIFICATION OR WITHDRAWAL OF BID

5.4.1 Prior to the Bid Deadline, a submitted Bid may be modified or withdrawn by notice to the Facility receiving Bids at the location designated for receipt of Bids. Such notice shall be in writing over the signature of Bidder and, in order to be effective, must be received on or before the Bid Deadline. A modification so made shall be worded so as not to reveal the amount of the original Bid.

5.4.2 A withdrawn Bid may be resubmitted on or before the Bid Deadline, provided that it then fully complies with the Bidding Requirements.

5.4.3 Bid Security shall be in an amount sufficient for the Bid as modified or resubmitted.

5.4.4 Bids may not be modified, withdrawn, or canceled within 60 days after the Bid Deadline unless otherwise provided in Supplementary Instructions to Bidders.

ARTICLE 6

CONSIDERATION OF BIDS

6.1 OPENING OF BIDS

6.1.1 Bids which have the required identification as stipulated in Article 5.3.1 and are received on or before the Bid Deadline will be opened publicly.

6.2 REJECTION OF BIDS

6.2.1 University will have the right to reject all Bids.

6.2.2 University will have the right to reject any Bid not accompanied by the required Bid Security or any other item required by the Bidding Documents, or a Bid which is in any other way incomplete or irregular.

6.3 AWARD

6.3.1 University will have the right, but is not required, to waive nonmaterial irregularities in a Bid. If the University awards the Contract, it will be awarded to the responsible Bidder submitting the lowest responsive Bid as determined by University and who is not rejected by University for failing or refusing, within 10 days after receipt of notice of selection, to sign the Agreement or submit to University all of the items required by the Bidding Documents.

6.3.2 University will have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents. The opening of Bids and evaluation of Alternates will be conducted in accordance with a procedure that, at University's option, either (i) prescribes, prior to the time of Bid opening, the order in which Alternates will be selected or (ii) prevents, before the determination of the apparent low Bidder has been made, information that would identify which Bid belongs to which Bidder from being revealed to the representative of the University selecting the Alternates to be used in determining the low Bidder. After determination of the apparent low Bidder has been made, University will publicly disclose the identity of each Bidder that submitted a Bid and the amount of each such Bid.

6.3.3 University will determine the low Bidder on the basis of the sum of the Lump Sum Base Bid plus all Unit Prices multiplied by their respective Estimated Quantities as stated in the Bid Form, if any, plus the daily rate for Compensable Delay multiplied by the "multiplier" as stated in the Bid Form, plus the amounts of all Alternates to be included in the Contract Sum at the time of award. The Contract Sum will be the sum of the Lump Sum Base Bid and the additive or deductive amounts for all Alternates that University has elected to be included in the Contract Sum as of the time of award.

6.3.4 The University will post the Bid results in a public place at the address where the Bids are received (unless another address is specified in the Bidding Documents).

6.3.5 University will select the apparent lowest responsive and responsible Bidder and notify such Bidder on University's form within 50 days (unless the number of days is modified in Supplementary Instructions to Bidders) after the Bid Deadline or reject all Bids. Within 10 days after receipt of notice of selection as the apparent lowest responsive and responsible Bidder, Bidder shall submit to University all of the following items:

- .1 Three originals of the Agreement signed by Bidder.
- .2 Three originals of the Payment Bond required under Article 11 of the General Conditions.
- .3 Three originals of the Performance Bond required under Article 11 of the General Conditions.
- .4 Certificates of Insurance on form provided by University required under Article 11 of the General Conditions.
- .5 Name of, qualifications of, and references for the Superintendent proposed for the Work.
- .6 Names of all Subcontractors, with their addresses, telephone number, facsimile number, contact person, portion of the Work and designation of any Subcontractor

as a Small Business Enterprise (SBE), Disadvantaged Business Enterprise (DBE), Women-owned Business Enterprise (WBE) and Disabled Veteran Business Enterprise (DVBE) on Report of Subcontractor Information in the form contained in the Exhibits. Evidence, as required by University, of the reliability and responsibility of the proposed Subcontractors such as statements of experience, statements of financial condition, and references.

- .7 Preliminary Contract Schedule as required under Article 3 of the General Conditions.
- .8 If Bidder wishes to utilize securities in lieu of retention beginning with the first Application for Payment, Selection of Retention Options accompanied by a completed Escrow Agreement for Deposit of Securities in Lieu of Retention and Deposit of Retention in the form contained in the Exhibits.
- .9 Cost Breakdown as required by Article 9 of the General Conditions.

6.3.6 Prior to award of the Contract, University will notify Bidder in writing, if University, after due investigation, objects to a Subcontractor or Superintendent proposed by Bidder, in which case Bidder shall propose a substitute acceptable to University. Substitution of Superintendent shall be made in accordance with Article 3 of the General Conditions. Substitution of a Subcontractor shall be made in accordance with Article 5 of the General Conditions. Failure of University to object to a proposed Superintendent or Subcontractor prior to award shall not preclude University from requiring replacement of Superintendent or any Subcontractor based upon information received subsequent to award, information which cannot be properly evaluated prior to award due to time constraints, or information relating to a failure to comply with the requirements of the Contract.

6.3.7 If Bidder submits three originals of the signed Agreement and all other items required to be submitted to University within 10 days after receipt of notice of selection as the apparent lowest responsive and responsible Bidder, and if all such items comply with the requirements of the Bidding Documents and are acceptable to University, University will award the Contract to Bidder by signing the Agreement and returning a signed copy of the Agreement to Bidder.

6.3.8 If University consents to the withdrawal of the Bid of the apparent lowest responsive and responsible Bidder, or the apparent lowest responsive and responsible Bidder fails or refuses to sign the Agreement or submit to University all of the items required by the Bidding Documents, within 10 days after receipt of notice of selection, or that Bidder is not financially or otherwise qualified to perform the Contract, University may reject such Bidder's Bid and select the next apparent lowest responsive Bidder, until all Bids are exhausted, or reject all Bids. Any Bidder whose Bid is rejected because the Bidder has failed or refused, within 10 days after receipt of notice of selection, to sign the Agreement or submit to University all of the items required by the Bidding Documents, shall be liable to the University for all resulting damages.

ARTICLE 7

BID PROTEST

7.1 FILING A BID PROTEST

7.1.1 Any Bidder, person, or entity may file a Bid protest. The protest shall specify the reasons and facts upon which the protest is based and shall be in writing and received by with the Facility not later than 5:00 PM on the 3rd business day following:

- .1 if the Bid Form does not contain any Alternate(s), the date of the Bid opening;
- .2 if the Bid Form contains any Alternate(s), the date of posting in a public place of Bid results.

7.1.2 If a Bid is rejected by the Facility, and such rejection is not in response to a Bid protest, any Bidder, person or entity may dispute that rejection by filing a Bid protest (limited to the rejection) in writing and received by the Facility not later than 5:00 PM on the 3rd business day following the rejected Bidder's receipt of the notice of rejection.

7.1.3 For the purpose of computing any time period in this Article 7, the date of receipt of any notice shall be the date on which the intended recipient of such notice actually received it. Delivery of any notice may be by any means, with verbal or written confirmation of receipt by the intended recipient.

7.2 RESOLUTION OF BID CONTROVERSY

7.2.1 Facility will investigate the basis for the Bid protest and analyze the facts. Facility will notify Bidder whose Bid is the subject of the Bid protest of evidence presented in the Bid protest and evidence found as a result of the investigation, and, if deemed appropriate, afford Bidder an opportunity to rebut such evidence, and permit Bidder to present evidence that it should be allowed to perform the Work. If deemed appropriate by Facility, an informal hearing will be held. Facility will issue a written decision within 15 days following receipt of the Bid protest, unless factors beyond Facility's reasonable control prevent such a resolution, in which event such decision will be issued as expeditiously as circumstances reasonably permit. The decision will state the reasons for the action taken by Facility. A written copy of the decision will be furnished to the protestor, the Bidder whose Bid is the subject of the Bid protest, and all Bidders affected by the decision. As used in this Article 7, a Bidder is affected by the decision on a Bid protest if a decision on the protest could have resulted in the Bidder not being the lowest responsible and responsive Bidder for the Contract. A written copy of the Facility's decision must be received by the protestor, the Bidder whose Bid is the subject of the Bid protest, and all Bidders affected by the decision no later than 3 business days prior to award of the contract.

7.2.2 Notwithstanding the provisions of Article 7.2.1, at the election of Facility, a Bid protest may be referred directly to University's Construction Review Board without prior investigation and review by Facility. The Chair of the Construction Review Board will either decide the Bid protest or appoint a Hearing Officer. If a Hearing Officer is appointed, the Hearing Officer will review the Bid protest in accordance with the provisions of Article 7.2.4.

7.2.3 Bidder whose Bid is the subject of the protest, all Bidders affected by the Facility's decision on the protest, and the protestor have the right to appeal to the Construction Review Board if not satisfied with Facility's decision. The appeal must be in writing and shall specify the decision being appealed and all the facts and circumstances relied upon in support of the appeal. A copy of the appeal must be received by the Chair, Construction Review Board, not later than 5:00 pm on the 3rd business day following appellant's receipt of the written decision of Facility, at the following address:

Chair, Construction Review Board
University of California
Office of the President
1111 Franklin Street, 6th Floor
Oakland, CA 94607-5200
Attention: Associate Director, Design & Construction Policy

And, by email to:

constructionreviewboard@ucop.edu

A copy of the appeal must be sent to all parties involved in the Bid protest and to Facility, to the same address and in the same manner as the original protest. An appeal received after 5:00 pm is considered received as of the next business day. If the final date for receipt of an appeal falls on a Saturday, Sunday, or University holiday, the appeal will be considered timely only if received by 5:00 pm on the following business day. The burden of proving timely receipt of the appeal is on the appealing party.

7.2.4 The Chair of the Construction Review Board will review the Facility's decision and the appeal, and issue a written decision, or if appropriate, appoint a Hearing Officer to conduct a hearing and issue a written decision. If a hearing is held, the hearing shall be held not later than the 10th day following the appointment of the Hearing Officer unless the Hearing Officer for good cause determines otherwise. The written decision of the Chair or Hearing Officer will state the basis of the decision, and the decision will be final and not subject to any further appeal to University. The Chair or Hearing Officer may consult with the University's Office of the General Counsel on the decision as to legal form. The University will complete its internal Bid protest procedures before award of the Contract.

END OF INSTRUCTIONS TO BIDDERS

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1. Contract Time: As specified in Section 1 of the Bid Form.
2. List of Subcontractors (Bid Form Paragraph 9.0) and List of Changes in Subcontractors Due to Alternates (Bid Form Paragraph 10.0).

The default rule is that, if a Bidder lists one subcontractor for a Work Activity (such as “Electrical”) under Bid Form Paragraph 9.0 and a different subcontractor for the same Work Activity (such as “Electrical”) for the Alternate Work under Bid Form Paragraph 10.0 without reference to the Alternate, then it is deemed that the second subcontractor listed in Paragraph 10.0 will perform the Base Bid Work and the Alternate Work, unless the Bidder expressly writes otherwise.

A Bidder may list more than one subcontractor per trade, provided that the Work Activity to be performed by each listed subcontractor is adequately described on the spaces provided on the Bid Form, so that which subcontractor will perform which Work Activity can be determined.

For example, in case of Alternates, if a Bidder wants one subcontractor to perform the electrical Base Bid Work and another subcontractor to perform the electrical Alternate Work, then the Bidder should list the first subcontractor under Bid Form Paragraph 9.0 as performing the “Electrical” Work Activity, and list the second subcontractor under Bid Form Paragraph 10.0 (for listing changes in subcontractors due to Alternates) as performing the “Electrical Alt” or “Electrical Alt Work” or “Electrical Alt Only” or similarly to define the Alternate Work Activity separately to be performed.

3. Requests for clarification or interpretation of the Bidding Documents must be submitted in writing, and shall be addressed only to:

Kara Longtin
Email: kara.longtin@ucr.edu
Tel: 951.827.2610

The deadline to submit requests for clarification or interpretation is on or before 2:00 PM, on Monday, January 10, 2022.

4. The Pre Bid Conference will be conducted via ZOOM conference call on **Tuesday, January 4, 2022, at 1:00 PM.**

To request the meeting link and ID, please email kara.longtin@ucr.edu and use the following in the subject header:

950590 SOM ED1 Data Center renovation- Request for Pre-Bid Meeting Link

At this time, there are no plans for a site visit, if a bidder would like access to the site, this will be done by appointment only and through the coordination of the Contract Administrator noted above. Do not contact the project manager directly.

5. Bids will be submitted electronically only. The Bid Form, and all other required documents are to be submitted via email to kara.longtin@ucr.edu no later than **Friday, January 21, 2022 at 2:00 PM.** The email shall be identified with the Project name, Bidder's name and address, and, if applicable, the designated portion of the Project for which the Bid is submitted.

6. Immediately following the Bid Deadline, bids will be opened and posted on the University's website. Bids will be made available to be reviewed by bidders shortly after bids have been validated. Efforts will be made to accommodate and observe all typical procedures during COVID-19 restrictions. .
7. Contractor will be assessed as liquidated damages the sum of **\$300.00** for each day the Work remains incomplete beyond the expiration of the Contract Time. After Substantial Completion, the rate for liquidated damages shall be reduced to the sum of **\$300.00** per day. See Article 5 of the Agreement for detailed requirements
8. Replace the existing Paragraph 1.4 with the following:
 - 1.4 The term "Bid Deadline" means the date and time on or before which Bids must be received, as designated in the **ADVERTISEMENT FOR BIDS** and which may be revised by Addenda.
9. Replace the existing Paragraph 3.1.1 with the following:
 - 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the **ADVERTISEMENT FOR BIDS**.
10. Replace the existing Paragraph 3.5.1 with the following:
 - 3.5.1 Addenda will be issued only by University and only in writing. Addenda will be identified as such and will be mailed or delivered to all Planholders. At its sole discretion, the University may elect to deliver Addenda via facsimile or email to Planholders who have provided a facsimile number or email address for receipt of Addenda or communications.
11. Replace the existing Paragraph 3.5.3 with the following:
 - 3.5.3 Addenda will be issued such that Planholders should receive them no later than 72 hours prior to the Bid Deadline. Addenda withdrawing the request for Bids or postponing the Bid Deadline may be issued anytime prior to the Bid Deadline.
12. Replace the existing Paragraph 5.2.4 with the following:
 - 5.2.4 Bid Security will be returned after the contract has been awarded. Notwithstanding the preceding, if a Bidder fails or refuses, within **10** days after receipt of notice of selection, to sign the Agreement or submit to University all of the items required by the Bidding Documents, the University will retain that Bidder's Bid Security. If the Bid Security is in the form of a Bid Bond, the Bid Security will be retained until the University has been appropriately compensated; if the Bid Security is in the form of certified check, the University will negotiate said check and after deducting its damages, return any balance to Bidder.
13. Add the following as Paragraph 5.3.5:
 - 5.3.5 ~~As specified in the **ADVERTISEMENT FOR BIDS**, the University has determined that bidders who submit bids for this Project must be prequalified. The names of the bidders prequalified to bid on this Project will appear in an addendum.~~

14. Replace the existing Paragraph 5.4.4 with the following:
 - 5.4.4 Bids may not be modified, withdrawn, or canceled within **60** days after the Bid Deadline.

15. Replace the existing Paragraph 6.3.1 with the following:
 - 6.3.1 University will have the right, but is not required, to waive nonmaterial irregularities in a Bid. If the University awards the Contract, it will be awarded to the responsible Bidder submitting the lowest responsive Bid as determined by University and who is not rejected by University for failing or refusing, within **10** days after receipt of notice of selection, to sign the Agreement or submit to University all of the items required by the Bidding Documents.

16. Replace the existing Paragraph 6.3.5 with the following:
 - 6.3.5 University will select the apparent lowest responsive and responsible Bidder and notify such Bidder on University's form within **50** days (unless the number of days is modified in Supplementary Instructions to Bidders) after the Bid Deadline or reject all Bids. Within **10** days after receipt of notice of selection as the apparent lowest responsive and responsible Bidder, Bidder shall submit to University all of the following items:
 - .1 Three originals of the Agreement signed by Bidder.
 - .2 Three originals of the Payment Bond required under Article 11 of the General Conditions.
 - .3 Three originals of the Performance Bond required under Article 11 of the General Conditions.
 - .4 Certificates of Insurance on form provided by University required under Article 11 of the General Conditions.
 - .5 Names of all Subcontractors, with their addresses, telephone and facsimile numbers, contact persons, portions of the Work and designation of any Subcontractor as a Small Business Enterprise (SBE), Disadvantaged Business Enterprise (DBE), Women-owned Business Enterprise (WBE) and Disabled Veteran Business Enterprise (DVBE) on the Report of Subcontractor Information form, along with a completed Self-Certification form, contained in the Exhibits. Evidence, as required by University, of the reliability and responsibility of the proposed Subcontractors such as statements of experience, statements of financial condition, and references.
 - .6 Preliminary Contract Schedule as required under Article 3 of the General Conditions.
 - .7 If Bidder wishes to utilize securities in lieu of retention beginning with the first Application for Payment, a completed Selection of Retention Options form accompanied by a completed Escrow Agreement for Deposit of Securities in Lieu of Retention and Deposit of Retention in the form contained in the Exhibits.
 - .8 Cost Breakdown as required by Article 9 of the General Conditions.

17. Replace the existing Paragraph 6.3.7 with the following:

- 6.3.7 If Bidder submits three originals of the signed Agreement and all other items required to be submitted to University within **10** days after receipt of notice of selection as the apparent lowest responsive and responsible Bidder, and if all such items comply with the requirements of the Bidding Documents and are acceptable to University, University will award the Contract to Bidder by signing the Agreement and returning a signed copy of the Agreement to Bidder.
18. Replace the existing Paragraph 6.3.8 with the following:
- 6.3.8 If University consents to the withdrawal of the Bid of the apparent lowest responsive and responsible Bidder, or the apparent lowest responsive and responsible Bidder fails or refuses to sign the Agreement or submit to University all of the items required by the Bidding Documents, within **10** days after receipt of notice of selection, or that Bidder is not financially or otherwise qualified to perform the Contract, University may reject such Bidder's Bid and select the next apparent lowest responsive Bidder, until all Bids are exhausted, or reject all Bids. Any Bidder whose Bid is rejected because the Bidder has failed or refused, within **10** days after receipt of notice of selection, to sign the Agreement or submit to University all of the items required by the Bidding Documents, shall be liable to the University for all resulting damages.
19. The University has negotiated contracts with certain suppliers (listed in the "Information Available to Bidders") to supply materials to University construction projects. Bidders may be able to obtain favorable pricing from the listed suppliers for materials required for this Contract. Bidders are not obligated to obtain any required materials from the listed suppliers. Use of any of the listed suppliers is at the Bidder's risk, and the University does provide any warranties, express or implied, with respect to the listed suppliers, their products and/or services. In particular, University does not warrant that the listed suppliers, their products and/or services are suitable for this Project.
20. **PREVAILING WAGE INFORMATION:** A bidder can obtain the prevailing wage information through the internet at www.dir.ca.gov or at <http://www.dir.ca.gov/DLSR/PWD>.

END OF SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

INFORMATION AVAILABLE TO BIDDERS

The following information is made available for the convenience of bidders and is not a part of the Contract. The information is provided subject to the provisions of Article 3 of the General Conditions.

1. The University of California has contracts for materials, equipment and/or services with the suppliers listed on the Office of the President Procurement Services website at: <https://www.ucop.edu/procurement-services/for-suppliers/construction-supplier-resources.html>

General Contractors or others submitting bids for University construction projects may enter into agreements with these suppliers that utilize the pricing and terms contained in the University-supplier agreements. The university does not represent or warrant that materials/equipment/services of these suppliers meet the requirements of the University's construction contracts.

Use of such suppliers shall not relieve Contractor from its obligation to meet all contractual requirements in any contracts with the University. The university will not be a party to any agreements with such suppliers and accepts no performance obligations or liability with respect to such agreements.

2. Reports:

None

3. Record Documents and As-Builts:

None

END OF INFORMATION AVAILABLE TO BIDDERS

BID FORM

FOR: SOM ED1 DATA CENTER RENOVATION
PROJECT NUMBER: 950590
CONTRACT NUMBER: 950590-LF-2021-94
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CALIFORNIA

December 21, 2021

BID TO:

Planning, Design & Construction
UNIVERSITY OF CALIFORNIA, RIVERSIDE
1223 University Avenue, Suite 240
Riverside, CA 92521

(951) 827-2610

BID FROM:

(Name of Bidder)

(Contact Name)

(Address)

(City, State, Zip Code)

_____ (Telephone Number) _____ (Facsimile Number)

(E-mail)

(Date Bid Submitted)

Note: All portions of this Bid Form must be completed, and the Bid Form must be signed before the Bid is submitted. Failure to do so will result in the Bid being rejected as non-responsive.

BIDDER'S NAME: _____

1.0 BIDDER'S REPRESENTATIONS

Bidder, represents that a) Bidder and all Subcontractors, regardless of tier, has the appropriate current and active Contractor's licenses required by the State of California and the Bidding Documents; b) it has carefully read and examined the Bidding Documents for the proposed Work on this Project; c) it has examined the site of the proposed Work and all Information Available to Bidders; d) it has become familiar with all the conditions related to the proposed Work, including the availability of labor, materials, and equipment; e) Bidder and all Subcontractors, regardless of tier, are currently registered with the California Department of Industrial Relations pursuant to California Labor Code Section 1725.5 and 1771.1. Bidder hereby offers to furnish all labor, materials, equipment, tools, transportation, and services necessary to complete the proposed Work on this Project in accordance with the Contract Documents for the sums quoted. Bidder further agrees that it will not withdraw its Bid within **60** days after the Bid Deadline, and that, if it is selected as the apparent lowest responsive and responsible Bidder, that it will, within 10 days after receipt of notice of selection, sign and deliver to University the Agreement in triplicate and furnish to University all items required by the Bidding Documents. If awarded the Contract, Bidder agrees to complete the proposed Work within **330** days after the date of commencement specified in the Notice to Proceed.

2.0 ADDENDA

Bidder acknowledges that it is Bidder's responsibility to ascertain whether any Addenda have been issued and if so, to obtain copies of such Addenda from University's Facility at the appropriate address stated on Page 1 of this Bid Form. Bidder therefore agrees to be bound by all Addenda that have been issued for this Bid.

3.0 NOT USED

4.0 LUMP SUM BASE BID

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(Place figures in appropriate boxes.)

Bidder includes in the Lump Sum Base Bid the following allowances:

Allowance No. 1: Include an allowance of **\$105,600.00** for 3 CRAC Units (1) AC-3/C-3, (1) FCU-1, (1) FCU-2, as specified in Specification Section 01 2100.

5.0 SELECTION OF APPARENT LOW BIDDER

Refer to the Instructions to Bidders for selection of apparent low bidder.

BIDDER'S NAME: _____

6.0 UNIT PRICES- NOT USED

7.0 DAILY RATE OF COMPENSATION FOR COMPENSABLE DELAYS WITH TWO OPTIONS

Bidder shall determine and provide below the daily rate of compensation for any Compensable Delay caused by University at any time during the performance of the Work. A Facility may choose a minimum compensable delay in the best interests of the Project. If so, use the language in parentheses { } and in grey highlight:

\$, X 30 Day multiplier
 (Place figures in appropriate boxes.)

Failure to fill in a dollar figure for the daily rate for Compensable Delay shall render the bid non-responsive. University will perform the extension of the daily rate times the multiplier.

The daily rate shown above will be the total amount of Contractor entitlement for each day of Compensable Delay caused by University at any time during the performance of the Work and shall constitute payment in full for all delay costs, direct or indirect (including, without limitation, compensation for all extended home office overhead and extended general conditions), of the Contractor and all subcontractors, suppliers, persons, and entities under or claiming through Contractor on the Project. The number of days of Compensable Delay shown as a "multiplier" above is not intended as an estimate of the number of days of Compensable Delay anticipated by the University. The University will pay the daily rate of compensation only for the actual number of days of Compensable Delay, as defined in the General Conditions; the actual number of days of Compensable Delay may be greater or lesser than the "multiplier" shown above.

8.0 ALTERNATES

In order for a Bid to be responsive, Bidder must submit an additive bid, a deductive bid, or a "no change" bid, for each Alternate listed below. The failure to do so shall result in the Bid being rejected as non-responsive. The failure to quote an amount, unless the bidder marks the "no change" box, will result in the bid being rejected as non-responsive.

The Contract Time will change by the number of days, if any, specified for each accepted Alternate.

Alternate No. 1

Wire mesh partitions; welded wire fence to ceiling, as specified in section 01 2300 and pages G0.01 and A2.03 of drawings.

Bid for Alternate No. 1

If "Add" or "Deduct" is intended, indicate by placing figures in the corresponding boxes. If "No Change" is intended, indicate by marking the "No Change" box

Add \$, , .

Deduct \$, , .

No Change: Bidder will perform this Alternate without change to Contract Sum.

No extension of time will be granted if this Alternate is accepted.

University reserves the right to accept this Alternate within 10 calendar days after the date University signs the Agreement:

Alternate No. 2

Paint walls to match existing, as specified in section 01 2300 and pages G0.01 and A2.03 of drawings.

Bid for Alternate No. 2

If "Add" or "Deduct" is intended, indicate by placing figures in the corresponding boxes. If "No Change" is intended, indicate by marking the "No Change" box

Add \$, , .

Deduct \$, , .

No Change: Bidder will perform this Alternate without change to Contract Sum.

No extension of time will be granted if this Alternate is accepted.

University reserves the right to accept this Alternate within 10 calendar days after the date University signs the Agreement:

Alternate No. 3

Replace acoustical ceiling tile to match existing, as specified in section 01 2300 and pages G0.01 and A2.04 of drawings.

Bid for Alternate No. 3

If "Add" or "Deduct" is intended, indicate by placing figures in the corresponding boxes. If "No Change" is intended, indicate by marking the "No Change" box

Add \$, , .

Deduct \$, , .

No Change: Bidder will perform this Alternate without change to Contract Sum.

No extension of time will be granted if this Alternate is accepted.

University reserves the right to accept this Alternate within 10 calendar days after the date University signs the Agreement:

Alternate No. 4

CHW in-row cooling unit. Set airflow to direct inward towards racks. Extend CHW piping from the taps in underfloor plenum and connect to units., as specified in section 01 2300 and pages M2.12, P2.11 and E2.11 of drawings.

Bid for Alternate No. 4

If "Add" or "Deduct" is intended, indicate by placing figures in the corresponding boxes. If "No Change" is intended, indicate by marking the "No Change" box

Add \$, , .

Deduct \$, , .

No Change: Bidder will perform this Alternate without change to Contract Sum.

No extension of time will be granted if this Alternate is accepted.

University reserves the right to accept this Alternate within 10 calendar days after the date University signs the Agreement:

BIDDER'S NAME: _____

11.0 BIDDER INFORMATION

TYPE OF ORGANIZATION

(Corporation, Partnership, Individual, Joint Venture, etc.)

IF A CORPORATION, THE CORPORATION IS ORGANIZED UNDER THE LAWS OF:

THE STATE OF _____
(State)

NAME OF PRESIDENT OF THE CORPORATION:

(Insert Name)

NAME OF SECRETARY OF THE CORPORATION:

(Insert Name)

IF A PARTNERSHIP, NAMES OF ALL GENERAL PARTNERS:

(Insert Name(s))

CALIFORNIA CONTRACTORS LICENSE(S):

(Classification(s)) (License Number) (Expiration Date)

(For Joint Venture, list Joint Venture's license and licenses for all Joint Venture partners.)

BIDDER'S NAME: _____

12.0 REQUIRED COMPLETED ATTACHMENTS

The following documents are submitted with and made a condition of this Bid:

1. Bid Security in the form of _____
(Bid Bond or Certified Check)

13.0 DECLARATION

I, _____, hereby declare that I am the
(Printed Name)
_____ of _____
(Title) (Name of Bidder)

submitting this Bid Form; that I am duly authorized to execute this Bid Form on behalf of Bidder; and that all information set forth in this Bid Form and all attachments hereto are, to the best of my knowledge, true, accurate, and complete as of its submission date.

I further declare that this bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

I declare, under penalty of perjury, that the foregoing is true and correct and that this Declaration was executed at:

_____, in the State of _____,
(Name of City if within a City, otherwise Name of County) (State)

on _____,
(Date)

(Signature)

BID BOND

KNOW ALL PERSONS BY THESE PRESENTS:

That we, _____,
 as Principal, and _____, as Surety, are held and firmly bound unto THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, hereinafter called THE REGENTS, in the sum of 10% of the Lump Sum Base Bid amount for payment of which in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT, WHEREAS, Principal has submitted a Bid for the work described as follows:

Project Name: SOM ED1 Data Center Renovation
 Project Number: 950590, Contract Number: 950590-LF-2021-94
 Location: 900 University Ave, Riverside, CA. 92507

NOW, THEREFORE, if Principal shall not withdraw said Bid within the time period specified after the Bid Deadline, as defined in the Bidding Documents, or within **60** days after the Bid Deadline if no time period be specified, and, if selected as the apparent lowest responsible Bidder, Principal shall, within the time period specified in the Bidding Documents, do the following:

- (1) Enter into a written agreement, in the prescribed form, in accordance with the Bid.
- (2) File two bonds with THE REGENTS, one to guarantee faithful performance and the other to guarantee payment for labor and materials, as required by the Bidding Documents.
- (3) Furnish certificates of insurance and all other items as required by the Bidding Documents.

In the event of the withdrawal of said Bid within the time period specified, or within **60** days if no time period be specified, or the disqualification of said Bid due to failure of Principal to enter into such agreement and furnish such bonds, certificates of insurance, and all other items as required by the Bidding Documents, if Principal shall pay to THE REGENTS an amount equal to the difference, not to exceed the amount hereof, between the amount specified in said Bid and such larger amount for which THE REGENTS procure the required work covered by said Bid, if the latter be in excess of the former, then this obligation shall be null and void, otherwise to remain in full force and effect.

In the event suit is brought upon this bond by THE REGENTS, Surety shall pay reasonable attorneys' fees and costs incurred by THE REGENTS in such suit.

IN WITNESS WHEREOF, we have hereunto set our hands this ____ day of _____, 20__.

PRINCIPAL:

SURETY:

 (Name of Company)

By: _____
 (Signature)

 (Printed Name)

 (Title)

 (Name of Company)

By: _____
 (Signature)

 (Printed Name)

 (Title)

Address for Notices:

 (Street Address)

 (City, State & Zip Code)

NOTE: Notary acknowledgement for Surety and Surety's Power of Attorney must be attached.

AGREEMENT

This AGREEMENT is made on _____, between THE REGENTS OF THE UNIVERSITY OF CALIFORNIA (“University”),

whose Facility is: University of California, Riverside

whose address for notices is: UCR Planning, Design & Construction
UNIVERSITY OF CALIFORNIA, RIVERSIDE
1223 University Avenue, Suite 240
Riverside, CA 92521

and Contractor: **Name**

whose address for notices is: **Street Address**
City, State & Zip

for the Project: SOM ED1 Data Center Renovation
Project Number: 950590
University of California, Riverside
County of Riverside
Riverside, California 92521

University's Responsible Administrator: Drew Hecht, Architect
Director of Project Management
Planning, Design & Construction

University's Representative is: Tameesha Hayes
Project Manager
Planning, Design & Construction

whose address for notices is: UCR Planning, Design & Construction
UNIVERSITY OF CALIFORNIA, RIVERSIDE
1223 University Avenue, Suite 240
Riverside, CA 92521

Contract Documents for the Work Prepared by: David Mathison
Moreto, Mathison & Associates, Inc.
1315 S. Grand Avenue
Glendora, CA 91740
Tel: 626-594-0307

University and Contractor hereby agree as follows:

ARTICLE 1 WORK

Contractor shall provide all work required by the Contract Documents (the "Work"). Contractor agrees to do additional Work arising from changes ordered by the University pursuant to Article 7 of the General Conditions. Contractor shall (1) pay all sales, consumer and other taxes and (2) obtain and pay for any governmental licenses and permits necessary for the work, other than building and utility permits.

ARTICLE 2 CONTRACT DOCUMENTS

"Contract Documents" means the Advertisement for Bids, Instructions To Bidders, Supplementary Instructions to Bidders, Bid Form, this Agreement, General Conditions, Supplementary Conditions, Exhibits, Specifications, List of Drawings, Drawings, Addenda, Notice to Proceed, Change Orders, Notice of Completion, and all other documents identified in this Agreement that together form the contract between University and Contractor for the Work (the "Contract"). The Contract constitutes the complete agreement between University and Contractor and supersedes any previous agreements or understandings.

ARTICLE 3 CONTRACT SUM

Subject to the provisions of the Contract Documents University shall pay to Contractor, for the performance of the Work, \$ [REDACTED], the "Contract Sum".

The Contract Sum includes the following Allowances:

Allowance No. 1: Include an allowance of \$105,600.00 for 3 CRAC Units (1) AC-3/C-3, (1) FCU-1, (1) FCU-2, as specified in Specification Section 01 2100.

The Contract Sum includes the following Alternates accepted by University:

List Alternates Accepted by University at Time of Award

University reserves the right to accept the following Alternates within 10 days after the date of this Agreement:

List Alternates Not Accepted by University at Time of Award

Unit Prices, if any, are as follows:

Not Used

The Contract Sum will be increased by an amount equal to the Unit Price multiplied by the actual number of units of each Unit Price item incorporated in the Work.

ARTICLE 4 CONTRACT TIME

Contractor shall commence the Work on the date specified in the Notice to Proceed and fully complete the work within **330** days, the "Contract Time".

By signing this agreement, Contractor represents to University that the Contract Time is reasonable for completion of the work and that Contractor will complete the Work within the Contract Time. Time limits stated in the Contract Documents are of the essence of the Contract.

ARTICLE 5 LIQUIDATED DAMAGES

If Contractor fails to complete the Work within the Contract Time, Contractor shall pay to University, as liquidated damages and not as a penalty, the sum of **\$300.00** for each day after the expiration of the Contract Time that the Work remains incomplete. After Substantial Completion, the rate for liquidated damages shall be reduced to the sum of **\$300.00** per day. University and Contractor agree that if the Work is not completed within the Contract Time, University's damages would be extremely difficult or impracticable to determine and that the aforesaid amounts are reasonable estimates of and reasonable sums for such damages. University may deduct any liquidated damages due from Contractor from any amounts otherwise due to Contractor under the Contract Documents. This provision shall not limit any right or remedy of University in the event of any other default of Contractor other than failing to complete the Work within the Contract Time.

ARTICLE 6 COMPENSABLE DELAY

If Contractor is entitled to an increase in the Contract Sum as a result of a Compensable Delay, determined pursuant to Articles 7 and 8 of the General Conditions, the Contract Sum will be increased by the sum of \$ [REDACTED] per day for each day for which such compensation is payable.

ARTICLE 7 DUE AUTHORIZATION

The person or persons signing this Agreement on behalf of Contractor hereby represent and warrant to University that this Agreement is duly authorized, signed, and delivered by Contractor.

THIS AGREEMENT is entered into by University and Contractor as of the date set forth above.

CONTRACTOR:

<p>_____</p> <p style="text-align: center;">(Name of Company)</p> <p>a _____</p> <p style="text-align: center;">(Type of Organization)</p> <p>By: _____</p> <p style="text-align: center;">(Signature)</p> <p>_____</p> <p style="text-align: center;">(Print Name)</p> <p>_____</p> <p style="text-align: center;">(Title)</p>	<p>California Contractor's License(s):</p> <p>_____</p> <p style="text-align: center;">(Name of Licensee)</p> <p>_____</p> <p style="text-align: center;">(Classification and License Number)</p> <p>_____</p> <p style="text-align: center;">(Expiration Date)</p> <p>_____</p> <p style="text-align: center;">(Employer Identification Number)</p>
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Recommended:

By University's Representative:

(Signature & Date)

Tameesha Hayes
 Project Manager
 Planning, Design & Construction

(Print Name & Title)

Funds Sufficient:

By Financial Administrative Officer:

(Signature & Date)

Susan McFadden
 Senior Financial Analyst
 Planning, Design & Construction

(Print Name & Title)

UNIVERSITY:

By The Regents of the University of California:

(Signature & Date)

Drew Hecht, Architect
 Director of Project Management
 Planning, Design & Construction

(Print Name & Title)

Account No.:	_____	Activity Code:	_____
Fund:	_____	Function:	_____
Cost Center:	_____	Project Code:	_____

Attach notary acknowledgement for all signatures of Contractor. If signed by other than the sole proprietor, a general partner, or corporate officer, attach original notarized Power of Attorney or Corporate Resolution.

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ARTICLE 1 GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 APPLICABLE CODE REQUIREMENTS

The term "Applicable Code Requirements" means all laws, statutes, the most recent building codes, ordinances, rules, regulations, and lawful orders of all public authorities having jurisdiction over University, Contractor, any Subcontractor, the Project, the Project site, the Work, or the prosecution of the Work including without limitation the requirements set forth in Article 3.7.

1.1.2 APPLICATION FOR PAYMENT

The term "Application For Payment" means the submittal from Contractor wherein payment for certain portions of the completed Work is requested in accordance with Article 9.

1.1.3 BENEFICIAL OCCUPANCY

The term "Beneficial Occupancy" means the University's occupancy or use of any part of the Work in accordance with Article 9.

1.1.4 CERTIFICATE FOR PAYMENT

The term "Certificate For Payment" means the form signed by University's Representative attesting to the Contractor's right to receive payment for certain completed portions of the Work in accordance with Article 9.

1.1.5 CHANGE ORDER

See Article 7.2 of the General Conditions.

1.1.6 CLAIM

See Article 4.3 of the General Conditions.

1.1.7 COMPENSABLE DELAY

The term "Compensable Delay" means a delay that entitles the Contractor to an adjustment of the Contract Sum and an adjustment of the Contract Time pursuant to Articles 7 and 8 of the General Conditions.

1.1.8 CONTRACT

The term "Contract" shall have the meaning identified in Article 2 of the Agreement.

1.1.9 CONTRACT DOCUMENTS

The term "Contract Documents" means all documents listed in Article 2 of the Agreement, as modified by Change Order, including but not limited to the Drawings and Specifications.

1.1.10 CONTRACT MILESTONE

The term "Contract Milestone" means any requirement in the Contract Documents that reflects a planned point in time for the start or completion of a portion of the Work measured from i) the date of the Notice to Proceed or ii) the date of another Contract Milestone defined in the Contract Documents, as applicable.

1.1.11 CONTRACT SCHEDULE

The term "Contract Schedule" means the graphical representation of a practical plan, in accordance with the Specifications, to perform and complete the Work within the Contract Time in accordance with Article 3.

1.1.12 CONTRACT SUM

The term "Contract Sum" means the amount of compensation stated in the Agreement for the performance of the Work, as adjusted by Change Order.

1.1.13 CONTRACT TIME

The term "Contract Time" means the number of days set forth in the Agreement, as adjusted by Change Order, within which Contractor must achieve Final Completion.

1.1.14 CONTRACTOR

The term "Contractor" means the person or firm identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number.

1.1.15 CONTRACTOR FEE

See Article 7.3 of the General Conditions.

1.1.16 COST OF EXTRA WORK

See Article 7.3 of the General Conditions.

1.1.17 DAY

The term “day,” as used in the Contract Documents, shall mean calendar day, unless otherwise specifically provided.

1.1.18 DEFECTIVE WORK

The term “Defective Work” means work that is unsatisfactory, faulty, omitted, incomplete, deficient, or does not conform to the requirements of the Contract Documents, directives of University’s Representative, or the requirements of any inspection, reference standard, test, or approval specified in the Contract Documents.

1.1.19 DRAWINGS

The term “Drawings” means the graphic and pictorial portions of the Contract Documents showing the design, location, and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams. The Drawings are listed in the List of Drawings.

1.1.20 EXCUSABLE DELAY

The term “Excusable Delay” means a delay that entitles the Contractor to an adjustment of the Contract Time but not an adjustment of the Contract Sum, pursuant to Articles 7 and 8 of the General Conditions.

1.1.21 EXTRA WORK

The term “Extra Work” means Work beyond or in addition to the Work required by the Contract Documents.

1.1.22 FIELD ORDER

See Article 7.2 of the General Conditions.

1.1.23 FINAL COMPLETION

The term “Final Completion” means the date at which the Work has been fully completed in accordance with the requirements of the Contract Documents pursuant to Article 9.8.1 of the General Conditions.

1.1.24 GUARANTEE TO REPAIR PERIOD

See Article 12.2 of the General Conditions.

1.1.25 HAZARDOUS MATERIAL

The term “Hazardous Material” means any substance or material identified as hazardous under any California or federal statute governing handling, disposal and/or cleanup of any such substance or material.

1.1.26 PROJECT

The term “Project” means the Work of the Contract and all other work, labor, equipment, and materials necessary to accomplish the Project . The Project may include construction by University or by Separate Contractors.

1.1.27 PROJECT SITE

The term “Project Site” or “Project site” or “Site” or “site” means lands and facilities upon which the Work pertaining to physical construction operations is performed, including such access and other lands and facilities designated in the Contract Documents for use by Contractor.

1.1.28 SEPARATE CONTRACTOR

The term “Separate Contractor” means a person or firm under separate contract with University performing other work related to the Project.

1.1.29 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

See Article 3.12 of the General Conditions.

1.1.30 SPECIFICATIONS

The term “Specifications” means that portion of the Contract Documents consisting of the written requirements

for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

1.1.31 SUBCONTRACTOR

The term “Subcontractor” means a person or firm that has a contract with Contractor or with a Subcontractor to perform a portion of the Work. Unless otherwise specifically provided, the term Subcontractor includes Subcontractors of all tiers.

1.1.32 SUBSTANTIAL COMPLETION

See Article 9.7 of the General Conditions.

1.1.33 SUPERINTENDENT

The term “Superintendent” means the person designated by Contractor to represent Contractor at the Project site in accordance with Article 3.

1.1.34 TIER

The term “tier” means the contractual level of a Subcontractor or supplier with respect to Contractor. For example, a first-tier Subcontractor is under subcontract with Contractor, a second-tier Subcontractor is under subcontract with a first-tier Subcontractor, and so on.

1.1.35 UNEXCUSABLE DELAY

The term “Unexcusable Delay” means a delay that does not entitle the Contractor to an adjustment of the Contract Sum and does not entitle the Contractor to an adjustment of the Contract Time.

1.1.36 UNILATERAL CHANGE ORDER.

See Article 7.2 of the General Conditions.

1.1.37 UNIVERSITY

The term “University” means The Regents of the University of California.

1.1.38 UNIVERSITY’S BUILDING OFFICIAL

The term “University’s Building Official,” or “Certified Building Official,” means the individual the University has designated to act in the capacity as the “Building Official” as defined by the California Building Standards Code. The University’s Building Official will determine whether the Work complies with Applicable Code Requirements and will determine whether and when it is appropriate to issue a Certificate of Occupancy.

1.1.39 UNIVERSITY’S REPRESENTATIVE

The term “University’s Representative” means the person identified as such in the Agreement.

1.1.40 UNIVERSITY’S RESPONSIBLE ADMINISTRATOR

The term “University’s Responsible Administrator” means the person, or his or her authorized designee, who is authorized to execute the Agreement, Change Orders, Field Orders, and other applicable Contract Documents on behalf of the University.

1.1.41 WORK

The term “Work” means all construction, services and other requirements of the Contract Documents as modified by Change Order, whether completed or partially completed, and includes all labor, materials, equipment, tools, and services provided or to be provided by Contractor to fulfill Contractor’s obligations. The Work may constitute the whole or a part of the Project.

1.2 OWNERSHIP AND USE OF CONTRACT DOCUMENTS

1.2.1 The Contract Documents and all copies thereof furnished to or provided by Contractor are the property of the University and are not to be used on other work.

1.3 INTERPRETATION

1.3.1 The Contract Documents are complementary and what is required by one shall be as binding as if required by all. In the case of conflict between terms of the Contract Documents, the following order of precedence shall apply:

- .1 The Agreement,
- .2 The Supplementary Conditions,
- .3 The General Conditions,
- .4 The Specifications,
- .5 The Drawings.

1.3.2 With respect to the Drawings, figured dimensions shall control over scaled measurements and specific details shall control over typical or standard details.

1.3.3 With respect to the Contract Documents, Addenda shall govern over other portions of the Contract Documents to the extent specifically noted; subsequent Addenda shall govern over prior Addenda only to the extent specifically noted.

1.3.4 Organization of the Specifications into various subdivisions and the arrangement of the Drawings shall not control Contractor in dividing the Work among Subcontractors or in establishing the extent of work to be performed by any trade.

1.3.5 Unless otherwise stated in the Contract Documents, technical words and abbreviations contained in the Contract Documents are used in accordance with commonly understood construction industry meanings; and non-technical words and abbreviations are used in accordance with their commonly understood meanings.

1.3.6 The Contract Documents may omit modifying words such as "all" and "any," and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement. The use of the word "including," when following any general statement, shall not be construed to limit such statement to specific items or matters set forth immediately following such word or to similar items or matters, whether or not nonlimiting language (such as "without limitation," "but not limited to," or words of similar import) is used with reference thereto, but rather shall be deemed to refer to all other items or matters that could reasonably fall within the broadest possible scope of such general statement.

1.3.7 Whenever the context so requires, the use of the singular number shall be deemed to include the plural and vice versa. Each gender shall be deemed to include any other gender, and each shall include corporation, partnership, trust, or other legal entity whenever the context so requires. The captions and headings of the various subdivisions of the Contract Documents are intended only for reference and convenience and in no way define, limit, or prescribe the scope or intent of the Contract Documents or any subdivision thereof.

ARTICLE 2 UNIVERSITY

2.1 INFORMATION AND SERVICES PROVIDED BY UNIVERSITY

2.1.1 If required for performance of the Work, as determined by University's Representative, University will make available a survey describing known physical characteristics, boundaries, easements, and utility locations for the Project site.

2.1.2 University is not subject to any requirement to obtain or pay for local building permits, inspection fees, plan checking fees, or certain utility fees. Except as otherwise provided in the Contract Documents, University will obtain and pay for any utility permits, demolition permits, easements, and government approvals for the use or occupancy of permanent structures required in connection with the Work.

2.1.3 Contractor will be furnished, free of charge, such copies of the Contract Documents as University deems reasonably necessary for execution of the Work.

2.2 ACCESS TO PROJECT SITE

2.2.1 University will provide, no later than the date designated in the Contract Schedule accepted by University's Representative, access to the lands and facilities upon which the Work is to be performed, including such access and other lands and facilities designated in the Contract Documents for use by

Contractor.

2.3 UNIVERSITY'S RIGHT TO STOP THE WORK

2.3.1 If Contractor fails to correct Defective Work as required by Article 12.2 or fails to perform the Work in accordance with the Contract Documents, University or University's Representative may direct Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated by Contractor. Contractor shall not be entitled to any adjustment of Contract Time or Contract Sum as a result of any such order. University and University's Representative have no duty or responsibility to Contractor or any other party to exercise the right to stop the Work.

2.4 UNIVERSITY'S RIGHT TO CARRY OUT THE WORK

2.4.1 If Contractor fails to carry out the Work in accordance with the Contract Documents, fails to provide sufficient labor, materials, equipment, tools, and services to maintain the Contract Schedule, or otherwise fails to comply with any material term of the Contract Documents, and, after receipt of written notice from University, fails within 2 days, excluding Saturdays, Sundays and legal holidays, or within such additional time as the University may specify, to correct such failure, University may, without prejudice to other remedies University may have, correct such failure at Contractor's expense. In such case, University will be entitled to deduct from payments then or thereafter due Contractor the cost of correcting such failure, including without limitation compensation for the additional services and expenses of University's consultants made necessary thereby. If payments then or thereafter due Contractor are not sufficient to cover such amounts, Contractor shall pay the additional amount to University.

2.5 UNIVERSITY'S RIGHT TO REPLACE UNIVERSITY'S REPRESENTATIVE

2.5.1 University may at any time and from time to time, without prior notice to or approval of Contractor, replace University's Representative with a new University's Representative. Upon receipt of notice from University informing Contractor of such replacement and identifying the new University's representative, Contractor shall recognize such person or firm as University's Representative for all purposes under the Contract Documents.

ARTICLE 3 CONTRACTOR

3.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.1.1 Contractor and its Subcontractors shall review and compare each of the Contract Documents with the others and with information furnished or made available by University, and shall promptly report in writing to University's Representative any errors, inconsistencies, or omissions in the Contract Documents or inconsistencies with Applicable Code Requirements observed by Contractor or its Subcontractors.

3.1.2 Contractor and its Subcontractors shall take field measurements, verify field conditions, and carefully compare with the Contract Documents such field measurements, conditions, and other information known to Contractor before commencing the Work. Errors, inconsistencies, or omissions discovered at any time shall be promptly reported in writing to University's Representative.

3.1.3 If Contractor and its Subcontractors performs any construction activity involving an error, inconsistency, or omission referred to in Articles 3.1.1 and 3.1.2, without giving the notice required in those Articles and obtaining the written consent of University's Representative, Contractor shall be responsible for the resultant losses, including, without limitation, the costs of correcting Defective Work.

3.2 SUPERVISION AND CONSTRUCTION PROCEDURES

3.2.1 Contractor shall supervise, coordinate, and direct the Work using Contractor's best skill and attention. Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, procedures, and the coordination of all portions of the Work.

3.2.2 Contractor shall be responsible to University for acts and omissions of Contractor's agents, employees, and Subcontractors, and their respective agents and employees.

3.2.3 Contractor shall not be relieved of its obligation to perform the Work in accordance with the Contract Documents either by acts or omissions of University or University's Representative in the administration of the Contract, or by tests, inspections, or approvals required or performed by persons or firms other than Contractor.

3.2.4 Contractor shall be responsible for inspection of all portions of the Work, including those portions already performed under this Contract, to determine that such portions conform to the requirements of the Contract and are ready to receive subsequent Work.

3.2.5 Contractor shall at all times maintain good discipline and order among its employees and Subcontractors. Contractor shall provide competent, fully qualified personnel to perform the Work.

3.3 LABOR AND MATERIALS

3.3.1 Unless otherwise provided in the Contract, Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and Final Completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.4 CONTRACTOR'S WARRANTY

3.4.1 Contractor warrants to University that all materials and equipment used in or incorporated into the Work will be of good quality, new, and free of liens, claims, and security interests of third parties; that the Work will be of good quality and free from defects; and that the Work will conform with the requirements of the Contract. If required by University's Representative, Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

3.5 TAXES

3.5.1 Contractor shall pay all sales, consumer, use, and similar taxes for the Work or portions thereof provided by Contractor.

3.6 PERMITS, FEES, AND NOTICES

3.6.1 Except for the permits and approvals which are to be obtained by University or the requirements with respect to which University is not subject as provided in Article 2.1.2, Contractor shall secure and pay for all permits, approvals, government fees, licenses, and inspections necessary for the proper execution and performance of the Work. Contractor shall deliver to University all original licenses, permits, and approvals obtained by Contractor in connection with the Work prior to the final payment or upon termination of the Contract, whichever is earlier.

3.7 APPLICABLE CODE REQUIREMENTS

3.7.1 Contractor shall perform the Work in accordance with the following Applicable Code Requirements:

- .1 All laws, statutes, the most recent building codes, ordinances, rules, regulations, and lawful orders of all public authorities having jurisdiction over University, Contractor, any Subcontractor, the Project, the Project site, the Work, or the prosecution of the Work.
- .2 All requirements of any insurance company issuing insurance required hereunder.
- .3 The Federal Occupational Safety and Health Act and all other Applicable Code Requirements relating to safety.
- .4 Applicable titles in the State of California Code of Regulations.
- .5 Applicable sections in the State of California Labor Code.
- .6 All Applicable Code Requirements relating to nondiscrimination, payment of prevailing wages, payroll records, apprentices, and work day.

Without limiting the foregoing, Contractor shall comply with the provisions regarding nondiscrimination, payment of prevailing wages, payroll records, apprentices, and work day set forth in Article 14.

3.7.2 Contractor shall comply with and give notices required by all Applicable Code Requirements,

including all environmental laws and all notice requirements under the State of California Safe Drinking Water and Enforcement Act of 1986 (State of California Health and Safety Code Section 25249.5 and applicable sections that follow). Contractor shall promptly notify University's Representative in writing if Contractor becomes aware during the performance of the Work that the Contract Documents are at variance with Applicable Code Requirements.

3.7.3 If Contractor performs Work which it knows or should know is contrary to Applicable Code Requirements, without prior notice to University and University's Representative, Contractor shall be responsible for such Work and any resulting damages including, without limitation, the costs of correcting Defective Work.

3.8 SUPERINTENDENT

3.8.1 Contractor shall employ a competent Superintendent satisfactory to University who shall be in attendance at the Project site at all times during the performance of the Work. Superintendent shall represent Contractor and communications given to and received from Superintendent shall be binding on Contractor.

3.8.2 Contractor shall provide the Key Personnel, in addition to the Superintendent, as named in the Key Personnel Exhibit to this Contract. Substitution or replacement of any named individual requires the written approval of the University's Representative and approval will be at the sole discretion of University. Failure to maintain a Superintendent on the Project site at all times Work is in progress shall be considered a material breach of this Contract, entitling University to terminate the Contract or alternatively, issue a stop Work order until the Superintendent is on the Project site. If, by virtue of issuance of said stop Work order, Contractor fails to complete the Contract on time, Contractor will be assessed Liquidated Damages in accordance with the Agreement.

3.8.3 The Superintendent approved for the Project must be able to read, write and verbally communicate in English.

3.8.4 The Superintendent may not perform the Work of any trade, pick-up materials, or perform any Work not directly related to the supervision and coordination of the Work at the Project site when Work is in progress.

3.9 SCHEDULES REQUIRED OF CONTRACTOR

3.9.1 Contractor shall submit a Preliminary Contract Schedule to University's Representative in the form and within the time limit required by the Specifications. University's Representative will review the Preliminary Contract Schedule with Contractor within the time limit required by the Specifications, or, if no such time period is specified, within a reasonable period of time.

3.9.2 Contractor shall submit a Contract Schedule and updated Contract Schedules to University's Representative in the form and within the time limits required by the Specifications and acceptable to University's Representative. University's Representative will determine acceptability of the Contract Schedule and updated Contract Schedules within the time limits required by the Specifications, or if no such time period is specified, within a reasonable period of time. If University's Representative deems the Contract Schedule or updated Contract Schedule unacceptable, it shall specify in writing to Contractor the basis for its objection.

3.9.3 The Preliminary Contract Schedule, the Contract Schedule, and updated Contract Schedules shall represent a practical plan to complete the Work within the Contract Time. Schedules showing the Work completed in less than the Contract Time may be acceptable if judged by University's Representative to be practical. Schedules showing the Work completed beyond the Contract Time may be submitted under the following circumstances:

.1 If accompanied by a Change Order Request seeking an adjustment of the Contract Time consistent the requirements of paragraph 8.4 for Adjustment of the Contract Time for Delay.; or

.2 If the Contract Time has passed, or if it is a practical impossibility to complete the Work within the Contract Time, then the updated Contract Schedule or fragnet schedule shall show completion at the earliest practical date.

University's Representative will timely review the updated Contract Schedule or Fragnet Schedule submitted by Contractor. If University's Representative determines that additional supporting data are necessary to fully evaluate the updated Contract Schedule or Fragnet Schedule, University's Representative will request such additional supporting data in writing. Such data shall be furnished no later than 10 days after the date of such request. University's Representative will render a decision promptly and in any case within 30 days after the later of the receipt of the updated Contract Schedule or Fragnet Schedule or the deadline for furnishing such additional supporting data. Failure of University's Representative to render a decision by the applicable deadline will be deemed a decision denying approval of the updated Contract Schedule or Fragnet Schedule.

Acceptance of any schedule showing completion beyond the Contract Time by University's Representative shall not change the Contract Time and is without prejudice to any right of the University. The Contract Time, not the Contract Schedule, shall control in the determination of liquidated damages payable by Contractor under Article 4 and Article 5 of the Agreement and in the determination of any delay under Article 8 of the General Conditions.

3.9.4 If a schedule showing the Work completed in less than the Contract Time is accepted, Contractor shall not be entitled to extensions of the Contract Time for Excusable Delays or Compensable Delays or to adjustments of the Contract Sum for Compensable Delays until such delays extend the Final Completion of the Work beyond the expiration of the Contract Time.

3.9.5 Contractor shall prepare and keep current to the reasonable satisfaction of University's Representative, a Submittal Schedule in the form contained in the Exhibits, for each submittal, as required by the Specifications, and that are coordinated with the other activities in the Contract Schedule.

3.9.6 The Preliminary Contract Schedule, Contract Schedule, and the Updated Contract Schedules shall meet the following requirements:

- .1 Schedules must be suitable for monitoring progress of the Work.
- .2 Schedules must provide necessary data about the timing for University decisions and University furnished items.
- .3 Schedules must be in sufficient detail to demonstrate adequate planning for the Work.
- .4 Schedules must represent a practical plan to perform and complete the Work within the Contract Time.

3.9.7 University's Representative's review of the form and general content of the Preliminary Contract Schedule, Contract Schedule, and Updated Contract Schedules is for the purpose of determining if the above-listed requirements have been satisfied.

3.9.8 Contractor shall plan, develop, supervise, control, and coordinate the performance of the Work so that its progress and the sequence and timing of Work will permit its completion within the Contract Time, any Contract milestones and any Contract phases.

3.9.9 In preparing the Preliminary Contract Schedule, the Contract Schedule, and updated Contract Schedules, Contractor shall obtain such information and data from Subcontractors as may be required to develop a reasonable and appropriate schedule for performance of the work and shall provide such information and data to the University's Representative upon request. Contractor shall continuously obtain from Subcontractors information and data about the planning for and progress of the Work and the delivery of equipment, shall coordinate and integrate such information and data into updated Contract Schedules, as appropriate, and shall monitor the progress of the Work and the delivery of equipment.

3.9.10 Contractor shall act as the expeditor of potential and actual delays, interruptions, hindrances, or disruptions for its own forces and those forces of Subcontractors, regardless of tier.

3.9.11 Contractor shall cooperate with University's Representative in the development of the Contract Schedule and updated Contract Schedules. University's Representative's acceptance of or its review comments about any schedule or scheduling data shall not relieve Contractor from its sole responsibility to plan for, perform, and complete the Work within the Contract Time. Acceptance of or review comments about any schedule shall not transfer responsibility for any schedule to University's Representative or University nor imply their agreement with (1) any assumption upon which such schedule is based or (2) any matter underlying or contained in such schedule. Failure of University's Representative to discover errors or omissions in schedules that it has reviewed, or to inform Contractor that Contractor, Subcontractors, or others are behind schedule, or to direct or enforce procedures for complying with the Contract Schedule shall not relieve

Contractor from its sole responsibility to perform and complete the Work within the Contract Time and shall not be a cause for an adjustment of the Contract Time or the Contract Sum.

3.10 AS-BUILT DOCUMENTS

3.10.1 Contractor shall maintain one set of As-built drawings and specifications, which shall be kept up to date during the Work of the Contract. All changes which are incorporated into the Work which differ from the documents as drawn and written shall be noted on the As-built set. Notations shall reflect the actual materials, equipment and installation methods used for the Work and each revision shall be initialed and dated by Superintendent. Prior to filing of the Notice of Completion each drawing and the specification cover shall be signed by Contractor and dated attesting to the completeness of the information noted therein. As-built Documents shall be turned over to the University's Representative and shall become part of the Record Documents.

3.11 DOCUMENTS AND SAMPLES AT PROJECT SITE

3.11.1 Contractor shall maintain the following at the Project site:

- .1 One as-built copy of the Contract Documents, in good order and marked to record current changes and selections made during construction.
- .2 The current accepted Contract Schedule.
- .3 Shop Drawings, Product Data, and Samples.
- .4 All other required submittals.

These shall be available to University's Representative and shall be delivered to University's Representative for submittal to University upon the earlier of Final Completion or termination of the Contract.

3.12 SHOP DRAWINGS, PRODUCT DATA, SAMPLES, AND ENVIRONMENTAL PRODUCT DECLARATIONS

3.12.1 Definitions:

- .1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by Contractor or a Subcontractor to illustrate some portion of the Work.
- .2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate or describe materials or equipment for some portion of the Work.
- .3 Samples are physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
- .4 Environmental Product Declarations are those documents and other submissions required to be furnished by Contractor or a Subcontractor pursuant to California Public Contract Code Section 3500 et seq., the Buy Clean California Act, as further described in Article 3.12.9 below.

3.12.2 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate, for those portions of the Work for which submittals are required, how Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

3.12.3 Contractor shall review, approve, and submit to University's Representative Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of University or of Separate Contractors. Submittals made by Contractor which are not required by the Contract Documents may be returned without action by University's Representative.

3.12.4 Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples, or similar submittals until the respective submittal has been reviewed by University's Representative and no exceptions have been taken by University's Representative. Such Work shall be in accordance with approved submittals and the Contract Documents.

3.12.5 By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals,

Contractor represents that it has determined or verified materials and field measurements and conditions related thereto, and that it has checked and coordinated the information contained within such submittals with the requirements of the Contract Documents and Shop Drawings for related Work.

3.12.6 If Contractor discovers any conflicts, omissions, or errors in Shop Drawings or other submittals, Contractor shall notify University's Representative and receive instruction before proceeding with the affected Work.

3.12.7 Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by University's Representative's review of Shop Drawings, Product Data, Samples, or similar submittals, unless Contractor has specifically informed University's Representative in writing of such deviation at the time of submittal and University's Representative has given written approval of the specific deviation. Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals by University's Representative's review, acceptance, comment, or approval thereof.

1.12.8 Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by University's Representative on previous submittals.

1.12.9 Environmental Product Declarations

3.12.9.1 Contractor shall comply with California Public Contract Code Section 3500 et seq., the Buy Clean California Act ("BCCA").

3.12.9.2 The term "Eligible Materials", as used herein, shall mean the same as defined by the BCCA, and shall include at a minimum the following materials:

- (1) Carbon steel rebar.
- (2) Flat glass.
- (3) Mineral wool board insulation.
- (4) Structural steel.

3.12.9.3 Compliance with the BCCA and this Article applies to all Eligible Materials for the Project.

3.12.9.4 Contractor shall submit to University a current facility-specific Environmental Product Declaration ("EPD"), Type III, as defined by the International Organization for Standardization ("ISO") standard 14025, or similarly robust life cycle assessment methods that have uniform standards in data collection consistent with ISO standard 14025, industry acceptance, and integrity, for each Eligible Material proposed to be used on the Project.

3.12.9.5 Eligible Materials installed on the Project by Contractor must comply with any standards to the extent established in the BCCA or by University, whichever is more stringent. The facility-specific global warming potential for any Eligible Material must not exceed any existing maximum acceptable global warming potential for that material pursuant to the BCCA or by University, whichever is more stringent ("EM Standards").

3.12.9.6 Contractor shall not install any Eligible Materials on the Project until Contractor submits a facility-specific EPD for that material which demonstrates that the material complies with any existing EM Standards and this Article. Contractor shall be responsible for any losses, expenses, penalties or damages of any type incurred or sustained by University, including any tear out and replacement of Defective Work, which are caused by Contractor's failure to comply with the requirements of the BCCA or this Article.

3.13 USE OF SITE AND CLEAN UP

3.13.1 Contractor shall confine operations at the Project site to areas permitted by law, ordinances, permits, and the Contract Documents. Contractor shall not unreasonably encumber the Project site with materials or equipment.

3.13.2 Contractor shall, during performance of the Work, keep the Project site and surrounding area free from the accumulation of excess dirt, waste materials, and rubbish caused by Contractor. Contractor shall

remove all excess dirt, waste material, and rubbish caused by the Contractor; tools; equipment; machinery; and surplus materials from the Project site and surrounding area at the completion of the Work.

3.13.3 Personnel of Contractor and Subcontractors shall not occupy, live upon, or otherwise make use of the Project site during any time that Work is not being performed at the Project site, except as otherwise provided in the Contract Documents.

3.14 CUTTING, FITTING, AND PATCHING

3.14.1 Contractor shall do all cutting, fitting, or patching of the Work required to make all parts of the Work come together properly and to allow the Work to receive or be received by work of Separate Contractors shown upon, or reasonably implied by, the Contract Documents.

3.14.2 Contractor shall not endanger the Work, the Project, or adjacent property by cutting, digging, or otherwise. Contractor shall not cut or alter the work of any Separate Contractor without the prior consent of University's Representative.

3.15 ACCESS TO WORK

3.15.1 University, University's Representative, their consultants, and other persons authorized by University will at all times have access to the Work wherever it is in preparation or progress. Contractor shall provide safe and proper facilities for such access and for inspection.

3.16 ROYALTIES AND PATENTS

3.16.1 Contractor shall pay all royalties and license fees required for the performance of the Work. Contractor shall defend suits or claims resulting from Contractor's or any Subcontractor's infringement of patent rights and shall Indemnify, defend and hold harmless University and University's Representative from losses on account thereof.

3.17 DIFFERING SITE CONDITIONS

3.17.1 If Contractor encounters any of the following conditions at the site, Contractor shall immediately notify the University's Representative in writing of the specific differing conditions before they are disturbed and before any affected Work is performed, and permit investigation of the conditions:

- .1 Subsurface or latent physical conditions at the site (including Hazardous Materials) which differ materially from those indicated in this Contract, or if not indicated in this Contract, in the Information Available to Bidders; or
- .2 Unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

3.17.2 Contractor shall be entitled to an adjustment to the Contract Sum and/or Contract Time as the result of extra costs and/or delays resulting from a materially differing site condition, if and only if Contractor fulfills the following conditions:

- .1 Contractor fully complies with Article 3.17.1; and
- .2 Contractor fully complies with Article 4 (including the timely filing of a Change Order Request and all other requirements for Change Orders Requests and Claims).

3.17.3 Adjustments to the Contract Sum and/or Contract Time shall be subject to the procedures and limitations set forth in Articles 7 and 8.

3.18 CONCEALED, UNFORESEEN, OR UNKNOWN CONDITIONS OR EVENTS

3.18.1 Except and only to the extent provided otherwise in Articles 3.17, 7 and 8 of the General Conditions, by signing the Agreement, Contractor agrees:

- .1 To bear the risk of concealed, unforeseen or unknown conditions or events, if any, which may be encountered in performing the Contract; and
- .2 That Contractor's bid for the Contract was made with full knowledge of this risk.

In agreeing to bear the risk of concealed, unforeseen or unknown conditions or events, Contractor understands that, except and only to the extent provided otherwise in Articles 3.17, 7 and 8, concealed, unforeseen or unknown conditions or events shall not excuse Contractor from its obligation to achieve Final Completion of the Work within the Contract Time, and shall not entitle the Contractor to an adjustment of the Contract Sum.

3.18.2 If Contractor encounters concealed, unforeseen or unknown conditions or events that may require a change to the design shown in the Contract Documents, Contractor shall immediately notify University's Representative in writing such that University's Representative can determine if a change to the design is required. Contractor shall be liable to University for any extra costs incurred as the result of Contractor's failure to immediately give such notice.

3.18.3 If, as the result of concealed, unforeseen or unknown conditions or events, the University issues a Change Order or Field Order that changes the design from the design depicted in the Contract Documents, Contractor shall be entitled, subject to compliance with all the provisions of the Contract, including those set forth in Articles 4, 7 and 8, to an adjustment of the Contract Sum and/or Contract Time, for the cost and delay resulting from implementing the changes to the design. Except as provided in this Article 3.18.3, or as may be expressly provided otherwise in the Contract, there shall be no adjustment of the Contract Sum and/or Contract Time as a result of concealed, unforeseen or unknown conditions or events.

3.18.4 Contractor shall, as a condition precedent to any adjustment in Contract Sum or Contract Time under Article 3.18.3, fully comply with Article 4 (including the timely filing of a Change Order Request and all other requirements for Change Orders Requests and Claims).

3.19 HAZARDOUS MATERIALS

3.19.1 The University shall not be responsible for any Hazardous Material brought to the site by the Contractor.

3.19.2 If the Contractor: (i) introduces and/or discharges a Hazardous Material onto the site in a manner not specified by the Contract Documents; and/or (ii) disturbs a Hazardous Material identified in the Contract Documents, the Contractor shall hire a qualified remediation contractor at Contractor's sole cost to eliminate the condition as soon as possible. Under no circumstance shall the Contractor perform Work for which it is not qualified. University, in its sole discretion, may require the Contractor to retain at Contractor's cost an independent testing laboratory.

3.19.3 If the Contractor encounters a Hazardous Material which may cause foreseeable injury or damage, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such material or substance (except in an emergency situation); and (iii) notify University (and promptly thereafter confirm such notice in writing)

3.19.4 Subject to Contractor's compliance with Article 3.19.3, the University shall verify the presence or absence of the Hazardous Material reported by the Contractor, except as qualified under Section 3.19.1 and 3.19.3, and, in the event such material or substance is found to be present, verify that the levels of the hazardous material are below OSHA Permissible Exposure Levels and below levels which would classify the material as a state of California or federal hazardous waste. When the material falls below such levels, Work in the affected area shall resume upon direction by the University. The Contract Time and Sum shall be extended appropriately as provided in Articles 7 and 8.

3.19.5 The University shall indemnify and hold harmless the Contractor from and against claims, damages, losses and expenses, arising from a Hazardous Material on the Project site, if such Hazardous Material: (i) was not shown on the Contract Documents or Information Available to Bidders; (ii) was not brought to the site by Contractor; and (iii) exceeded OSHA Permissible Exposure Levels or levels which would classify the material as a state of California or federal hazardous waste. The indemnity obligation in this Article shall not apply to:

- .1 Claims, damages, losses or expenses arising from the breach of contract, negligence or willful misconduct of Contractor, its suppliers, its Subcontractors of all tiers and/or any persons or entities working under Contractor; and
- .2 Claims, damages, losses or expenses arising from a Hazardous Material subject to Article 3.19.2.

3.19.6 In addition to the requirements in Article 3.22, Contractor shall indemnify and hold harmless the University from and against claims, damages, losses and expenses, arising from a Hazardous Material on the Project site, if such Hazardous Material exceeded OSHA Permissible Exposure Levels or levels which would classify the material as a state of California or federal hazardous waste, and was either i) shown on the Contract Documents or Information Available to Bidders; or (ii) brought to the site by Contractor. Nothing in this paragraph shall obligate the Contractor to indemnify University in the event of the sole negligence of the University, its officers, agents, or employees.

3.20 INFORMATION AVAILABLE TO BIDDERS

3.20.1 Any information provided pursuant to INFORMATION AVAILABLE TO BIDDERS is subject to the following provisions:

- .1 The information is made available for the convenience of Bidders and is not a part of the Contract.
- .2 The Contractor may rely on written descriptions of physical conditions included in the information to the extent such reliance is reasonable.
- .3 Other components of the information, including but not limited to recommendations, may not be relied upon by Contractor. University shall not be responsible for any interpretation of or conclusion drawn from the other components of the information by the Contractor.

3.21 LIABILITY FOR AND REPAIR OF DAMAGED WORK

3.21.1 Contractor shall be liable for any and all damages and losses to the Project (whether by fire, theft, vandalism, earthquake or otherwise) prior to University's acceptance of the Project as fully completed except that Contractor shall not be liable for damages and losses to the Project caused by earthquake in excess of magnitude 3.5 on the Richter Scale, tidal wave, or flood, provided that the damages or losses were not caused in whole or in part by the negligent acts or omissions of Contractor, its officers, agents or employees (including all Subcontractors and suppliers of all tiers). As used herein, "flood" shall have the same meaning as in the builder's risk property insurance.

3.21.2 Contractor shall promptly repair and replace any Work or materials damaged or destroyed for which the Contractor is liable under Article 3.21.1.

3.22 INDEMNIFICATION

3.22.1 Contractor shall indemnify, defend and hold harmless University, University's consultants, University's Representative, University's Representative's consultants, and their respective directors, officers, agents, and employees from and against losses (including without limitation the cost of repairing defective work and remedying the consequences of defective work) arising out of, resulting from, or relating to the following:

- .1 The failure of Contractor to perform its obligations under the Contract.
- .2 The inaccuracy of any representation or warranty by Contractor given in accordance with or contained in the Contract Documents.
- .3 Any claim of damage or loss by any Subcontractor against University arising out of any alleged act or omission of Contractor or any other Subcontractor, or anyone directly or indirectly employed by Contractor or any Subcontractor.
- .4 Any claim of damage or loss resulting from Hazardous Materials introduced, discharged, or disturbed by Contractor as required per Article 3.19.6.

3.22.2 The University shall not be liable or responsible for any accidents, loss, injury (including death) or damages happening or accruing during the term of the performance of the Work herein referred to or in connection therewith, to persons and/or property, and Contractor shall fully indemnify, defend and hold harmless University and protect University from and against the same as provided in paragraph 3.22.1 above.

In addition to the liability imposed by law upon the Contractor for damage or injury (including death) to persons or property by reason of the negligence of the Contractor, its officers, agents, employees or Subcontractors, which liability is not impaired or otherwise affected hereby, the Contractor shall defend, indemnify, hold harmless, release and forever discharge the University, its officers, employees, and agents from and against and waive any and all responsibility of same for every expense, liability, or payment by reason of any damage or injury (including death) to persons or property suffered or claimed to have been suffered through any negligent act, omission, or willful misconduct of the Contractor, its officers, agents, employees, or any of its Subcontractors, or anyone directly or indirectly employed by either of them or from the condition of the premises or any part of the premises while in control of the Contractor, its officers, agents, employees, or any of its Subcontractors or anyone directly or indirectly employed by either of them, arising out of the performance of the Work called for by this Contract. Contractor agrees that this indemnity and hold harmless shall apply even in the event of negligence of University, its officers, agents, or employees, regardless of whether such negligence is contributory to any claim, demand, loss, damage, injury, expense, and/or liability; but such indemnity and hold harmless shall not apply (i) in the event of the sole negligence of University, its officers, agents, or employees; or (ii) to the extent that the University shall indemnify and hold harmless the Contractor for Hazardous Materials pursuant to Article 3.19.5 .

3.22.3 In claims against any person or entity indemnified under this Article 3.22 that are made by an employee of Contractor or any Subcontractor, a person indirectly employed by Contractor or any Subcontractor, or anyone for whose acts Contractor or any Subcontractor may be liable, the indemnification obligation under this Article 3.22 shall not be limited by any limitation on amount or type of damages, compensation, or benefits payable by or for Contractor or any Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

3.22.4 The indemnification obligations under this Article 3.22 shall not be limited by any assertion or finding that the person or entity indemnified is liable by reason of a non-delegable duty.

3.22.5 Contractor shall indemnify University from and against Losses resulting from any claim of damage made by any Separate Contractor against University arising out of any alleged acts or omissions of Contractor, any Subcontractor, anyone directly or indirectly employed by either of them, or anyone for whose acts either of them may be liable.

3.22.6 Contractor shall indemnify Separate Contractors from and against Losses arising out of the negligent acts, omissions, or willful misconduct of Contractor, any Subcontractor, anyone directly or indirectly employed by either of them, or anyone for whose acts either of them may be liable.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

4.1 ADMINISTRATION OF THE CONTRACT BY UNIVERSITY'S REPRESENTATIVE

4.1.1 University's Representative will provide administration of the Contract as provided in the Contract Documents and will be the representative of University. University's Representative will have authority to act on behalf of University only to the extent provided in the Contract Documents.

4.1.2 University's Representative will have the right to visit the Project site at such intervals as deemed appropriate by the University's Representative. However, no actions taken during such Project site visit by University's Representative shall relieve Contractor of its obligations as described in the Contract Documents.

4.1.3 University's Representative will not have control over, will not be in charge of, and will not be responsible for construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, since these are solely Contractor's responsibility.

4.1.4 Except as otherwise provided in the Contract Documents or when direct communications have been specifically authorized, University and Contractor shall communicate through University's Representative. Except when direct communication has been specifically authorized in writing by University Representative, communications by Contractor with University's consultants and University's Representative's consultants shall be through University's Representative. Communications by University and University's Representative with Subcontractors will be through Contractor. Communications by Contractor and Subcontractors with Separate Contractors shall be through University's Representative. Contractor shall not rely on oral or other non-written communications.

4.1.5 Based on University's Representative's Project site visits and evaluations of Contractor's Applications For Payment, University's Representative will recommend amounts, if any, due Contractor and will issue Certificates For Payment in such amounts.

4.1.6 University's Representative will have the authority to reject the Work, or any portion thereof, which does not conform to the Contract Documents. University's Representative will have the authority to stop the Work or any portion thereof. Whenever University's Representative considers it necessary or advisable for implementation of the intent of the Contract Documents, University's Representative will have the authority to require additional inspection or testing of the Work in accordance with the Contract Documents, whether or not such Work is fabricated, installed, or completed. However, no authority of University's Representative conferred by the Contract Documents nor any decision made in good faith either to exercise or not exercise such authority, will give rise to a duty or responsibility of University or University's Representative to Contractor, or any person or entity claiming under or through Contractor.

4.1.7 University's Representative will have the authority to conduct inspections as provided in the Contract Documents, to take Beneficial Occupancy and to determine the dates of Substantial Completion and Final Completion; will receive for review and approval any records, written warranties, and related documents required by the Contract Documents and assembled by Contractor; and will issue a final Certificate For Payment upon Contractor's compliance with the requirements of the Contract Documents.

4.1.8 University's Representative will be, in the first instance, the interpreter of the requirements of the Contract Documents and the judge of performance thereunder by Contractor. Should Contractor discover any conflicts, omissions, or errors in the Contract Documents; have any questions about the interpretation or clarification of the Contract Documents; question whether Work is within the scope of the Contract Documents; or question that Work required is not sufficiently detailed or explained, then, before proceeding with the Work affected, Contractor shall notify University's Representative in writing and request interpretation, clarification, or furnishing of additional detailed instructions. University's Representative's response to questions and requests for interpretations, clarifications, instructions, or decisions will be made with reasonable promptness. Should Contractor proceed with the Work affected before receipt of a response from University's Representative, any portion of the Work which is not done in accordance with University's Representative's interpretations, clarifications, instructions, or decisions shall be removed or replaced and Contractor shall be responsible for all resultant losses.

4.2 CONTRACTOR CHANGE ORDER REQUESTS

4.2.1 Contractor may request changes to the Contract Sum and/or Contract Time for Extra Work, materially differing site conditions, or Delays to Final Completion of the Work.

4.2.2 Conditions precedent to obtaining an adjustment of the Contract Sum and/or Contract Time, payment of money, or other relief with respect to the Contract Documents, for any other reason, are:

- .1 Timely submission of a Change Order Request that meets the requirements of Articles 4.2.3.1 and 4.2.3.2; and
- .2 If requested, timely submission of additional information requested by the University Representative pursuant to Article 4.2.3.3.

4.2.3 Change Order Request:

4.2.3.1 A Change Order Request will be deemed timely submitted if, and only if, it is submitted within 7 days of the date the Contractor discovers, or reasonably should discover the circumstances giving rise to the Change Order Request, unless additional time is allowed in writing by University's Representative for submission of the Change Order Request, provided that if :

- .1 the Change Order Request includes compensation sought by a Subcontractor; AND
- .2 the Contractor requests in writing to the University's Representative, within the 7-day time period, additional time to permit Contractor to conduct an appropriate review of the Subcontractor Change Order Request,

the time period for submission of the actual Change Order Request shall be extended by the number of days specified in writing by the University's Representative.

4.2.3.2 A Change Order Request must state that it is a Change Order Request, state and justify the reason for the request, and specify the amount of any requested adjustment of the Contract Sum, Contract Time, and/or other monetary relief. If the Contractor requests an adjustment to the Contract Sum or other monetary relief, the Contractor shall submit the following with the Change Order Request:

- .1 a completed Cost Proposal in the form contained in the Exhibits meeting the requirements of Article 7; OR
- .2 a partial Cost Proposal and a declaration of what required information is not then known to Contractor. If Contractor failed to submit a completed Cost Proposal with the Change Order Request, Contractor shall submit a completed Cost Proposal meeting the requirements of Article 7 within 7 days of the date the Contractor submitted the Change Order Request unless additional time is allowed by the University's Representative.

4.2.3.3 Upon request of University's Representative, Contractor shall submit such additional information as may be requested by University's Representative for the purpose of evaluating the Change Order Request. Such additional information may include:

- .1 If Contractor seeks an adjustment of the Contract Sum or other monetary relief, actual cost records for any changed or extra costs (including without limitation, payroll records, material and rental invoices and the like), shall be submitted by the deadline established by the University's Representative, who may require such actual cost records to be submitted and reviewed, on a daily basis, by the University's Representative and/or representatives of the University's Representative.
- .2 If Contractor seeks an adjustment of the Contract Time, written documentation demonstrating Contractor's entitlement to a time extension under Article 8.4, which shall be submitted within 15 days of the date requested. If requested, Contractor may submit a fragnet in support of its request for a time extension. The University may, but is not obligated to, grant a time extension on the basis of a fragnet alone which, by its nature, is not a complete schedule analysis. If deemed appropriate by University Representative, Contractor shall submit a more detailed schedule analysis in support of its request for a time extension.
- .3 If Contractor seeks an adjustment of the Contract Sum or other monetary relief for delay, written documentation demonstrating Contractor's entitlement to such an adjustment under Article 7.3.9, which shall be submitted within 15 days of the date requested.
- .4 Any other information requested by the University's Representative for the purpose of evaluating the Change Order Request, which shall be submitted by the deadline established by the University's Representative.

4.2.4 University's Representative will make a decision on a Change Order Request, within a reasonable time, after receipt of a Change Order Request. In the event the Change Order Request is submitted pursuant to Article 8.4.1, the University's Representative shall promptly review and accept or reject it within thirty (30) days. A final decision is any decision on a Change Order Request which states that it is final. If University's Representative issues a final decision denying a Change Order Request in whole or in part, Contractor may contest the decision by filing a timely Claim under the procedures specified in Article 4.4.

4.2.5 Contractor may file a written demand for a final decision by University's Representative on all or part of any Change Order Request as to which the University's Representative has not previously issued a final decision pursuant to Article 4.2.4; such written demand may not be made earlier than the 30th day after submission of the Change Order Request. Within 30 days of receipt of the demand, University's Representative will issue a final decision on the Change Order Request. The University's Representative's failure to issue a decision within the 30-day period shall be treated as the issuance, on the last day of the 30-day period, of a final decision to deny the Change Order Request in its entirety.

4.3 CLAIMS

4.3.1 The term "Claim" means a written demand or assertion by Contractor seeking an adjustment or interpretation of the terms of the Contract Documents, payment of money, extension of time, or other relief with respect to the Contract Documents, including a determination of disputes or matters in question between University and Contractor arising out of or related to the Contract Documents or the performance of the Work. However, the term "Claim" shall not include, and the Claims procedures provided under this Article 4, including but not limited to arbitration, shall not apply to the following:

- .1 Claims respecting penalties for forfeitures prescribed by statute or regulation which a government agency is specifically authorized to administer, settle, or determine.
- .2 Claims respecting personal injury, death, reimbursement, or other compensation arising out of or resulting from liability for personal injury or death.
- .3 Claims by University, except as set forth in Articles 4.5, 4.6, and 4.7.
- .4 Claims respecting stop payment notices.

4.3.2 A Claim arises upon the issuance of a written final decision denying in whole or in part Contractor's Change Order Request pursuant to Articles 4.2.4 and 4.2.5.

4.3.3 A Claim must include the following:

- .1 A statement that it is a Claim and a request for a decision pursuant to Article 4.5.
- .2 A detailed factual narrative of events fully describing the nature and circumstances giving rise to the Claim, including but not limited to, necessary dates, locations, and items of work affected.
- .3 A certification, executed by Contractor, that the claim is filed in good faith. The certification must be made on the Claim Certification form, included in the Exhibits to the Contract. The language of the Claim Certification form may not be modified.
- .4 A certification, executed by each Subcontractor claiming not less than 5% of the total monetary amount sought by the claim, that the subcontractor's portion of the claim is filed in good faith. The certification must be made on the Claim Certification form, included in the Exhibits to the Contract. The language of the Claim Certification form may not be modified.
- .5 A statement demonstrating that a Change Order Request was timely submitted as required by Article 4.2.3
- .6 If a Cost Proposal or declaration was required by Article 4.2.3, a statement demonstrating that the Cost Proposal or the declaration was timely submitted as required by Article 4.2.3.
- .7 A detailed justification for any remedy or relief sought by the Claim, including to the extent applicable, the following:
 - .1 If the Claim involves Extra Work, a detailed cost breakdown of the amounts claimed, including the items specified in Article 7.3.2. An estimate of the costs must be provided even if the costs claimed have not been incurred when the Claim is submitted. To the extent costs have been incurred when the Claim is submitted, the Claim must include actual cost records (including without limitation, payroll records, material and rental invoices and the like) demonstrating that costs claimed have actually been incurred. To the extent costs have not yet been incurred at the time the Claim is submitted, actual cost records must be submitted on a current basis not less than once a month during any periods costs are incurred. A cost record will be considered current if submitted within 30 days of the date the cost reflected in the record is incurred. At the request of the University's Representative, claimed extra costs may be subject to further verification procedures (such as having an inspector verify the performance of alleged Extra Work on a daily basis). The cost breakdown must include an itemization of costs for i) labor including workers' names, classifications, regular hours and overtime hours worked, dates worked, and other pertinent information; ii) materials stored or incorporated in the work including invoices, purchase orders, location of materials either

- stored or incorporated into the work, dates materials were transported to the project or incorporated into the work, and other pertinent information; and iii) itemization of machinery and equipment including make, model, hours of use, dates of use and equipment rental rates of any rented equipment.
- .2 If the Claim involves an extension of the Contract Time, written documentation demonstrating the Contractor's entitlement to a time extension under Article 8.4, including the specific dates for which a time extension is sought and the specific reasons for entitlement of a time extension.
 - .3 If the Claim involves an adjustment of the Contract Sum for delay, written documentation demonstrating the Contractor's entitlement to such an adjustment under Article 7.3.9, including but not limited to, a detailed time impact analysis of the Contract Schedule. The Contract Schedule must demonstrate Contractor's entitlement to such an adjustment under Article 7.3.9.

4.4 ASSERTION OF CLAIMS

4.4.1 Claims by Contractor shall be first submitted to University's Representative for decision.

4.4.2 Notwithstanding the making of any Claim or the existence of any dispute regarding any Claim, unless otherwise directed by University's Representative, Contractor shall not cause any delay, cessation, or termination in or of Contractor's performance of the Work, but shall diligently proceed with performance of the Work in accordance with the Contract Documents.

4.4.3 Contractor shall submit a Claim in writing, together with all supporting data specified in Article 4.3.3, to University's Representative as soon as possible but not later than 30 days after the date the Claim arises under Article 4.3.2, provided that after written notification to the University's Representative within such time period, the time period for submission of the Claim shall be extended by the number of days specified in writing by the University's Representative where the Claim includes compensation sought by a Subcontractor and the Contractor requests an extension of time to permit it to discharge its responsibilities to conduct an appropriate review of the Subcontractor claim.

4.4.4 Strict compliance with the requirements of Articles 4.2, 4.3 and 4.4 are conditions precedent to Contractor's right to an informal conference to meet and confer to resolve a Claim, mediate a Claim, or arbitrate or litigate a Claim. Contractor specifically agrees to assert no Claims via an informal conference, mediation, arbitration or litigation unless there has been strict compliance with Articles 4.2, 4.3, and 4.4. The failure of Contractor to strictly comply with the requirements of Articles 4.2, 4.3 and 4.4 constitutes a failure by Contractor to exhaust its administrative remedies with the University, thereby denying any court or arbitration panel of jurisdiction to adjudicate the Claim.

4.5 DECISION OF UNIVERSITY'S REPRESENTATIVE ON CLAIMS

4.5.1 University's Representative will timely review Claims submitted by Contractor. If University's Representative determines that additional supporting data are necessary to fully evaluate a Claim, University's Representative will request such additional supporting data in writing. Such data shall be furnished no later than 10 days after the date of such request. University's Representative will render a decision promptly and in any case within 30 days after the later of the receipt of the Claim or the deadline for furnishing such additional supporting data; provided that, if the amount of the Claim is in excess of \$50,000, the aforesaid 30-day period shall be 45 days. Failure of University's Representative to render a decision by the applicable deadline will be deemed a decision denying the Claim on the date of the deadline, unless, upon receipt of a Claim, Contractor and University mutually agree to extend the time periods provided herein, or unless otherwise extended by law. The decision of University's Representative will be final and binding unless appealed in accordance with Articles 4.5.2, 4.6, and 4.7. The University's Representative's decision on a Claim or dispute will include a written statement both identifying all disputed and undisputed portions of the Claim and substantially including the following:

"This is a decision under Article 4.5 of the General Conditions of your contract. If you are dissatisfied with the decision, and if you complied with the procedural requirements for

asserting claims specified in Article 4 of the General Conditions of your contract, you may have the right to demand in writing an informal conference to meet and confer for settlement of any remaining issues in dispute, following which, if still dissatisfied, you may demand in writing a further resolution via nonbinding mediation, after which you have the right to arbitrate or litigate this decision. If you fail to take appropriate action within 30 days of the date of this decision, the decision shall become final and binding and not subject to further appeal.”

4.5.2 If either Contractor or University disputes University’s Representative’s decision on a Claim, then, within 30 days after the decision of University’s Representative on the Claim, or, if no decision has been issued, within 30 days from the date of the applicable deadline in Article 4.5.1 for University Representative to render a decision, such party (the “Disputing Party”) must provide written notice demanding an informal conference to meet and confer. University shall schedule the conference within 30 days upon receipt of the notice demanding an informal conference. The parties will attempt in good faith to resolve any controversy or Claim arising out of or relating to this Contract by negotiation at the conference.

4.6 MEDIATION

4.6.1 Within 10 business days following the informal conference to meet and confer stated in Article 4.5.2, if the Claim or any portion of the Claim remains in dispute, the University shall provide a written statement identifying the disputed and undisputed portions of the Claim. Within 30 days of receipt of the statement, if either Contractor or University disputes any portion of the Claim, then the Disputing Party must provide written notice to the non-disputing party demanding non-binding mediation. The Contractor and the University shall share the associated costs equally and shall mutually agree to a mediator within 10 business days. If the parties cannot agree upon a mediator, each party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the Claim, with each party bearing the fees and costs of its respective mediator. Mediation shall include, but not be limited to, neutral evaluation, a dispute review board, or other negotiation or evaluation through an independent third party or board. The Contractor and the University may mutually agree to waive any individual mediation in writing and proceed to arbitration or litigation pursuant to this Contract.

4.7 LITIGATION AND ARBITRATION

4.7.1 Either party may provide a written notice of its election to arbitrate or provide written notice of its election to litigate the Claim within 30 days after the mediation pursuant to Article 4.6.1, or, if the parties mutually agreed in writing to waive mediation, within 30 days after the agreement is signed by both parties.

4.7.2 If a notice of election to arbitrate or litigate is not given by either party within 30 days pursuant to Article 4.7.1, University’s Representative’s decision on the Claim will be final and binding and not subject to appeal or challenge.

4.7.3 If the Disputing Party gives timely notice of its election to arbitrate the University’s Representative’s decision on a Claim, Disputing Party shall have the right, within 120 days after a Notice of Completion, or a Notice of Cessation, as applicable, is filed for the Contract, to make a demand for arbitration in accordance with Article 4.7. Failure to perfect a Claim for which a timely election to arbitrate has been made by the timely filing of a demand for arbitration and timely payment of all applicable and required fees to the American Arbitration Association (“AAA”) shall result in the University’s Representative’s decision on said Claim becoming final and binding and not subject to appeal or challenge. If the Disputing Party makes a timely demand for arbitration, and the amount of the Claim in question, when combined with all other Claims, if any, which are the subject of previously filed demands for arbitration that have not been resolved by settlement or arbitration award, is \$100,000 or more, then the other party may elect to litigate all such Claims by filing a written notice with the “AAA” within 30 days after its receipt of notice from the AAA of the Disputing Party’s demand for arbitration of the Claim that raises the total amount of Claims subject to arbitration to \$100,000 or more. If the other party fails to give notice of its election to litigate within such 30-day period, it shall be deemed to have consented to arbitration and waived the right to litigate. If after commencement of arbitration the amount of unresolved Claims in arbitration are allowed to be increased to \$100,000 or more, through an AAA-allowed amendment or otherwise, either party may elect to litigate within 30 days following the date that the electing party first receives written notification from the AAA that total Claims in arbitration equal or exceed \$100,000. If neither party gives notice of its election to litigate within such 30-day period as applicable, then

both parties shall be deemed to have consented to arbitration and waived the right to litigate.

4.7.4 A demand for arbitration pursuant to Article 4.7.3 shall include a copy of the Claim presented to University's Representative pursuant to Article 4.4, a copy of the decision of University's Representative pursuant to Article 4.5, if any, a copy of the University's written statement identifying the portion of the Claim that remained in dispute following the informal conference pursuant to Article 4.6.1, and a summary of the remaining portions of the Claim in dispute. The demand shall state the amount in controversy, if any, and state the remedy sought. The demand shall identify the University's Responsible Administrator as the representative of the responding party and the Office of the General Counsel as counsel for the responding party. The demand shall be filed with the AAA and shall not be deemed to have been made until all applicable fees have been paid to the AAA by the demanding party. Copies of the demand and attachments shall be sent to University's Responsible Administrator as the representative of the responding party and the University's Office of General Counsel as attorney for the responding party, at the addresses set forth in the Project Directory, at the time the demand for arbitration is initiated with the AAA.

4.7.5 Except as modified by this Article 4.7, arbitration shall be initiated and conducted in accordance with the Construction Industry Arbitration Rules of the AAA then in effect. The following additional modifications shall be made to the aforesaid AAA rules:

- .1 Civil discovery shall be permitted for the production of documents and taking of depositions. Other discovery may be permitted at the discretion of the arbitrator. All disputes regarding discovery shall be decided by the arbitrator.
- .2 University's Representative and/or University's consultants, shall if required by agreement with University, upon demand by University join in and be bound by the Arbitration. University's Representative and University's consultants will have the same rights in any arbitration proceeding as are afforded by the AAA rules to Contractor and University.
- .3 Contractor's sureties shall be bound by any arbitration award and may join in any arbitration proceeding.
- .4 Except as provided in Articles 4.7.5.2. and 4.7.5.3 above, no Subcontractor or other person shall have a right or obligation to join in or be a party to any arbitration proceeding provided for in this Article 4 either directly, by joinder, by consolidation or actions, by counterclaim or crossclaim, or otherwise without the express written consent of University, Contractor, and the joining party.
- .5 If more than one demand for arbitration is made by a party with respect to Claims referred to University's Representative, all such Claims shall be consolidated into a single arbitration unless the parties otherwise agree in writing.
- .6 If total Claims are less than \$50,000, the AAA expedited procedures as modified by this Article 4 shall apply. If total Claims are between \$50,000 and \$100,000 they shall be heard by a single arbitrator who shall be an attorney. If total Claims are in excess of \$100,000 and are submitted to arbitration, either by agreement or by failure to elect litigation the controversy shall be heard by a panel of three arbitrators, one of which shall be an attorney.
- .7 No arbitrator shall be appointed and no discovery may be commenced prior to the date of Final Completion unless University and Contractor otherwise agree.
- .8 The exclusive forum for determining arbitrability shall be the Superior Court of the State of California. The AAA shall not submit to any arbitrator any matter concerning the arbitrability of the dispute if the arbitrability is contested.
- .9 If the expedited procedures of the AAA are applicable, the AAA shall submit simultaneously to each party an identical list of 7 proposed arbitrators drawn from the National Panel of Commercial Arbitrators, and each party may strike 3 names from the list on a peremptory basis and return the list to the AAA within 10 days from the date of receipt.
- .10 Except as provided herein, the arbitration shall be conducted and enforced under California law, including the California Arbitration Act (California Code of Civil Procedure section 1280 and following). The Federal Arbitration Act shall not apply to the arbitration.

4.7.6 Unless University and Contractor otherwise agree in writing, the arbitration decision shall be binding upon the parties, made under and in accordance with the laws of the State of California, supported by substantial evidence, and in writing. If the total of all Claims or cross Claims submitted to arbitration is in

excess of \$50,000, the award shall contain the basis for the decision, findings of fact, and conclusions of law. Any arbitration award shall be subject to confirmation, vacation, or correction under the procedures and on the grounds specified in the California Code of Civil Procedure including without limitation Section 1296. The expenses and fees of the arbitrators and the administrative fees of the AAA shall be divided among the parties equally. Each party shall pay its own counsel fees, witness fees, and other expenses incurred for its own benefit.

4.7.7 University may, but is not required, to assert as a counterclaim any matter arising out of the claims asserted by Contractor in the arbitration. University's failure to assert any such counterclaim in an arbitration shall be without prejudice to the University's right to assert the counterclaim in litigation or other proceeding.

4.7.8 Any litigation shall be filed in the Superior Court of the State of California for the County in which the contract was to be performed.

4.8 WAIVER

4.8.1 A waiver of or failure by University or University's Representative to enforce any requirement in this Article 4 in connection with any Claim shall not constitute a waiver of, and shall not preclude the University or University's Representative from enforcing such requirements in connection with any other Claims.

4.8.2 The Contractor agrees and understands that no oral approval, either express or implied, of any Claim shall be binding upon University unless and until such approval is ratified by execution of a written Change Order.

ARTICLE 5 SUBCONTRACTORS

5.1 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.1.1 Unless otherwise stated in the Contract Documents, Contractor shall submit in writing, prior to entering into subcontract agreements, the names and addresses of all Subcontractors proposed for the Work that were not previously listed in Contractor's Bid.

5.1.2 Any Subcontractor may be disqualified if University or University's Representative determines that such Subcontractor fails to meet the requirements of the Contract Documents or for any other reason.

5.1.3 In accordance with the Subletting and Subcontracting Fair Practices Act, nothing herein shall be deemed to entitle Contractor, without the approval of University, to substitute other subcontractors for those named in Contractor's List of Subcontractors and List of Changes in Subcontractors Due to Alternates contained in the completed Bid Form; and, except with such approval, no such substitution shall be made.

5.1.4 Except as hereinafter provided, any increase in the cost of the Work resulting from the replacement or substitution of a Subcontractor, as required by University or University's Representative pursuant to Article 5.1.1 shall be borne solely by Contractor and Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time on account of such replacement or substitution.

5.2 SUBCONTRACTUAL RELATIONS

5.2.1 Any part of the Work performed for Contractor by a first-tier Subcontractor shall be pursuant to a written subcontract. Each such subcontract shall require the Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to Contractor by the terms of the Contract Documents, to assume toward Contractor all the obligations and responsibilities which Contractor assumes towards University by the Contract Documents, and to perform such portion of the Work in accordance with the Contract Documents. Each such subcontract shall preserve and protect the rights of University under the Contract Documents, with respect to the Work to be performed by Subcontractor, so that subcontracting thereof will not prejudice such rights. Contractor shall cause each such subcontract to expressly include the following requirements:

- .1 Subcontractor waives all rights that Subcontractor may have against University for damages caused by fire or other perils covered by builder's risk property insurance carried by Contractor or University, except for such rights Subcontractor may have to the proceeds of such insurance held by University under Article 11.
- .2 University and entities and agencies designated by University will have access to

and the right to audit and the right to copy at University's cost all of Subcontractor's books, records, contracts, correspondence, instructions, drawings, receipts, vouchers, purchase orders, and memoranda relating to the Work. Subcontractor shall preserve all such records and other items for a period of at least 3 years after Final Completion.

- .3 Subcontractor recognizes the rights of University under Article 5.3, Contingent Assignment of Subcontracts, and agrees, upon notice from University that University has elected to accept said assignment and to retain Subcontractor pursuant to the terms of the subcontract, to complete the unperformed obligations under the subcontract and, if requested by University, to execute a written agreement confirming that Subcontractor is bound to University under the terms of the subcontract.

5.2.2 Upon the request of University, Contractor shall promptly furnish to University a true, complete, and executed copy of any subcontract.

5.2.3 Nothing contained in the Contract Documents shall create any contractual relationship between any Subcontractor and University, except when, and only to the extent that, University elects to accept the assignment of the subcontract with such Subcontractor pursuant to Article 5.3, Contingent Assignment of Subcontracts.

5.3 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.3.1 Contractor hereby assigns to University all its interest in first-tier subcontracts now or hereafter entered into by Contractor for performance of any part of the Work. The assignment will be effective upon acceptance by University in writing and only as to those subcontracts which University designates in writing. University may accept said assignment at any time during the course of the Work and prior to Final Completion in the event of a suspension or termination of Contractor's rights under the Contract Documents. Such assignment is part of the consideration to University for entering into the Contract with Contractor and may not be withdrawn prior to Final Completion.

ARTICLE 6 CONSTRUCTION BY UNIVERSITY OR BY SEPARATE CONTRACTORS

6.1 UNIVERSITY'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 University reserves the right to award separate contracts for, or to perform with its own forces, construction or operations related to the Work or other construction or operations at or affecting the Project site, including portions of the Work which have been deleted by Change Order. Contractor shall cooperate with University's forces and Separate Contractors.

6.1.2 University will provide coordination of the activities of University's forces and of each Separate Contractor with the Work of Contractor. Contractor shall participate with University and Separate Contractors in joint review of construction schedules and Project requirements when directed to do so. Contractor shall make necessary revisions to the Contract Schedule after such joint review.

6.2 MUTUAL RESPONSIBILITY

6.2.1 Contractor shall afford University and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities. Contractor shall connect, schedule, and coordinate its construction and operations with the construction and operations of University and Separate Contractors as required by the Contract Documents.

6.2.2 If a portion of the Work is dependent upon the proper execution or results of other construction or operations by University or Separate Contractors, Contractor shall inspect such other construction or operations before proceeding with that portion of the Work. Contractor shall promptly report to University's Representative apparent discrepancies or defects which render the other construction or operations unsuitable to receive the Work. Unless otherwise directed by University's Representative, Contractor shall not proceed with the portion of the Work affected until apparent discrepancies or defects have been corrected. Failure of Contractor to so report within a reasonable time after discovering such discrepancies or defects

shall constitute an acknowledgment that the other construction or operations by University or Separate Contractors is suitable to receive the Work, except as to defects not then reasonably discoverable.

6.3 UNIVERSITY'S RIGHT TO CLEAN UP

6.3.1 If a dispute arises between Contractor and Separate Contractors as to the responsibility under their respective contracts for maintaining the Project site and surrounding areas free from waste materials and rubbish, University may clean up and allocate the cost between those firms it deems to be responsible.

ARTICLE 7 CHANGES IN THE WORK

7.1 CHANGES

7.1.1 University may, from time to time, order or authorize additions, deletions, and other changes in the Work by Change Order or Field Order without invalidating the Contract and without notice to sureties. Absence of such notice shall not relieve such sureties of any of their obligations to University.

7.1.2 Contractor may request a Change Order under the procedures specified in Article 4.2.

7.1.3 A Field Order may be issued by University, does not require the agreement of Contractor, and shall be valid with or without the signature of Contractor.

7.1.4 Contractor shall proceed promptly with any changes in the Work, unless otherwise provided in the relevant Change Order or Field Order.

7.2 DEFINITIONS

7.2.1 A Change Order is a Contract Document (as shown in the Exhibits) which has been signed by both University and Contractor, and states their agreement, as applicable, to the following:

- .1 A change in the Work, if any.
- .2 The amount of an adjustment of the Contract Sum, if any.
- .3 The amount of an adjustment of the Contract Time, if any.
- .4 A modification to any other Contract term or condition.

7.2.2 A Unilateral Change Order may be issued by University, without the Contractor' signature, where the University determines that a change in the Work requires an adjustment of the Contract Sum or Contract Time, even though no agreement has been reached between University and Contractor with regard to such change in the Work.

7.2.3 A Field Order (as shown in the Exhibits) is a Contract Document issued by the University that orders the Contractor to perform Work. A Field Order may, but need not, constitute a change in the Work and may, but need not, entitle Contractor to an adjustment of the Contract Sum or Contract Time.

7.3 CHANGE ORDER PROCEDURES

7.3.1 Contractor shall provide a Change Order Request and Cost Proposal pursuant to Article 4.2 and this Article 7.3 of the General Conditions. Adjustments of the Contract Sum resulting from Extra Work and Deductive Work shall be determined using one of the methods described in this Article 7.3. Adjustments of the Contract Time shall be subject to the provisions in Article 8. Contractor's obligation to provide Cost Proposals shall be subject to the following:

- .1 The obligation of Contractor to provide Cost Proposals is not Extra Work, and shall not entitle the Contractor to an adjustment of the Contract Sum or Contract Time.
- .2 The failure of Contractor to timely provide a Cost Proposal pursuant to Article 4.2 and this Article 7.3.1 is a material breach of the Contract. Contractor shall be responsible for any delay in implementing a change for which Contractor failed to timely provide a Cost Proposal consistent with the requirements of Article 4.2 and this Article 7.3.1.

7.3.2 The term "Cost of Extra Work" as used in this Article 7.3 shall mean actual costs incurred or to be incurred by Contractor and each Subcontractor regardless of tier involved, to the extent not otherwise

disallowed under Article 7.3.3, and shall be limited to the following (to the extent the Contractor demonstrates that the costs are both reasonable and actually incurred, if such costs have been incurred):

- .1 Straight-time wages or salaries for employees employed at the Project site, or at fabrication sites off the Project site, incurred as a result of the performance of the Extra Work.2 Fringe Benefits and Payroll Taxes for employees employed at the Project site, or at fabrication sites off the Project site, incurred as a result of the performance of the Extra Work.
- .3 Overtime wages or salaries, specifically authorized in writing by University's Representative, for employees employed at the Project site, or at fabrication sites off the Project site, incurred as a result of the performance of the Extra Work.
- .4 Fringe Benefits and Payroll Taxes for overtime Work specifically authorized in writing by University's Representative, for employees employed at the Project site, or at fabrication sites off the Project site, incurred as a result of the performance of the Extra Work.
- .5 Costs of materials and consumable items which are furnished and incorporated into the Extra Work, as approved by University's Representative. Such costs shall be charged at the lowest price available to the Contractor but in no event shall such costs exceed competitive costs obtainable from other subcontractors, suppliers, manufacturers, and distributors in the area of the Project site. All discounts, rebates, and refunds and all returns from sale of surplus materials and consumable items shall accrue to University and Contractor shall make provisions so that they may be obtained.
- .6 Sales taxes on the costs of materials and consumable items which are incorporated into and used in the performance of the Extra Work pursuant to Article 7.3.2.5 above.
- .7 Rental charges for necessary machinery and equipment, whether owned or hired, as authorized in writing by University's Representative, exclusive of hand tools, used directly in the performance of the Extra Work. Such rental charges shall not exceed the current Equipment Rental Rates published by the California Department of Transportation for the area in which the work is performed. Such rental rates are found at <http://www.dot.ca.gov/hq/construc/equipmnt.html> . Contractor shall attach a copy of said schedule to the Cost Proposal. The charges for any machinery and equipment shall cease when the use thereof is no longer necessary for the Extra Work.
- .8 Additional costs of royalties and permits due to the performance of the Extra Work.
- .9 The cost for Insurance and Bonds shall not exceed 2% of items .1 through .8 above.

University and Contractor may agree upon rates to be charged for any of the items listed in this Article 7.3.2. Such agreed upon rates shall be subject to audit pursuant to Article 15.7. Contractor shall promptly refund to University any amounts (including associated mark-ups) in excess of the actual costs of such items.

7.3.3 Cost of Extra Work shall not include any of the following:

- .1 Supervision
- .2 Superintendent(s).
- .3 Assistant Superintendent(s).
- .4 Project Engineer(s).
- .5 Project Manager(s).
- .6 Scheduler(s).
- .7 Estimator(s).
- .8 Small tools (Replacement value does not exceed \$300).
- .9 Office expenses including staff, materials and supplies.
- .10 On-site or off-site trailer and storage rental and expenses.
- .11 Site fencing.
- .12 Utilities including gas, electric, sewer, water, telephone, facsimile, copier equipment.

- .13 Data processing personnel and equipment.
- .14 Federal, state, or local business income and franchise taxes.
- .15 Overhead and Profit.
- .16 Costs and expenses of any kind or item not specifically and expressly included in Article 7.3.2.

7.3.4 The term "Contractor Fee" shall mean the full amount of compensation, both direct and indirect (including without limitation all overhead and profit), to be paid to Contractor for its own Work and the Work of all Subcontractors, for all costs and expenses not included in the Cost of Extra Work, whether or not such costs and expenses are specifically referred to in Article 7.3.3. The Contractor Fee shall not be compounded.

The Contractor Fee shall be computed as follows:

- .1 Fifteen percent (15%) of the cost of that portion of the Extra Work to be performed by the prime contractor with its own forces.
- .2 Fifteen percent (15%) of the cost of that portion of the Work to be performed by a Subcontractor with its own forces, plus 5% for the prime contractor. Total combined Contractor and Subcontractor fee shall not exceed 20%.
- .3 Fifteen percent (15%) of the cost of that portion of the Work to be performed by a sub-subcontractor with its own forces, or any lower tier of Subcontractor, plus 5% for the Subcontractor, plus 5% for the prime contractor. Total combined Contractor, Subcontractor and all sub-subcontractor fee shall not exceed 25%.

7.3.5 Compensation for Extra Work shall be computed on the basis of one or more of the following:

- .1 Where the Work involved is covered by Unit Prices contained in the Contract Documents, by application of the Unit Prices to the quantities of the items involved.
- .2 Where Unit Prices are not applicable, a mutually agreed upon lump sum supported by a Cost Proposal pursuant to 7.3.1.
- .3 Where Contractor and University cannot agree upon a lump sum, by Cost of Extra Work plus Contractor Fee applicable to such Extra Work.

7.3.6 As a condition to Contractor's right to an adjustment of the Contract Sum pursuant to Article 7.3.5.3, Contractor must keep daily detailed and accurate records itemizing each element of cost and shall provide substantiating records and documentation, including time cards and invoices. Such records and documentation shall be submitted to University's Representative on a daily basis.

7.3.7 For Work to be deleted by Change Order, the reduction of the Contract Sum shall be computed on the basis of one or more of the following:

- .1 Unit Prices stated in the Contract Documents.
- .2 Where Unit Prices are not applicable, a lump sum agreed upon by University and Contractor, based upon the actual costs which would have been incurred in performing the deleted portions of the Work as calculated in accordance with Articles 7.3.2 and 7.3.3, supported by a Cost Proposal pursuant to Article 7.3.1.

7.3.8 If any one Change involves both Extra Work and Deleted Work in the same portion of the Work, a Contractor fee will not be allowed if the deductive cost exceeds the additive cost. If the additive cost exceeds the deductive cost, a Contractor Fee will be allowed only on the difference between the two amounts.

7.3.9 The Contract Sum will be adjusted for a delay if, and only if, Contractor demonstrates that all of the following three conditions are met:

- .1 Condition Number One: The delay results in an extension of the Contract Time pursuant to Article 8.4.1.
- .2 Condition Number Two: The delay is caused solely by one or more of the following:
 - .1 An error or omission in the Contract Documents; or
 - .2 The University's decision to change the scope of the Work, where such decision is not the result of any default or

- .3 misconduct of the Contractor; or
- .3 The University's decision to suspend the Work, where such decision is not the result of any default or misconduct of the Contractor; or
- .4 The failure of the University (including the University acting through its consultants, Design Professionals, Separate Contractors or the University's Representative) to perform any Contract obligation where the failure to so perform is not the result of any default or misconduct of the Contractor.
- .5 A materially differing site condition pursuant to Article 3.17.

- .3 Condition Number Three: The delay is not concurrent with a delay caused by an event other than those listed in Article 7.3.9.2.

7.3.10 For each day of delay that meets all three conditions prescribed in Article 7.3.9 the Contract Sum will be adjusted by the daily rate included in the Agreement and specifically identified as the rate to be paid to Contractor for Compensable Delays. Pursuant to Article 9.7.4, said daily rate shall not apply to delays occurring after Substantial Completion.

7.3.11 Except as provided in Articles 7 and 8, Contractor shall have no claim for damage or compensation for any delay, interruption, hindrance, or disruption.

7.3.12 If for any reason one or more of the conditions prescribed in Article 7.3.9 is held legally unenforceable, the remaining conditions must be met as a condition to obtaining an adjustment of the Contract Time under Article 7.3.10.

7.4 FIELD ORDERS

7.4.1 Field Orders issued by the University Representative shall be subject to the following:

- .1 A Field Order may state that it does or does not constitute a change in the Work.
- .2 If the Field Order states that it does not constitute a change in the Work and the Contractor asserts that the Field Order constitutes a change in the Work, in order to obtain an adjustment of the Contract Sum or Contract Time for the Work encompassed by the Field Order, Contractor must follow all procedures set forth in Article 4, starting with the requirement of submitting a timely Change Order Request within 7 days of Contractor's receipt of the Field Order; failure to strictly follow those procedures is a bar to any Claim for an adjustment of the Contract Sum or Contract Time arising from performance of the Work described in the Field Order.
- .3 If the Field Order states that it does constitute a change in the Work, the Work described in the Field Order shall be considered Extra Work and the Contractor shall be entitled to an adjustment of the Contract Sum and Contract Time, calculated under and subject to Contractor's compliance with the procedures for verifying and substantiating costs and delays in Articles 7 and 8.
- .4 In addition, if the Field Order states that it does constitute a change in the Work, the Field Order may or may not contain University's estimate of adjustment of Contract Sum and/or Contract Time. If the Field Order contains an estimate of adjustment of Contract Sum or Contract Time, the Field Order is subject to the following:
 - .1 The Contractor shall not exceed the University's estimate of adjustment to Contract Sum or Contract Time without prior written notification to the University's Representative.
 - .2 If the Contractor asserts that the change in the Work encompassed by the Field Order may entitle Contractor to an adjustment of Contract Sum or Contract Time in excess of the University's estimate, in order not to be bound by University's estimate Contractor must follow all procedures set forth in Article 4, starting with the requirement of submitting a timely Change Order Request within 7 days of

Contractor's receipt of the Field Order; failure to strictly follow those procedures is a bar to any Claim for an adjustment of the Contract Sum or Contract Time, in excess of the University's estimate, arising from performance of the Work described in the Field Order.

7.4.2 Upon receipt of a Field Order, Contractor shall promptly proceed to perform the Work as ordered in the Field Order notwithstanding any disagreement by the Contractor concerning whether the Work is extra.

7.5 VARIATION IN QUANTITY OF UNIT PRICE WORK

7.5.1 University has the right to increase or decrease the quantity of any Unit price item for which an Estimated Quantity is stated in the Bid Form.

7.6 WAIVER

7.6.1 A waiver of or failure by University or University's Representative to enforce any requirement in this Article 7, including without limitation the requirements in Articles 7.3.6, 7.3.8, 7.3.9, 7.3.10, 7.3.11, or 7.3.12 in connection with any adjustment of the Contract Sum, will not constitute a waiver of, and will not preclude the University or University's Representative from enforcing, such requirements in connection with any other adjustments of the Contract Sum.

7.6.2 The Contractor agrees and understands that no oral approval, either express or implied, of any adjustment of the Contract Sum by University or its agents shall be binding upon University unless and until such approval is ratified by execution of a written Change Order.

ARTICLE 8 CONTRACT TIME

8.1 COMMENCEMENT OF THE WORK

8.1.1 The date of commencement of the Work shall be set forth in the Notice To Proceed. The date of commencement of the Work shall not be postponed by the failure of Contractor, Subcontractors, or of persons or firms for whom Contractor is responsible, to act.

8.2 PROGRESS AND COMPLETION

8.2.1 By signing the Agreement:

- .1 Contractor represents to University that the Contract Time is reasonable for performing the Work and that Contractor is able to perform the Work within the Contract Time.
- .2 Contractor agrees that University is purchasing the right to have the Contractor present on the Project site for the full duration of the Contract Time, even if Contractor could finish the Contract in less than the Contract Time.

8.2.2 Contractor shall not, except by agreement or instruction of University in writing, commence operations on the Project site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by Contractor. The dates of commencement and Final Completion of the Work shall not be changed by the effective date of such insurance.

8.2.3 Contractor shall proceed expeditiously with adequate forces and shall achieve full completion of the Work within the Contract Time. If University's Representative determines and notifies Contractor that Contractor's progress is such that Contractor will not achieve full completion of the Work within the Contract Time, Contractor shall immediately and at no additional cost to University, take all measures necessary, including working such overtime, additional shifts, Sundays, or holidays as may be required to ensure that the Work is fully completed within the Contract Time. Upon receipt of such notice from University's representative, Contractor shall immediately notify University's Representative of all measures to be taken to ensure full completion of the Work within the Contract Time. Contractor shall reimburse University for any extra costs or expenses (including the reasonable value of any services provided by University's employees) incurred by University as the result of such measures.

8.3 DELAY

8.3.1 Except and only to the extent provided otherwise in Articles 7 and 8, by signing the Agreement, Contractor agrees:

- .1 to bear the risk of delays to the Work; and
- .2 that Contractor's bid for the Contract was made with full knowledge of this risk.

In agreeing to bear the risk of delays to the Work, Contractor understands that, except and only to the extent provided otherwise in Articles 7 and 8, the occurrence of events that delay the Work shall not excuse Contractor from its obligation to achieve Final Completion of the Work within the Contract Time, and shall not entitle the Contractor to an adjustment of the Contract Sum.

8.4 ADJUSTMENT OF THE CONTRACT TIME FOR DELAY

8.4.1 Subject to Article 8.4.2, the Contract Time will be extended for each day of delay for which Contractor demonstrates that all of the following four conditions have been met; a time extension will not be granted for any day of delay for which Contractor fails to demonstrate compliance with the four conditions:

- .1 Condition Number One: The delay is critical. A delay is critical if and only to the extent it delays a work activity that cannot be delayed without delaying Final Completion of the Work beyond the Contract Time. Under this Article 8.4.1.2, if the Contract Schedule shows Final Completion of the Work before expiration of the Contract Time, a delay is critical if and only to the extent the delay pushes Final Completion of the Work to a date that is beyond the Contract Time.
- .2 Condition Number Two: Within 7 days of the date the Contractor discovers or reasonably should discover an act, error, omission or unforeseen condition or event causing the delay is likely to have an impact on the critical path of the Project, (even if the Contractor has not yet been delayed when the Contractor discovers or reasonably should discover the critical path impact of the act, error, omission or unforeseen condition giving rise to the delay) the Contractor submits both a timely and complete Change Order Request that meets the requirements of Article 4.2.
- .3 Condition Number Three: The delay is not caused by:
 - .1 A concealed, unforeseen or unknown condition or event except for a materially differing site condition pursuant to Article 3.17; or
 - .2 The financial inability, misconduct or default of the Contractor, a Subcontractor or supplier; or
 - .3 The unavailability of materials or parts.
- .4 Condition Number Four: The delay is caused by:
 - .1 Fire; or
 - .2 Strikes, boycotts, or like obstructive actions by labor organizations; or
 - .3 Acts of God (As used herein, "Acts of God" shall include only earthquakes in excess of a magnitude of 3.5 on the Richter Scale and tidal waves); or
 - .4 A materially differing site condition pursuant to Article 3.17; or
 - .5 An error or omission in the Contract; or
 - .6 The University's decision to change the scope of the Work, where such decision is not the result of any default or misconduct of the Contractor; or
 - .7 The University's decision to suspend the Work, where such decision is not the result of any default or misconduct of the Contractor; or
 - .8 The failure of the University (including the University acting through its consultants, Design Professionals, Separate Contractors or the University's representative) to perform any

- Contract obligation unless such failure is due to Contractor's default or misconduct.
- .9 "Adverse weather," but only for such days of adverse weather, or on-site conditions caused by adverse weather, that are in excess of the number of days specified in the Supplementary Conditions. In order for a day to be considered a day of adverse weather for the purpose of determining whether Contractor is entitled to an adjustment in Contract Time, both of the following conditions must be met:
 - .1 the day must be a day in which, as a result of adverse weather, less than one half day of critical path work is performed by Contractor; and
 - .2 the day must be identified in the Contract Schedule as a scheduled work day.

8.4.2 If and only if a delay meets all four conditions prescribed in Article 8.4.1, then a time extension will be granted for each day that Final Completion of the Work is delayed beyond the Contract Time, subject to the following:

- .1 When two or more delays (each of which meet all four conditions prescribed in Article 8.4.1) occur concurrently on the same day, and each such concurrent delay by itself without consideration of the other delays would be critical, then all such concurrent delays shall be considered critical. For the purpose of determining whether and to what extent the Contract Time should be adjusted pursuant to Article 8.4.2, such concurrent critical delays shall be treated as a single delay for each such day.
- .2 Contractor shall be entitled to a time extension for a day of delay that meets all four requirements of Article 8.4.1 if the delay is concurrent with a delay that does not meet all four conditions of Article 8.4.1.

8.4.3 If for any reason one or more of the four conditions prescribed in Article 8.4.1 is held legally unenforceable, then all remaining conditions must be met as a condition to obtaining an extension of the Contract Time under Article 8.4.2.

8.5 COMPENSATION FOR DELAY

8.5.1 To the maximum extent allowed by law, any adjustment of the Contract Sum as the result of delays shall be limited to the amounts specified in Article 7. Such adjustment shall, to the maximum extent allowed by law, constitute payment in full for all delay related costs (including costs for disruption, interruption and hindrance, general conditions, on and off-site overhead and profit) of Contractor, its Suppliers and Subcontractors of all tiers and all persons and entities working under or claiming through Contractor in connection with the Project.

8.5.2 By signing the Agreement, the parties agree that the University is buying the right to do any or all of the following, which are reasonable and within the contemplation of the parties:

- .1 To order changes in the Work, regardless of the extent and number of changes, including without limitation:
 - .1 Changes to correct errors or omissions, if any, in the Contract Documents.
 - .2 Changes resulting from the University's decision to change the scope of the Work subsequent to execution of the Contract.
 - .3 Changes due to unforeseen conditions.
- .2 To suspend the Work or any part thereof.
- .3 To delay the Work, including without limitation, delays resulting from the failure of the University or the University's Representative to timely perform any Contract obligation and delays for University's convenience.

8.6 WAIVER

8.6.1 A waiver of or failure by University or University's Representative to enforce any requirement in this Article 8, including without limitation the requirements in Article 8.4, in connection with any or all past delays shall not constitute a waiver of, and shall not preclude the University or University's Representative from enforcing, such requirements in connection with any present or future delays.

8.6.2 Contractor agrees and understands that no oral approval, either express or implied, of any time extension by University or its agents shall be binding upon University unless and until such approval is ratified by execution of a written Change Order.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 COST BREAKDOWN

9.1.1 Within 10 days after receipt of the Notice of Selection as the apparent lowest responsible Bidder, and with the Agreement, Contractor shall submit to University's Representative a Cost Breakdown of the Contract Sum in the form contained in the Exhibits. The Cost Breakdown shall itemize as separate line items the cost of each Work Activity and all associated costs, including but not limited to warranties, as-built documents, overhead expenses, and the total allowance for profit. Insurance and bonds shall each be listed as separate line items. The total of all line items shall equal the Contract Sum. The Cost Breakdown, when approved by the University's Representative, shall become the basis for determining the cost of Work performed for Contractor's Applications for Payment.

9.2 PROGRESS PAYMENT

9.2.1 University agrees to pay monthly to Contractor, subject to Article 9.4.3, an amount equal to 95% of the sum of the following:

- .1 Cost of the Work in permanent place as of the date of the Contractor's Application For Payment.
- .2 Plus cost of materials not yet incorporated in the Work, subject to Article 9.3.5.
- .3 Less amounts previously paid.

Under this Article 9.2.1, University may, but is not required, to pay Contractor more frequently than monthly.

9.2.2 After Substantial Completion and subject to Article 9.4.3, University will make any of the remaining progress payments in full.

9.3 APPLICATION FOR PAYMENT

9.3.1 On or before the 10th day of the month or such other date as is established by the Contract Documents, Contractor shall submit to University's Representative an itemized Application For Payment, for the cost of the Work in permanent place, as approved by University's Representative, which has been completed in accordance with the Contract Documents, less amounts previously paid.

The Application For Payment shall be prepared as follows:

- .1 Use the form contained in the Exhibits.
- .2 Itemize in accordance with the Cost Breakdown.
- .3 Include such data substantiating Contractor's right to payment as University's Representative may reasonably require, such as invoices, certified payrolls, daily time and material records, and, if securities are deposited in lieu of retention pursuant to Article 9.5, a certification of the market value of all such securities as of a date not earlier than 5 days prior to the date of the Application For Payment.
- .4 Itemize retention.

9.3.2 Applications For Payment shall not include requests for payment on account of (1) changes which have not been authorized by Change Orders or (2) amounts Contractor does not intend to pay a Subcontractor

because of a dispute or other reason.

9.3.3 If required by University, an Application For Payment shall be accompanied by (1) a summary showing payments that will be made to Subcontractors covered by such application and conditional releases upon progress payment or final payment and (2) unconditional waivers and releases of claims and stop payment notices, in the form contained in the Exhibits, from each Subcontractor listed in the preceding Application For Payment covering sums disbursed pursuant to that preceding Application For Payment.

9.3.4 Contractor warrants that, upon submittal of an Application For Payment, all Work, for which Certificates For Payment have been previously issued and payment has been received from University, shall be free and clear of all claims, stop payment notices, security interests, and encumbrances in favor of Contractor, Subcontractors, or other persons or firms entitled to make claims by reason of having provided labor, materials, or equipment relating to the Work.

9.3.5 At the sole discretion of University, University's Representative may approve for inclusion in the Application For Payment the cost of materials not yet incorporated in the Work but already delivered and suitably stored either at the Project site or at some other appropriate location acceptable to University's Representative. In such case, Contractor shall furnish evidence satisfactory to University's Representative (1) of the cost of such materials and (2) that such materials are under the exclusive control of Contractor. Only materials to be incorporated in the Work will be considered for payment. Any payment shall not be construed as acceptance of such materials nor relieve Contractor from sole responsibility for the care and protection of such materials; nor relieve Contractor from risk of loss to such materials from any cause whatsoever; nor relieve Contractor from its obligation to complete the Work in accordance with the Contract; nor act as a waiver of the right of University to require fulfillment of all terms of the Contract. Nothing contained within this Article 9.3.5 shall be deemed to obligate University to agree to payment for any non-incorporated materials or any part thereof, payment being in the sole and absolute discretion of University.

9.4 CERTIFICATE FOR PAYMENT

9.4.1 If Contractor has submitted an Application For Payment in accordance with Article 9.3, University's Representative shall, not later than 5 working days after the date of receipt of the Application For Payment, issue to University, with a copy to Contractor, a Certificate For Payment for such amount as University's Representative determines to be properly due.

9.4.2 If any such Application For Payment is determined not to be in accordance with Article 9.3, University will inform Contractor as soon as practicable, but not later than 5 working days after receipt. Thereafter, Contractor shall have 3 days to revise and resubmit such Application For Payment; otherwise University's Representative may issue a Certificate For Payment in the amount that University's Representative determines to be properly due without regard to such Application For Payment.

9.4.3 Approval of all or any part of an Application For Payment may be withheld, a Certificate For Payment may be withheld, and all or part of a previous Certificate For Payment may be nullified and that amount withheld from a current Certificate For Payment on account of any of the following:

- .1 Defective Work not remedied.
- .2 Third-party claims against Contractor or University arising from the acts or omissions of Contractor or Subcontractors.
- .3 Stop payment notices.
- .4 Failure of Contractor to make timely payments due Subcontractors for material or labor.
- .5 A reasonable doubt that the Work can be completed for the balance of the Contract Sum then unpaid.
- .6 Damage to University or Separate Contractor for which Contractor is responsible.
- .7 Reasonable evidence that the Work will not be completed within the Contract Time; and that the unpaid balance of the Contract Sum would not be adequate to cover University's damages for the anticipated delay.
- .8 Failure of Contractor to maintain and update as-built documents.
- .9 Failure of Contractor to submit schedules or their updates as required by the Contract Documents.
- .10 Failure to provide conditional or unconditional releases from any Subcontractor or supplier, if such waiver(s) have been requested by University's Representative.

- .11 Performance of Work by Contractor without properly processed Shop Drawings.
- .12 Liquidated damages assessed in accordance with Article 5 of the Agreement.
- .13 Failure to provide updated Reports of Subcontractor Information and Self-Certifications, as applicable.
- .14 Failure to provide a Final Distribution of Contract Dollars with final Application for Payment.
- .15 Any other failure of Contractor to perform its obligations under the Contract Documents.

9.4.4 Subject to the withholding provisions of Article 9.4.3, University will pay Contractor the amount set forth in the Certificate For Payment no later than 10 days after the issuance of the Certificate For Payment.

9.4.5 Neither University nor University's Representative will have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

9.4.6 Neither a Certificate For Payment nor a progress payment made by University will constitute acceptance of Defective Work.

9.5 DEPOSIT OF SECURITIES IN LIEU OF RETENTION AND DEPOSIT OF RETENTION INTO ESCROW

9.5.1 At the request and expense of Contractor, a substitution of securities may be made for any monies retained by University under Article 9.2 to ensure performance under the Contract Documents. Securities equivalent in value to the retention amount required by the Contract Documents for each Certificate For Payment shall be deposited by Contractor with a state or federally chartered bank in the State of California ("Escrow Agent"), which shall hold such securities pursuant to the escrow agreement referred to in Article 9.5.3 until retention is due in accordance with Article 9.8. Securities shall be valued as often as conditions of the securities market warrant, but in no case less than once per month. Contractor shall deposit additional securities so that the current market value of the total of all deposited securities shall be at least equal to the total required amount of retention.

9.5.2 Alternatively to Article 9.5.1, and at the request and expense of Contractor, University will deposit retention directly with Escrow Agent. Contractor may direct the investment of such deposited retention into interest bearing accounts or securities, and such deposits or securities shall be held by Escrow Agent upon the same terms provided for securities deposited by Contractor. Contractor and its surety shall bear the risk of failure of the Escrow Agent selected.

9.5.3 A prerequisite to the substitution of securities in lieu of retention or the deposit of retention into escrow shall be the execution by Contractor, University, and Escrow Agent of an Escrow Agreement for Deposit of Securities in Lieu of Retention and Deposit of Retention in the form contained in the Exhibits. The Contractor shall submit the Selection of Retention Options and the Escrow Agreement for Deposit of Securities in Lieu of Retention and Deposit of Retention not later than the date when 50% of the Work has been completed. The terms of such escrow agreement are incorporated into the requirements of this Article 9.5.

9.6 BENEFICIAL OCCUPANCY

9.6.1 University reserves the right, at its option and convenience, to occupy or otherwise make use of any part of the Work at any time prior to Substantial Completion or Final Completion upon 10 days' notice to Contractor. Such occupancy or use is herein referred to as "Beneficial Occupancy." Beneficial Occupancy shall be subject to the following conditions:

- .1 University's Representative will make an inspection of the portion of the Project to be beneficially occupied and prepare a list of items to be completed or corrected prior to Final Completion. Prior to Beneficial Occupancy, University will issue a Certificate of Beneficial Occupancy on University's form.
- .2 Beneficial Occupancy by University shall not be construed by Contractor as an acceptance by University of that portion of the Work which is to be occupied.
- .3 Beneficial Occupancy by University shall not constitute a waiver of existing claims of University or Contractor against each other.

- .4 Contractor shall provide, in the areas beneficially occupied and on a 24 hour and 7 day week basis as required, utility services, heating, and cooling for systems which are in operable condition at the time of Beneficial Occupancy. All responsibility for the operation and maintenance of equipment shall remain with Contractor while the equipment is so operated. Contractor shall submit to University an itemized list of each piece of equipment so operated with the date operation commences.
- .5 The Guarantee to Repair Periods, as defined in Article 12.2, will commence upon the occupancy date stated in the Certificate of Beneficial Occupancy except that the Guarantee to Repair Periods for that part of equipment or systems that serve portions of the Work for which University has not taken Beneficial Occupancy or issued a Certificate of Substantial Completion shall not commence until the University has taken Beneficial Occupancy for that portion of the Work or has issued a Certificate of Substantial Completion with respect to the entire Project.
- .6 University will pay all normal operating and maintenance costs resulting from its use of equipment in areas beneficially occupied.
- .7 University will pay all utility costs which arise out of the Beneficial Occupancy.
- .8 Contractor shall not be responsible for providing security in areas beneficially occupied.
- .9 University will use its best efforts to prevent its Beneficial Occupancy from interfering with the conduct of Contractor's remaining Work.
- .10 Contractor shall not be required to repair damage caused by University in its Beneficial Occupancy.
- .11 Except as provided in this Article 9.6, there shall be no added cost to University due to Beneficial Occupancy.
- .12 Contractor shall continue to maintain all insurance required by the Contract in full force and effect.

9.7 SUBSTANTIAL COMPLETION

9.7.1 "Substantial Completion" means the stage in the progress of the Work, as determined by University's Representative, when the Work is complete and in accordance with the Contract Documents except only for completion of minor items which do not impair University's ability to occupy and fully utilize the Work for its intended purpose and a Certificate of Occupancy has been issued by the University.

9.7.2 When Contractor gives notice to University's Representative that the Work is substantially complete, unless University's Representative determines that the Work is not sufficiently complete to warrant an inspection to determine Substantial Completion, University's Representative will inspect the Work. If the University's Representative determines that the Work is not substantially completed the University's Representative will prepare and give to Contractor a comprehensive list of items to be completed or corrected before establishing Substantial Completion. Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. Upon notification that the items on the list are completed or corrected, as applicable, the University's Representative will make an inspection to determine whether the Work is substantially complete. Costs for additional inspection by University's Representative shall be deducted from any monies due and payable to Contractor.

9.7.3 When University's Representative determines that the Work is substantially complete, University's Representative will arrange for inspection by University's Building Official and other officials, as appropriate, for the purpose of issuing a Certificate of Occupancy. After a Certificate of Occupancy has been issued by the University, the University's Representative will prepare a Certificate of Substantial Completion on University's form as contained in the Exhibits, which, when signed by University, shall establish the date of Substantial Completion and the responsibilities of University and Contractor for security, maintenance, utilities, insurance, and damage to the Work. The University's Representative will prepare and furnish to the Contractor a comprehensive "punch list" of items to be completed or corrected prior to Final Completion.

9.7.4 Unless otherwise provided in the Certificate of Substantial Completion, the Guarantee To Repair Period for the Work covered by the Certificate of Substantial Completion, shall commence on the date of Substantial Completion of the Work except that Substantial Completion shall not commence the Guarantee to Repair Period for any equipment or systems that:

- .1 Are not operational (equipment or systems shall not be considered operational if they cannot be used to provide the intended service; or
- .2 Are not accepted by the University.

The Guarantee To Repair Period for equipment or systems which become operational and accepted subsequent to Substantial Completion will begin on the date of their written acceptance by University.

9.7.5 The daily rate included in the Agreement and specifically identified as the rate to be paid to Contractor for Compensable Delays shall not apply to any delays occurring after the Work is substantially completed.

9.8 FINAL COMPLETION, FINAL PAYMENT, AND RELEASE OF RETENTION

9.8.1 Upon receipt of notice from Contractor that the Work is ready for final inspection, University's Representative will make such inspection. Final Completion shall be when University's Representative determines that the Work is fully completed and in accordance with the Contract Documents, including without limitation, satisfaction of all "punch list" items, and determines that a Certificate of Occupancy has been issued by the University. University will file a Notice of Completion within 15 days after Final Completion. After receipt of the final Application For Payment, if University's Representative determines that Final Completion has occurred, University's Representative will issue the final Certificate For Payment.

9.8.2 Final payment and retention shall be released to Contractor, as set forth in Article 9.8.3, after:

- .1 Contractor submits the final Application For Payment and all submittals required in accordance with Article 9.3;
- .2 Contractor submits all guarantees and warranties procured by Contractor from Subcontractors, all operating manuals for equipment installed in the Project, as-built documents, and all other submittals required by the Contract Documents;
- .3 Contractor submits the Final Distribution of Contract Dollars in the form contained in the Exhibits; and
- .4 University's Representative issues the final Certificate For Payment.

At its sole discretion, after Final Completion, University may waive the requirement that Contractor submit a final Application For Payment before making final payment and/or release of retention to Contractor.

9.8.3 Final payment shall be paid not more than 10 days after University's Representative issues the final Certificate For Payment. Retention shall be released to Contractor 35 days after the filing of the Notice of Completion.

9.8.4 Acceptance of final payment by Contractor shall constitute a waiver of all claims, except claims for retention and claims previously made in writing and identified by Contractor as unsettled at the time of the final Application For Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1.1 Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 Contractor shall take adequate precautions for safety of and shall provide adequate protection to prevent damage, injury, or loss to the following:

- .1 Employees involved in the Work and other persons who may be affected thereby.

- .2 The Work in place and materials and equipment to be incorporated therein, whether in storage on or off the Project site, under care, custody, or control of Contractor or Subcontractors.
- .3 Other property at the Project site and adjoining property.

10.2.2 Contractor shall erect and maintain, as required by existing conditions and performance of the Work, adequate safeguards for safety and protection, including providing adequate lighting and ventilation, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.

10.2.3 When use or storage of explosives, other hazardous materials, equipment, or unusual methods are necessary for execution of the Work, Contractor shall exercise the utmost care and carry on such activities only under the supervision of properly qualified personnel.

10.2.4 Contractor shall designate a responsible member of Contractor's organization at the Project site whose duty shall be the prevention of accidents. That person shall be the Superintendent, unless otherwise designated by Contractor in writing to University and University's Representative.

10.2.5 Contractor shall not load or permit any part of the Work or the Project site to be loaded so as to endanger the safety of persons or property.

10.3 EMERGENCIES

10.3.1 In an emergency affecting the safety of persons or property, Contractor shall act to prevent or minimize damage, injury, or loss. Contractor shall promptly notify University's Representative, which notice may be oral followed by written confirmation, of the occurrence of such an emergency and Contractor's action.

ARTICLE 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S INSURANCE

11.1.1 Contractor shall, at its expense, purchase and maintain in full force and effect such insurance as will protect itself and University from claims, such as for bodily injury, wrongful death, and property damage, which may arise out of or result from the Work required by the Contract Documents, whether such Work is done by Contractor, by any Subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. The amounts of such insurance and any additional insurance requirements are specified in the Supplementary Conditions. See Article 3.21 regarding the scope and extent of Contractor's liability for and repair of damaged Work.

11.1.2 The following policies and coverages shall be furnished by Contractor:

- .1 **COMMERCIAL GENERAL LIABILITY INSURANCE** subject to terms no less broad than the Insurance Services Office's (ISO) form CG 0001 (2004 or later edition), or a substitute form providing coverage at least as broad as the ISO form specified, covering all Work done by or on behalf of Contractor and providing insurance for bodily injury, wrongful death, personal injury, property damage, and contractual liability. There shall be no limitations or exclusions of coverage beyond those contained in the standard ISO form CG 0001 (2004 or later edition). Except with respect to bodily injury and property damage included within the products and completed operations hazards, the aggregate limit shall apply separately to Work required of Contractor by these Contract Documents. Contractor shall continue to maintain Products/Completed Operations liability insurance coverage for a minimum completed operations period of 10 year(s) or the applicable Statute of Repose as provided by the law of the jurisdiction where the project is located as shown in the policy(ies), whichever is less. All terms and conditions of such coverage shall be maintained during this completed operations period, including the required minimum coverage limits and the requirement to provide the University with coverage as an additional insured for completed operations as

specified under this Article 11.1 and the Supplementary Conditions.

- .2 BUSINESS AUTOMOBILE LIABILITY INSURANCE subject to terms no less broad than the Insurance Services Office's (ISO) form CA 0001 (1990 or later edition), or a substitute form providing coverage at least as broad as the ISO form specified, covering owned, hired, leased, and non-owned automobiles used by or on behalf of Insured, and providing liability insurance for bodily injury and property damage arising from the use or operation of such auto(s) with a minimum combined single limit of not less than \$1,000,000 per accident. The minimum limits required may be satisfied by combination of primary and umbrella/excess policies. The Commercial Automobile Liability Insurance shall be provided by Contractor for all on site and off site Work.
- .3 WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE as required by Federal and State of California law. Contractor shall also require all of its Subcontractors to maintain this insurance coverage.

11.1.3 The coverages required under this Article 11 shall not in any way limit the liability of Contractor.

11.1.4 Contractor's Certificates of Insurance, executed by a duly authorized representative of each broker of record or each insurer as evidence of the insurance required by these Contract Documents and on the form contained in the Exhibits, shall be submitted by Contractor to University prior to the commencement of Work by the Contractor. The Certificates of Insurance shall provide for no cancellation or modification of coverage without prior written notice to University, in accordance with policy provisions.

11.1.5 In the event Contractor does not comply with these insurance requirements, University may, at its option, provide insurance coverage to protect University; and the cost of such insurance shall be paid by Contractor and may be deducted from the Contract Sum.

11.1.6 Contractor's insurance as required by Article 11.1.2, shall, by endorsement to the policies, include the following:

- .1 The Regents of the University of California, The University of California, University, and each of their Representatives, consultants, officers, agents, employees, and each of their Representative's consultants, regardless of whether or not identified in the Contract Documents or to the Contractor in writing, will be included as additional insureds on the Contractor's General Liability insurance for and relating to the Work to be performed by the Contractor and Subcontractors. Additional Insured provision or endorsement shall be at least as broad as the CG 20 07 04 in combination with the CG 20 37 07 04 (or earlier versions of CG 20 10 and CG 20 37 or Form B - CG 20 10 11 85 by itself), as published by Insurance Services Offices (ISO) and shall be included with Certificates of Insurance. The additional insured requirement shall not apply to Worker's Compensation and Employer's Liability insurance.

Further, the amount of insurance available to the University shall be for the full amount of the loss up to the available policy limits and shall not be limited to any minimum requirements stated in the Contract Documents.

- .2 University, University's consultants, University's Representative, and University's Representative's consultants will not by reason of their inclusion as insureds incur liability to the insurance carriers for payment of premiums for such insurance.
- .3 Coverage provided is primary and is not in excess of or contributing with any insurance or self-insurance maintained by University, University's consultants, University's Representative, and University's Representative's consultants. This provision, however, shall only apply as per the stipulations of Article 11.1.6.1.

11.1.7 The form and substance of all insurance policies required to be obtained by Contractor shall be subject to approval by University. All policies required by Articles 11.1.2.1, 11.1.2.2, and 11.1.2.3 shall be issued by companies with ratings and financial classifications as specified in the Supplementary Conditions.

11.1.8 Contractor shall, by mutual agreement with University, furnish any additional insurance as may be required by University. Contractor shall provide Certificates of Insurance evidencing such additional insurance.

11.1.9 The Certificate of Insurance shall show (1) all companies affording coverage and (2) the name of the insured exactly in the manner as shown on the Bid Form. The name of the insured must be the name under which the entity is licensed by the Contractors State License Board.

11.1.10 If insurance company refuses to use the Certificate of Insurance form as contained in the Exhibits, it must provide a Certificate of Insurance evidencing compliance with this Article including those provisions noted under DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES section of the Certificate of Insurance Exhibit by including an endorsement to its Certificate of Insurance form covering those noted provisions exactly as they appear on the Certificate of Insurance Exhibit.

11.1.11 At the request of University, Contractor shall submit to University copies of the policies obtained by Contractor.

11.2 BUILDER'S RISK PROPERTY INSURANCE

11.2.1 If and only if the Contract Sum exceeds \$300,000 at the time of award, University will provide its standard builder's risk property insurance, subject to the deductibles, terms and conditions, exclusions, and limitations as contained in the provisions of the policy. A copy of the University's standard builder's risk property insurance policy is available at the University's Facility office. In addition, a summary of the provisions of the policy is included as an Exhibit to the Contract. Contractor agrees that the University's provision of its standard builder's risk property insurance policy meets the University's obligation to provide builder's risk property insurance under the Contract and, in the event of a conflict between the provisions of the policy and any summary or description of the provisions contained herein or otherwise, the provisions of the policy shall control and shall be conclusively presumed to fulfill the University's obligation to provide such insurance. The proceeds under such insurance policies taken out by University insuring the Work and materials will be payable to University and Contractor as their respective interests, from time to time, may appear. Contractor shall be responsible for the deductible amount in the event of a loss. In addition, nothing in this Article 11.2 shall be construed to relieve Contractor of full responsibility for loss of or damage to materials not incorporated in the Work, and for Contractor's tools and equipment used to perform the Work, whether on the Project site or elsewhere, or to relieve Contractor of its responsibilities referred to under this Article 11. Materials incorporated in the Work, as used in this Article 11.2, shall mean materials furnished while in transit to, stored at, or in permanent place at the Project site.

11.2.2 Insurance policies referred to under this Article 11.2 shall:

- .1 Include a provision that the policies are primary and do not participate with nor are excess over any other valid collectible insurance carried by Contractor.
- .2 Include a waiver of subrogation against Contractor, its Subcontractors, its agents, and employees.

11.2.3 Builder's risk insurance coverage under this Article 11.2 will expire on the date of Final Completion recited in a Notice of Completion filed pursuant to Article 9.8.1. Should a Notice of Completion be filed more than 10 days after the date of Final Completion, the date of Final Completion recited in the Notice of Completion will govern.

11.3 PERFORMANCE BOND AND PAYMENT BOND

11.3.1 Contractor shall furnish bonds covering the faithful performance of the Contract (Performance Bond) and payment of obligations arising thereunder (Payment Bond) on the forms contained in Exhibits 3 and 2.

11.3.2 The Payment Bond and Performance Bond shall each be in the amount of the Contract Sum.

11.3.3 The Payment Bond and Performance Bond shall be in effect on the date the Contract is signed by University.

11.3.4 Contractor shall promptly furnish such additional security as may be required by University to protect its interests and those interests of persons or firms supplying labor or materials to the Work. Contractor shall furnish supplemental Payment and Performance Bonds each in the amount of the current Contract Sum at the request of the University.

11.3.5 Surety companies used by Contractor shall be, on the date the Contract is signed by University, an admitted surety insurer (as defined in the California Code of Civil Procedure Section 995.120).

11.3.6 The premiums for the Payment Bond and Performance Bond shall be paid by Contractor.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING OF WORK

12.1.1 If a portion of the Work is covered contrary to University's Representative's request or direction, or contrary to the requirements of the Contract Documents, it must, if required in writing by University's Representative, be uncovered for University's Representative's observation and be replaced at Contractor's expense without adjustment of the Contract Time or the Contract Sum.

12.1.2 If a portion of the Work has been covered, which is not required by the Contract Documents to be observed or inspected prior to its being covered and which University's Representative has not specifically requested to observe prior to its being covered, University's Representative may request to see such Work and it shall be uncovered and replaced by Contractor. If such Work is in accordance with the Contract Documents, the costs of uncovering and replacing the Work shall be added to the Contract Sum by Change Order; and if the uncovering and replacing of the Work extends the Contract Time, an appropriate adjustment of the Contract Time shall be made by Change Order. If such Work is not in accordance with the Contract Documents, Contractor shall pay such costs and shall not be entitled to an adjustment of the Contract Time or the Contract Sum.

12.2 CORRECTION OF DEFECTIVE WORK AND GUARANTEE TO REPAIR PERIOD

12.2.1 The term "Guarantee To Repair Period" means a period of 1 year, unless a longer period of time is specified, commencing as follows:

- .1 For any Work not described as incomplete in the Certificate of Substantial Completion, on the date of Substantial Completion.
- .2 For space beneficially occupied or for separate systems fully utilized prior to Substantial Completion pursuant to Article 9.6, from the first date of such Beneficial Occupancy or actual use, as established in a Certificate of Beneficial Occupancy.
- .3 For all Work other than .1 or .2 above, from the date of Final Completion.

12.2.2 Contractor shall (1) correct Defective Work that becomes apparent during the progress of the Work or during the Guarantee To Repair Period and (2) replace, repair, or restore to University's satisfaction any other parts of the Work and any other real or personal property which is damaged or destroyed as a result of Defective Work or the correction of Defective Work. Contractor shall promptly commence such correction, replacement, repair, or restoration upon notice from University's Representative or University, but in no case later than 10 days after receipt of such notice; and Contractor shall diligently and continuously prosecute such correction to completion. Contractor shall bear all costs of such correction, replacement, repair, or restoration, and all losses resulting from such Defective Work, including additional testing, inspection, and compensation for University's Representative's services and expenses. Contractor shall perform corrective Work at such times that are acceptable to University and in such a manner as to avoid, to the extent practicable, disruption to University's activities.

12.2.3 If immediate correction of Defective Work is required for life safety or the protection of property and is performed by University or Separate Contractors, Contractor shall pay to University all reasonable costs of correcting such Defective Work. Contractor shall replace, repair, or restore to University's satisfaction any other parts of the Work and any other real or personal property which is damaged or destroyed as a result of

such Defective Work or the correction of such Defective Work.

12.2.4 Contractor shall remove from the Project site portions of the Work and materials which are not in accordance with the Contract Documents and which are neither corrected by Contractor nor accepted by University.

12.2.5 If Contractor fails to commence correction of Defective Work within 10 days after notice from University or University's Representative or fails to diligently prosecute such correction to completion, University may correct the Defective Work in accordance with Article 2.4; and, in addition, University may remove the Defective Work and store salvageable materials and equipment at Contractor's expense.

12.2.6 If Contractor fails to pay the costs of such removal and storage as required by Articles 12.2.4 and 12.2.5 within 10 days after written demand, University may, without prejudice to other remedies, sell such materials at auction or at private sale, or otherwise dispose of such material. Contractor shall be entitled to the proceeds of such sale, if any, in excess of the costs and damages for which Contractor is liable to University, including compensation for University's Representative's services and expenses. If such proceeds of sale do not cover costs and damages for which Contractor is liable to University, the Contract Sum shall be reduced by such deficiency. If there are no remaining payments due Contractor or the remaining payments are insufficient to cover such deficiency, Contractor shall promptly pay the difference to University.

12.2.7 Contractor's obligations under this Article 12 are in addition to and not in limitation of its warranty under Article 3.4 or any other obligation of Contractor under the Contract Documents. Enforcement of Contractor's express warranties and guarantees to repair contained in the Contract Documents shall be in addition to and not in limitation of any other rights or remedies University may have under the Contract Documents or at law or in equity for Defective Work. Nothing contained in this Article 12 shall be construed to establish a period of limitation with respect to other obligations of Contractor under the Contract Documents. Establishment of the Guarantee To Repair Period relates only to the specific obligation of Contractor to correct the Work and in no way limits either Contractor's liability for Defective Work or the time within which proceedings may be commenced to enforce Contractor's obligations under the Contract Documents.

ARTICLE 13 TERMINATION OR SUSPENSION OF THE CONTRACT

13.1 TERMINATION BY CONTRACTOR

13.1.1 Subject to Article 13.1.2, Contractor shall have the right to terminate the Contract only upon the occurrence of one of the following:

- .1 Provided that University has not commenced reasonable action to remove any order of a court within the 90 day period, the Work is stopped for 90 consecutive days, through no act or fault of Contractor, any Subcontractor, or any employee or agent of Contractor or any Subcontractor, due to an issuance of an order of a court or other public authority having jurisdiction or due to an act of government, such as a declaration of a national emergency making material unavailable.
- .2 University fails to perform any material obligation under the Contract and fails to cure such default within 30 days, or University has not commenced to cure such default within 30 days where such cure will require a reasonable period beyond 30 days and diligently prosecutes the same to completion, after receipt of notice from Contractor stating the nature of such default(s).
- .3 Repeated suspensions by University, other than such suspensions as are agreed to by Contractor under Article 13.3, which constitute in the aggregate more than 20% of the Contract Time.

13.1.2 Upon the occurrence of one of the events listed in Article 13.1.1, Contractor may, upon 10 days additional notice to University and University's Representative, and provided that the condition giving rise to Contractor's right to terminate is continuing, terminate the Contract.

13.1.3 Upon termination by Contractor, University will pay to Contractor the sum determined by Article 13.4.4. Such payment will be the sole and exclusive remedy to which Contractor is entitled in the event of

termination of the Contract by Contractor pursuant to Article 13.1; and Contractor will be entitled to no other compensation or damages and expressly waives the same.

13.2 TERMINATION BY UNIVERSITY FOR CAUSE

13.2.1 University will have the right to terminate the Contract for cause at any time after the occurrence of any of the following events:

- .1 Contractor becomes insolvent or files for relief under the bankruptcy laws of the United States.
- .2 Contractor makes a general assignment for the benefit of its creditors or fails to pay its debts as the same become due.
- .3 A receiver is appointed to take charge of Contractor's property.
- .4 The commencement or completion of any Work activity on the critical path is more than 30 days behind the date set forth in the Contract Schedule for such Work activity, as a result of an Unexcusable Delay. For a Contract with a Contract Time of less than 300 days, the 30-day period shall be reduced to the number of days commensurate with 10% of the Contract Time.
- .5 Contractor abandons the Work.

13.2.2 Upon the occurrence of any of the following events, University will have the right to terminate the Contract for cause if Contractor fails to promptly commence to cure such default and diligently prosecute such cure within 5 days after notice from University, or within such longer period of time as is reasonably necessary to complete such cure:

- .1 Contractor persistently or repeatedly refuses or fails to supply skilled supervisory personnel, an adequate number of properly skilled workers, proper materials, or necessary equipment to prosecute the Work in accordance with the Contract Documents.
- .2 Contractor fails to make prompt payment of amounts properly due Subcontractors after receiving payment from University.
- .3 Contractor disregards Applicable Code Requirements.
- .4 Contractor persistently or materially fails to execute the Work in accordance with the Contract Documents.
- .5 Contractor is in default of any other material obligation under the Contract Documents.
- .6 Contractor persistently or materially fails to comply with applicable safety requirements.

13.2.3 Upon any of the occurrences referred to in Articles 13.2.1 and 13.2.2, University may, at its election and by notice to Contractor, terminate the Contract and take possession of the Project site and all materials, supplies, equipment, tools, and construction equipment and machinery thereon owned by Contractor; accept the assignment of any or all of the subcontracts; and then complete the Work by any method University may deem expedient. If requested by University, Contractor shall remove any part or all of Contractor's materials, supplies, equipment, tools, and construction equipment and machinery from the Project site within 7 days of such request; and if Contractor fails to do so, University may remove or store, and after 90 days sell, any of the same at Contractor's expense.

13.2.4 If the Contract is terminated by University as provided in this Article 13.2, Contractor shall not be entitled to receive any further payment until the expiration of 35 days after Final Completion and acceptance of all Work by University.

13.2.5 If the unpaid balance of the Contract Sum exceeds the cost of completing the Work, including all additional costs and expenses made necessary thereby, including costs for University staff time, plus all losses sustained, including any liquidated damages provided under the Contract Documents, such excess shall be paid to Contractor. If such costs, expenses, losses, and liquidated damages exceed the unpaid balance of the Contract Sum, Contractor shall pay such excess to University.

13.2.6 No termination or action taken by University after termination shall prejudice any other rights or remedies of University provided by law or by the Contract Documents upon such termination; and University may proceed against Contractor to recover all losses suffered by University.

13.3 SUSPENSION BY UNIVERSITY FOR CONVENIENCE

13.3.1 University may, at any time and from time to time, without cause, order Contractor, in writing, to suspend, delay, or interrupt the Work in whole or in part for such period of time, up to 90 days, as University may determine, with such period of suspension to be computed from the date of delivery of the written order. Such order shall be specifically identified as a "Suspension Order" under this Article 13.3. The Work may be stopped for such further period as the parties may agree. Upon receipt of a Suspension Order, Contractor shall, at University's expense, comply with its terms and take all reasonable steps to minimize costs allocable to the Work covered by the Suspension Order during the period of Work stoppage. Within 90 days after the issuance of the Suspension Order, or such extension to that period as is agreed upon by Contractor and University, University shall either cancel the Suspension Order or delete the Work covered by such Suspension Order by issuing a Change Order.

13.3.2 If a Suspension Order is canceled or expires, Contractor shall continue with the Work. A Change Order will be issued to cover any adjustments of the Contract Sum or the Contract Time necessarily caused by such suspension. Any Claim by Contractor for an adjustment of the Contract Sum or the Contract Time shall be made within 21 days after the end of the Work suspension. Contractor agrees that submission of its claim within said 21 days is an express condition precedent to its right to Arbitrate or Litigate such a claim.

13.3.3 The provisions of this Article 13.3 shall not apply if a Suspension Order is not issued by University. A Suspension Order shall not be required to stop the Work as permitted or required under any other provision of the Contract Documents.

13.4 TERMINATION BY UNIVERSITY FOR CONVENIENCE

13.4.1 University may, at its option, terminate this Contract, in whole or from time to time in part, at any time by giving notice to Contractor. Upon such termination, Contractor agrees to waive any claims for damages, including loss of anticipated profits, on account thereof; and, as the sole right and remedy of Contractor, University shall pay Contractor in accordance with Article 13.4.4.

13.4.2 Upon receipt of notice of termination under this Article 13.4, Contractor shall, unless the notice directs otherwise, do the following:

- .1 Immediately discontinue the Work to the extent specified in the notice.
- .2 Place no further orders or subcontracts for materials, equipment, services, or facilities, except as may be necessary for completion of such portion of the Work as is not discontinued.
- .3 Promptly cancel, on the most favorable terms reasonably possible, all subcontracts to the extent they relate to the performance of the discontinued portion of the Work.
- .4 Thereafter do only such Work as may be necessary to preserve and protect Work already in progress and to protect materials, plants, and equipment on the Project site or in transit thereto.

13.4.3 Upon such termination, the obligations of the Contract shall continue as to portions of the Work already performed and, subject to Contractor's obligations under Article 13.4.2, as to bona fide obligations assumed by Contractor prior to the date of termination.

13.4.4 Upon such termination, University shall pay to Contractor the sum of the following:

- .1 The amount of the Contract Sum allocable to the portion of the Work properly performed by Contractor as of the date of termination, less sums previously paid to Contractor.
- .2 Plus an amount equal to the lesser of \$50,000 or 5% of the difference between the Contract Sum and the amount of the Contract Sum allocable to the portion of the Work properly performed by Contractor as of the date of termination.
- .3 Plus previously unpaid costs of any items delivered to the Project site which were fabricated for subsequent incorporation in the Work.
- .4 Plus any proven losses with respect to materials and equipment directly resulting from such termination.
- .5 Plus reasonable demobilization costs.

- .6 Plus reasonable costs of preparing a statement of the aforesaid costs, expenses, and losses in connection with such termination.

The above payment shall be the sole and exclusive remedy to which Contractor is entitled in the event of termination of the Contract by University pursuant to Article 13.4; and Contractor will be entitled to no other compensation or damages and expressly waives same.

ARTICLE 14 STATUTORY AND OTHER REQUIREMENTS

14.1 PATIENT HEALTH INFORMATION

Contractor acknowledges that its employees, agents, subcontractors, consultants and others acting on its behalf may come into contact with Patient Health Information ("PHI") while performing work at the Project Site. This contact is most likely rare and brief (e.g. walking through a clinic where patient files may be visible, overhearing conversations between physicians while working or touring a hospital, noticing a relative or acquaintance receiving treatment in a University facility, etc.). Contractor shall immediately notify University Representative of any such contact. Any and all forms of PHI should not be examined closer, copied, photographed, recorded in any manner, distributed or shared. Contractor will adopt procedures to ensure that its employees, agents and subcontractors refrain from such activity. If Contractor, its employees, agents or subcontractors do further examine, copy, photograph, record in any manner, distribute or share this information, Contractor will report such actions immediately to the University Representative. Contractor will immediately take all steps necessary to stop any such actions and will ensure that no further violations of this contractual responsibility will occur. Contractor will report to University Representative within five (5) days after Contractor gives University Representative notice of the event/action of the steps taken to prevent future occurrences.

14.2 NONDISCRIMINATION

14.2.1 For purposes of this Article 14.2, the term Subcontractor shall not include suppliers, manufacturers, or distributors.

14.2.2 Contractor shall comply and shall ensure that all Subcontractors comply with Section 12900 through 12996, of the State of California Government Code.

14.2.3 Contractor agrees as follows during the performance of the Work:

- .1 Contractor shall provide equal treatment to, and shall not willfully discriminate against or allow harassment of any employee or applicant for employment on the basis of: race; color; religion; sex; age; ancestry; national origin; sexual orientation; physical or mental disability; veteran's status; medical condition (as defined in Section 12926 of the State of California Government Code and including cancer-related medical conditions and or genetic characteristics); genetic information (as defined in the Genetic Information Nondiscrimination Act of 2008 and including family medical history); marital status; gender identity, pregnancy, or citizenship (within the limits imposed by law or University's policy) or service in the uniformed services (as defined by the Uniformed Services Employment and Reemployment Rights Act of 1994). Contractor will also take affirmative action to ensure that any such employee or applicant for employment is not discriminated against on any of the bases identified above. Such equal treatment shall apply, but not be limited to the following: employment; upgrade; demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor also agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that qualified applicants will receive consideration for employment without regard to: race; color; religion; sex; age; ancestry; national origin; sexual orientation; physical or mental disability; veteran's status; medical condition (as defined in Section 12926 of the State of California Government Code and including cancer-related medical conditions and or genetic characteristics); genetic information (as defined in the Genetic Information Nondiscrimination Act of 2008

and including family medical history); marital status; gender identity, pregnancy, or citizenship (within the limits imposed by law or University's policy) or service in the uniformed services (as defined by the Uniformed Services Employment and Reemployment Rights Act of 1994). For purposes of this provision: (1) "Pregnancy" includes pregnancy, childbirth, and medical conditions related to pregnancy and childbirth; and (2) "Service in the uniformed services" includes membership, application for membership, performance of service, application for service, or obligation for service in the uniformed services.

.2 Contractor and all Subcontractors will permit access to their records of employment, employment advertisements, application forms, and other pertinent data and records by University or any appropriate agency of the State of California designated by University for the purposes of investigation to ascertain compliance with this Article 14.2. The outcome of the investigation may result in the following:

.1 A finding of willful violation of the provisions of this Contract or of the Fair Employment Practices Act may be regarded by University as (1) a basis for determining that Contractor is not a "responsible bidder" as to future contracts for which such Contractor may submit bids or (2) a basis for refusing to accept or consider the bids of Contractor for future contracts.

.2 University may deem a finding of willful violation of the Fair Employment Practices Act to have occurred upon receipt of written notice from the Fair Employment Practices Commission that it has (1) investigated and determined that Contractor has violated the Fair Employment Practices Act and (2) issued an order under the State of California Government Code Section 12970 or obtained an injunction under Government Code Section 12973.

.3 Upon receipt of such written notice from the Fair Employment Practices Commission, University may notify Contractor that, unless it demonstrates to the satisfaction of University within a stated period that the violation has been corrected, Contractor's bids on future projects will not be considered.

.4 Contractor agrees that, should University determine that Contractor has not complied with this Article 14.2, Contractor shall forfeit to University, as a penalty, for each day or portion thereof, for each person who was denied employment as a result of such non-compliance, the penalties provided in Article 14.3 for violation of prevailing wage rates. Such penalty amounts may be recovered from Contractor; and University may deduct any such penalty amounts from the Contract Sum.

.5 Nothing contained in this Article 14.2 shall be construed in any manner so as to prevent University from pursuing any other remedies that may be available at law.

.6 Contractor shall meet the following standards for compliance and provide University with satisfactory evidence of such compliance upon University's request, which shall be evaluated in each case by University:

.1 Contractor shall notify its Superintendent and other supervisory personnel of the nondiscrimination requirements of the Contract Documents and their responsibilities thereto.

.2 Contractor shall notify all sources of employee referrals (including unions, employment agencies, and the State of California Department of Employment) of the nondiscrimination requirements of the Contract Documents by sending to such sources and by posting the Notice of Equal Employment Opportunity (EEO).

.3 Contractor or its representative shall, through all unions with whom it may have agreements, develop agreements that (1) define responsibilities for nondiscrimination in hiring, referrals, upgrading, and training and (2) implement an affirmative nondiscrimination program, in terms of the unions' specific areas of skill and geography, such that qualified minority women, nonminority women, and minority men shall be available and given an equal opportunity for employment.

.4 Contractor shall notify University of opposition to the nondiscrimination requirements of the Contract Documents by individuals, firms, or organizations during the term of the Contract.

- .7 Contractor shall include the provisions of the foregoing Articles 14.2.3.2.1 through 14.2.3.2.6 in all subcontracts with Subcontractors, so that such provisions will be binding upon each such Subcontractor.

14.3 PREVAILING WAGE RATES

14.3.1 For purposes of this Article 14.3, the term Subcontractor shall not include suppliers, manufacturers, or distributors.

14.3.2 Contractor shall comply and shall ensure that all Subcontractors comply with prevailing wage law pursuant to the State of California Labor Code, including but not limited to Section 1720 et seq. of the State of California Labor Code. Compliance with these sections is required by this Contract. The Work under this Contract is subject to compliance monitoring and enforcement by the State of California Department of Industrial Relations.

14.3.3 The State of California Department of Industrial Relations has ascertained the general prevailing per diem wage rates in the locality in which the Work is to be performed for each craft, classification, or type of worker required to perform the Work. A copy of the general prevailing per diem wage rates will be on file at University's principal facility office and will be made available to any interested party upon request. Contractor shall post a copy of the general prevailing per diem wage rates as well as job site notices as prescribed by regulation at the job site. By this reference, such schedule is made part of the Contract Documents. Contractor shall pay not less than the prevailing wage rates, as specified in the schedule and any amendments thereto, to all workers employed by Contractor in the execution of the Work. Contractor shall cause all subcontracts to include the provision that all Subcontractors shall pay not less than the prevailing rates to all workers employed by such Subcontractors in the execution of the Work. Contractor shall forfeit to University, as a penalty, not more than \$200 for each calendar day or portion thereof for each worker that is paid less than the prevailing rates as determined by the Director of Industrial Relations for the work or craft in which the worker is employed for any portion of the Work done by Contractor or any Subcontractor. The amount of this penalty shall be determined pursuant to applicable law. Such forfeiture amounts may be deducted from the Contract Sum or sought directly from the surety under its Performance Bond if there are insufficient funds remaining in the Contract Sum. Contractor shall also pay to any worker who was paid less than the prevailing wage rate for the work or craft for which the worker was employed for any portion of the Work, for each day, or portion thereof, for which the worker was paid less than the specified prevailing per diem wage rate, an amount equal to the difference between the specified prevailing per diem wage rate and the amount which was paid to the worker. Review of any civil wage and penalty assessment shall be made pursuant to section 1742 of the California Labor Code.

14.4 PAYROLL RECORDS

14.4.1 For purposes of this Article 14.4, the term Subcontractor shall not include suppliers, manufacturers, or distributors.

14.4.2 Contractor and all Subcontractors shall keep an accurate payroll record, showing the name, address, social security number, job classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyworker, apprentice, worker, or other employee employed in connection with the Work. All payroll records shall be certified as being true and correct by Contractor or Subcontractors keeping such records; and the payroll records shall be available for inspection at all reasonable hours at the principal office of Contractor on the following basis:

- .1 A certified copy of an employee's payroll record shall be made available for inspection or furnished to such employee or the employee's authorized representative on request.
- .2 A certified copy of all payroll records shall be made available for inspection upon request to University, the State of California Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the State of California Division of Industrial Relations.
- .3 A certified copy of all payroll records shall be made available upon request by the public for inspection or copies thereof made; provided, however, that the request by the public shall be made to either University, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. The public shall not be given access to such records at the principal offices of Contractor or

Subcontractors. Any copy of the records made available for inspection as copies and furnished upon request to the public or any public agency by University shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address, and social security number. The name and address of Contractor awarded the Contract or performing the Contract shall not be marked or obliterated.

14.4.3 Contractor shall file a certified copy of the payroll records with the entity that requested the records within 10 days after receipt of a written request. Contractor shall inform University of the location of such payroll records for the Project, including the street address, city, and county; and Contractor shall, within 5 working days, provide notice of change of location of such records. In the event of noncompliance with the requirements of this Article 14.4 or with the State of California Labor Code Section 1776, Contractor shall have 10 days in which to comply following receipt of notice specifying in what respects Contractor must comply. Should noncompliance still be evident after the 10 day period, Contractor shall forfeit to University, as a penalty, \$100 for each day, or portion thereof, for each worker, until strict compliance is accomplished. Such forfeiture amounts may be deducted from the Contract Sum.

14.5 APPRENTICES

14.5.1 For purposes of this Article 14.5, the term Subcontractor shall not include suppliers, manufacturers, and distributors.

14.5.2 Only apprentices, as defined in the State of California Labor Code Section 3077, who are in training under apprenticeship standards and written apprentice agreements under Chapter 4, Division 3, of the State of California Labor Code, are eligible to be employed by Contractor and Subcontractors as apprentices. The employment and training of each apprentice shall be in accordance with the provisions of the apprenticeship standards and written apprentice agreements under which the apprentice is training and in accordance with prevailing wage law pursuant to the Labor Code, including but not limited to Section 1777.5. The Contractor bears responsibility for compliance with this section for all apprenticeable occupations.

14.5.3 Every apprentice shall be paid the standard wage to apprentices, under the regulations of the craft or trade at which the apprentice is employed, and shall be employed only at the Work in the craft or trade to which the apprentice is indentured.

14.5.4 When Contractor or Subcontractors employ workers in any apprenticeship craft or trade on the Work, Contractor or Subcontractors shall 1) send contract award information to the applicable joint apprenticeship committee that can supply apprentices to the site of the public work and 2) apply to the joint apprenticeship committee, which administers the apprenticeship standards of the craft or trade in the area of the Project site, for a certificate approving Contractor or Subcontractors under the apprenticeship standards for the employment and training of apprentices in the area of the Project site. The committee will issue a certificate fixing the number of apprentices or the ratio of apprentices to journeypersons who shall be employed in the craft or trade on the Work. The ratio will not exceed that stipulated in the apprenticeship standards under which the joint apprenticeship committee operates; but in no case shall the ratio be less than 1 hour of apprentice work for every 5 hours of journeyperson work, except as permitted by law. Contractor or Subcontractors shall, upon the issuance of the approval certificate in each such craft or trade, employ the number of apprentices or the ratio of apprentices to journeypersons fixed in the certificate issued by the joint apprenticeship committee or present an exemption certificate issued by the Division of Apprenticeship Standards.

14.5.5 "Apprenticeship craft or trade," as used in this Article 14.5, shall mean a craft or trade determined as an apprenticeship occupation in accordance with rules and regulations prescribed by the Apprenticeship Council.

14.5.6 If Contractor or Subcontractors employ journeymen or apprentices in any apprenticeship craft or trade in the area of the Project site, and there exists a fund for assisting to allay the cost of the apprenticeship program in the trade or craft, to which fund or funds other contractors in the area of the Project site are contributing, Contractor and Subcontractors shall contribute to the fund or funds in each craft or trade in which they employ journeymen or apprentices on the Work in the same amount or upon the same basis and in the same manner done by the other contractors. Contractor may include the amount of such contributions in computing its bid for the Contract; but if Contractor fails to do so, it shall not be entitled to any additional

compensation therefor from University.

14.5.7 In the event Contractor willfully fails to comply with this Article 14.5, it will be considered in violation of the requirements of the Contract.

14.5.8 Nothing contained herein shall be considered or interpreted as prohibiting or preventing the hiring by Contractor or Subcontractors of journeyworker trainees who may receive on-the-job training to enable them to achieve journeyworker status in any craft or trade under standards other than those set forth for apprentices.

14.6 WORK DAY

14.6.1 Contractor shall not permit any worker to labor more than 8 hours during any 1 day or more than 40 hours during any 1 calendar week, except as permitted by law and in such cases only upon such conditions as are provided by law. Contractor shall forfeit to University, as a penalty, \$25 for each worker employed in the execution of this Contract by Contractor, or any Subcontractor, for each day during which such worker is required or permitted to work more than 8 hours in any 1 day and 40 hours in any 1 calendar week in violation of the terms of this Article 14.6 or in violation of the provisions of any law of the State of California. Such forfeiture amounts may be deducted from the Contract Sum. Contractor and each Subcontractor shall keep, or cause to be kept, an accurate record showing the actual hours worked each day and each calendar week by each worker employed on the Project, which record shall be kept open at all reasonable hours to the inspection of University, its officers and agents, and to the inspection of the appropriate enforcement agency of the State of California.

ARTICLE 15 MISCELLANEOUS PROVISIONS

15.1 GOVERNING LAW

15.1.1 The Contract shall be governed by the law of the State of California.

15.2 SUCCESSORS AND ASSIGNS

15.2.1 University and Contractor respectively bind themselves and their successors, permitted assigns, and legal representatives to the other party and to the successors, permitted assigns, and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract, in whole or in part, without prior written consent of the other party. Notwithstanding any such assignment, each of the original contracting parties shall remain legally responsible for all of its obligations under the Contract.

15.3 RIGHTS AND REMEDIES

15.3.1 All University's rights and remedies under the Contract Documents will be cumulative and in addition to and not in limitation of all other rights and remedies of University under the Contract Documents or otherwise available at law or in equity.

15.3.2 No action or failure to act by University or University's Representative will constitute a waiver of a right afforded them under the Contract, nor will such action or failure to act constitute approval of or acquiescence in a condition or breach thereunder, except as may be specifically agreed in writing. No waiver by University or University's Representative of any condition, breach or default will constitute a waiver of any other condition, breach or default; nor will any such waiver constitute a continuing waiver.

15.3.3 No provision contained in the Contract Documents shall create or give to third parties any claim or right of action against University, University's Representative, or Contractor.

15.4 SURVIVAL

15.4.1 The provisions of the Contract which by their nature survive termination of the Contract or Final Completion, including all warranties, indemnities, payment obligations, and University's right to audit Contractor's books and records, shall remain in full force and effect after Final Completion or any termination of the Contract.

15.5 COMPLETE AGREEMENT

15.5.1 The Contract Documents constitute the full and complete understanding of the parties and supersede any previous agreements or understandings, oral or written, with respect to the subject matter hereof. The Contract may be modified only by a written instrument signed by both parties or as provided in Article 7.

15.6 SEVERABILITY OF PROVISIONS

15.6.1 If any one or more of the provisions contained in the Contract Documents should be invalid, illegal, or unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions contained herein shall not in any way be affected or impaired thereby.

15.7 UNIVERSITY'S RIGHT TO AUDIT

15.7.1 University and entities and agencies designated by University will have access to and the right to audit and the right to copy at University's cost all of Contractor's books, records, contracts, correspondence, instructions, drawings, receipts, vouchers, purchase orders, and memoranda relating to the Work. Contractor shall preserve all such records and other items during the performance of the Contract and for a period of at least 3 years after Final Completion.

15.8 METHODS OF DELIVERY FOR SPECIFIED DOCUMENTS

15.8.1 The following documents must be delivered in a manner specified in Article 15.8.2:

- .1 Contractor Notices of election to litigate or arbitrate;
- .2 Written demand for an informal conference to meet and confer pursuant to Article 4.5;
- .3 University's written statement identifying remaining disputes following informal conference pursuant to Article 4.6;
- .4 Written demand for non-binding mediation pursuant to Article 4.6;
- .5 Contractor claims pursuant to Article 4.3;
- .6 Contractor notices of conditions pursuant to Articles 3.17, 3.18, or 3.19;
- .7 University's notices of Contractor's failure to perform and/or correct defective work pursuant to Articles 4.1.6, 12.2 and 13.2.3;
- .8 University's notice to stop work pursuant to Article 2.3.1;
- .9 Notices of termination or suspension pursuant to Article 13.

15.8.2 Delivery methods for documents specified in Article 15.8.1:

- .1 By personal delivery.
- .2 Sent by facsimile copy where receipt is confirmed.
- .3 Sent by Express Mail, or another method of delivery providing for overnight delivery where receipt is confirmed.
- .4 Sent by registered or certified mail, postage prepaid, return receipt requested.

15.8.3 The documents identified in Article 15.8.1 shall only be effective if delivered in the manner specified in Article 15.8.2. Subject to the forgoing, such documents shall be deemed given and received upon actual receipt in the case of all except registered or certified mail; and in the case of registered or certified mail, on the date shown on the return receipt or the date delivery during normal business hours was attempted. Delivery of the specified documents shall be made at the respective street addresses set forth in the Agreement. Such street addresses may be changed by notice given in accordance with this Article 15.8.

15.9 TIME OF THE ESSENCE

15.9.1 Time limits stated in the Contract Documents are of the essence of the Contract.

15.10 MUTUAL DUTY TO MITIGATE

15.10.1 University and Contractor shall use all reasonable and economically practicable efforts to mitigate delays and damages to the Project and to one another with respect to the Project, regardless of the cause of such delay or damage.

15.11 UC FAIR WAGE

Contractor shall pay all persons providing construction services and/or any labor on site, including any University location, no less than the UC Fair Wage (defined as \$13 per hour as of 10/1/15, \$14 per hour as of 10/1/16, and \$15 per hour as of 10/1/17) and shall comply with all applicable federal, state and local working condition requirements.

SUPPLEMENTARY CONDITIONS

1. MODIFICATION OF GENERAL CONDITIONS, ARTICLE 11 – INSURANCE AND BONDS

Contractor shall furnish and maintain insurance in the amounts below.

The insurance required by 11.1.2.1 and 11.1.2.2 shall be (i) issued by companies with a Best rating of A- or better, and a financial classification of VIII or better (or an equivalent rating by Standard & Poor or Moody's) or (ii) guaranteed, under terms consented to by the University (such consent to not be unreasonably withheld), by companies with a Best rating of A- or better, and a financial classification of VIII or better (or an equivalent rating by Standard & Poor or Moody's). Such insurance shall be written for not less than the following:

Minimum Requirement

11.1.2.1	Commercial General Liability Insurance-Limits of Liability	
	Each Occurrence-Combined Single Limit for Bodily Injury and Property	<u>\$ 1,000,000.00</u>
	Products-Completed Operations Aggregate	<u>\$ 1,000,000.00</u>
	Personal and Advertising Injury	<u>\$ 1,000,000.00</u>
	General Aggregate	<u>\$ 2,000,000.00</u>
11.1.2.2	Business Automobile Liability Insurance-Limits of Liability	
	Each Accident-Combined Single Limit for Bodily Injury and Property Damage	<u>\$ 1,000,000.00</u>

Insurance required by Paragraph 11.1.2.3 shall be issued by companies (i) that have a Best rating of B+ or better, and a financial classification of VIII or better (or an equivalent rating by Standard & Poor or Moody's); or (ii) that are acceptable to the University. Such insurance shall be written for not less than the following:

11.1.2.3	WORKER'S COMPENSATION AND EMPLOYER'S LIABILITY –	Minimum Requirement
	Worker's Compensation:	(as required by Federal and State of California law)
	Employer's Liability:	
	Each Employee	\$1,000,000
	Each Accident	\$1,000,000
	Policy Limit	\$1,000,000

2. MODIFICATION OF ARTICLE 8 – CONTRACT TIME

Rainy weather in excess of the following number of days will be granted a Contract Time extension pursuant to Article 8.4 of the General Conditions:

None

3. MODIFICATION OF GENERAL CONDITIONS ARTICLE 15 – MISCELLANEOUS PROVISIONS

This Agreement may be executed in two or more counterparts, each of which shall be deemed an original but all of which together shall constitute one and the same Agreement. The counterparts of this Agreement may be executed via a University approved digital signature process and shall have the same force and effect as the use of a manual signature. The University reserves the right to reject any digital signature that cannot be positively verified by the University system as an authentic digital signature.

EXHIBITS

TABLE OF CONTENTS

Application for Payment

Certificate of Insurance

Certificate of Substantial Completion

Change Order

Change Order Request (with Cost Proposal Summary)

Claim Certification - General Contractor

Claim Certification - Subcontractor

Conditional Waiver and Release on Final Payment

Conditional Waiver and Release on Progress Payment

Escrow Agreement for Deposit of Securities In Lieu of Retention and Deposit of Retention

Field Order

Final Distribution of Contract Dollars

Final Inspection Acceptance

Payment Bond

Performance Bond

Report of Subcontractor Information

Selection of Retention Options

Self-Certification Form

Submittal Schedule

Substitution of Subcontractor – Indemnity Agreement and Consent

Summary of Builder’s Risk Insurance Policy

Unconditional Waiver and Release on Final Payment

Unconditional Waiver and Release on Progress Payment

APPLICATION FOR PAYMENT

Application No. _____ Period From: _____ To: _____

Application Date: _____ Contract Date: _____

To **University:** THE REGENTS OF THE UNIVERSITY OF CALIFORNIA,
 University of California, Riverside, and University's Representative

From Contractor: _____

 Address: _____

CHANGE ORDER SUMMARY:

	<u>Additions</u>	<u>Deductions</u>
Change Orders approved in previous months:	Total: _____	_____
Change Orders approved this month:		
Number: Date Approved:		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
	Total: _____	_____
	\$-	\$-

NET CHANGE BY CHANGE ORDERS: \$-

Application is made for payment under the Contract as shown below and in Schedule 1 attached hereto:

1. ORIGINAL CONTRACT SUM	
2. NET CHANGE BY CHANGE ORDERS	\$-
3. CONTRACT SUM TO DATE (Line 1 ± Line 2)	\$-
4. TOTAL AMOUNT COMPLETED TO DATE (Column E on Schedule 1)	_____
5. RETENTION: _____ % of Completed Work (Column H on Schedule 1)*	_____
a. Current Value of Securities Deposited in Escrow	_____
b. Current Value of Retention Deposited in Escrow	_____
c. Retention Held by University	_____
Current Retention Value (a + b + c)	\$-
6. TOTAL EARNED LESS RETENTION (Line 4 less Line 5)	\$-
7. TOTAL AMOUNT PREVIOUSLY PAID	_____
8. CURRENT PAYMENT DUE (Line 6 less Line 7)	\$-
9. BALANCE TO FINISH, PLUS RETENTION (Line 3 less Line 6)	\$-

*Pursuant to Article 9.2.2 of the General Conditions.

The undersigned Contractor hereby represents and warrants to University that all Work, for which Certificates For Payment have previously been issued and payment received from University, is free and clear of all claims, stop notices, security interests, and encumbrances in favor of Contractor, any Subcontractor, and any other persons or firms entitled to make claims by reason of having provided labor, materials, or equipment related to the Work.

The following Schedules are attached and incorporated herein, and made a part of this Application For Payment:

- Schedule 1 Cost Breakdown Schedule
- Schedule 2 Certification of Current Market Value of Securities in Escrow in Lieu of Retention
- Schedule 3 List of Subcontractors
- Schedule 4 Declaration of Releases of Claims

Contractor: _____

By: _____
(Signature & Date)

(Print Name & Title)

DECLARATION

I, _____, hereby declare that I am the
(Print Name)

_____ of Contractor submitting this Application For
(Title)

Payment; that I am duly authorized to execute and deliver this Application For Payment on behalf of Contractor; and that all information set forth in this Application For Payment and all Schedules attached hereto are true, accurate, and complete as of its date.

I declare, under penalty of perjury, that the foregoing is true and correct and that this declaration was subscribed at _____, _____,
(City) (County)

State of _____ on _____.
(Date)

(Signature & Date)

(Print Name & Title)



CERTIFICATE OF LIABILITY INSURANCE

(for non-UCIP Construction Projects and Consultant/Design Contracts)

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
	PHONE (A/C, No, Ext):	FAX (A/C, No):
	E-MAIL ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	NAIC #
INSURED	INSURER A :	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
	GENERAL LIABILITY <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input type="checkbox"/> OCCUR <hr/> <small>GENL</small> AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC						
	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO ALL OWNED AUTOS <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> SCHEDULED AUTOS NON-OWNED AUTOS						
	<input type="checkbox"/> UMBRELLA LIAB <input type="checkbox"/> OCCUR <input type="checkbox"/> EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DED RETENTION \$						
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? <input type="checkbox"/> Y/N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below						<input type="checkbox"/> WC STATUTORY LIMITS <input type="checkbox"/> OTH-ER
	<input type="checkbox"/> PROFESSIONAL LIABILITY <input type="checkbox"/> OCCUR <input type="checkbox"/> CLAIMS-MADE						

Special Provisions:

- The Regents of the University of California, The University of California, University, and each of their Representatives, consultants, officers, agents, employees, and each of their Representative's consultants, are included as additional insureds on the general liability policy as required by contract and pursuant to additional insured endorsement CG2010 (11/85) or a combination of both CG 2010 (10/01 or 07/04) and CG 2037 (10/01 or 07/04) but only in connection with SOM ED 1 Data Center Renovation, Project No. 950590, Contract No. 950590-LF-2021-94.
- The General Liability coverage contains a Severability of Interest provision and shall be primary insurance as respects The Regents of the University of California, its officers, agents and employees. Any insurance or self-insurance maintained by The Regents of the University of California shall be excess of and non-contributory with this insurance.

CERTIFICATE HOLDER: The Regents of the University of California

Forward to: UCR CAPITAL PROGRAMS PLANNING, DESIGN & CONSTRUCTION, ATTN: CONTRACTS 1223 UNIVERSITY AVENUE, SUITE 240 RIVERSIDE, CA 92521	<p>SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.</p> <p><i>AUTHORIZED REPRESENTATIVE</i></p>
--------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

CERTIFICATE OF SUBSTANTIAL COMPLETION

Contractor: _____

Date of Issuance: _____

The Work has been reviewed and the date of Substantial Completion is hereby established as of the date of issuance above.

A Certificate of Occupancy has been issued by the University's Building Official **Name, Title on Date**.

A punch list of items to be completed or corrected is included herein. The failure to include any items on such list does not alter the responsibility of Contractor to complete all of the Work in accordance with the Contract Documents.

In accordance with the Contract Documents, Contractor is notified as follows:

1. Without limitation of Contractor's obligation to fully complete the Work within the Contract Time, Contractor shall complete or correct the Work on the list of items ("Punch List") attached hereto within _____ days from the date of Substantial Completion.
2. University will be responsible for **INSERT "NONE" OR STATE ANY UNIVERSITY RESPONSIBILITIES AFTER SUBSTANTIAL COMPLETION: security, maintenance, utilities (e.g. water, sewer, electrical, gas, etc.)**
3. Contractor shall be responsible for all Contract requirements except items or responsibilities of University set forth in Paragraph 2 above.
4. List of items to be completed or corrected: **INSERT "NONE" or "SEE ATTACHMENT: LIST OF ITEMS TO BE COMPLETED OR CORRECTED."**

UNIVERSITY'S REPRESENTATIVE

UNIVERSITY:

By: The Regents of the University of California
University of California, Riverside

(Signature & Date)

Tameesha Hayes
Project Manager
Planning, Design & Construction

(Print Name & Title)

(Signature & Date)

Drew Hecht, Architect
Director of Project Management
Planning, Design & Construction

(Print Name & Title)

cc: Office of Risk Management

PUNCH LIST OF ITEMS TO BE COMPLETED OR CORRECTED

ATTACHMENT TO CERTIFICATE OF SUBSTANTIAL COMPLETION ISSUED

Contractor:

CHANGE ORDER REQUEST

Date: _____

Change Order Request (COR) No. _____

Scope of Change:

Instructions:

1. Complete this form by providing (a) all information required above, (b) the amount and justification based upon the Contract Schedule for any proposed adjustment of Contract Time, (c) the proposed adjustment of Contract Sum, (d) the attached "Cost Proposal Summary," and (e) the attached form entitled, "Supporting Documentation for the Cost Proposal Summary."
2. Attach the form entitled "Supporting Documentation for the Cost Proposal Summary" for Contractor and each Subcontractor involved in the Extra Work. Each such form shall be completed and signed by Contractor or Subcontractor actually performing the Work Activity identified on the form. Attach supporting data to each such form to substantiate the individually listed costs. The costs provided on these forms shall be used to substantiate additional costs shown on the Cost Proposal Summary.
3. The Contractor Fee shall be computed on the Cost of Extra Work of Contractor and each Subcontractor involved in the Extra Work; and shall constitute full compensation for all costs and expenses related to the subject change and not listed in the "Supporting Documentation for the Cost Proposal Summary," including overhead and profit.
4. Refer to Article 7.3 of the General Conditions for the method of computing the Contractor Fee.

Adjustment of the Contract Time (Include justification based upon the Contract Schedule): _____
 Refer to Article 8 of the General Conditions. (Days)

Adjustment of the Contract Sum (Total from Line 18, Col. 4 of Cost Proposal Summary): \$ _____
 Refer to Article 7 of the General Conditions.

Submitted: CONTRACTOR

Received: UNIVERSITY'S REPRESENTATIVE

 (Company Name)

 (Signature & Date)

 (Print Name & Title)

 (Signature & Date)

Tameesha Hayes
Project Manager
Planning, Design & Construction

 (Print Name & Title)

cc: Executive Director, Architects & Engineers, Capital Programs

COST PROPOSAL SUMMARY

Contractor: _____ COR No. _____

		(1) Contractor	(2) 1st Tier Subs	(3) 2nd & Lower Tier Subs	(4) Total
ACTUAL COSTS	1. Straight Time Wages/Salaries-Labor				-
	2. Fringe Benefits and Payroll Taxes-Labor				-
	3. Overtime Wages/Salaries-Labor				-
	4. Fringe Benefits & Payroll Taxes-Overtime				-
	5. Materials & Cnsumable Items				-
	6. Sales Taxes (On Line 5)				-
	7. Rental Charges				-
	8. Royalties				-
	9. Permits				-
	10. Total Direct Expense (Sum of Lines 1-9)	\$-	\$-	\$-	\$-
	11. Insurance & Bonds (up to 2% of Line 10)	-	-	-	-
CONTRACTOR FEE	12. Sub-Sub (15% of Line 10, Col. 3)			-	-
	13. Subcontractor (5% of Line 10, Col. 3)		-		-
	14. Subcontractor (15% of Line 10, Col. 2)		-		-
	15. Contractor (5% of Line 10, Col. 2 & 3)	-			-
	16. Contractor (15% of Line 10, Col. 1)	-			-
	17. Contractor Fee (Sum of Lines 12-16)	\$-	\$-	\$-	\$-
TOTAL	18. Sum of Lines 10, 11, & 17	\$-	\$-	\$-	\$-

Actual Costs are taken from Line 12 of the attached forms entitled, "Supporting Documentation For the Cost Proposal Summary" for Contractor and each Subcontractor involved in the Extra Work.

SUPPORTING DOCUMENTATION FOR THE COST PROPOSAL SUMMARY

Supporting Documentation

From: _____ COR No. _____
(Contractor/Subcontractor Name)

Work Activity: _____

COST ITEM	DESCRIPTION	COST ⁽¹⁾
ACTUAL COSTS	1. Straight Time Wages/Salaries-Labor	
	2. Fringe Benefits & Payroll Taxes-Labor: ___% of Line 1	
	3. Overtime Wages/Salaries-Labor (Attach University's Representative's written authorization.)	
	4. Fringe Benefits & Payroll Taxes-Overtime: ___% of Line 3	
	5. Materials & Consumable Items	
	6. Sales Taxes: ___% of Line 5	
	7. Rental Charges (Attach CalTrans' Schedule.)	
	8. Royalties	
	9. Permits	
	10. Total Direct Expense (Sum of Lines 1-9)	\$-
	11. Insurance & Bonds ___% of Line 10 (up to 2% of Line 10)	-
TOTAL	12. Sum of Lines 10 & 11	\$-

Prepared By:⁽²⁾

CONTRACTOR:⁽³⁾

 (Company Name)

 (Company Name)

 (Signature & Date)

 (Signature & Date)

 (Print Name & Title)

 (Print Name & Title)

Notes:

- (1) This form shall be prepared and signed by Contractor or Subcontractor actually performing the Work Activity indicated above.
- (2) If this form is signed by a Subcontractor, it shall be reviewed and signed by Contractor certifying the accuracy of the information.

CHANGE ORDER

Contract Date: _____

Change Order No.: _____

Date Issued: _____

To Contractor: _____

Attn: _____

Address: _____

DESCRIPTION OF CHANGE: (Reference attachments)	Contract Sum Adjustment	Contract Time Adjustment
1. _____		
2. _____		

Description of Change continued on Page 2. Subtotal from Page 2: **\$0.00** **0**

Adjustment of Contract Sum:

Original Contract Sum: _____
 Prior Adjustments: _____
 Contract Sum before this Change: **\$-**
 Adjustment for this Change: **\$-**
 Revised Contract Sum: **\$-**

Adjustment of Contract Time:

Original Contract Time: 0 (Days)
 Prior Adjustments: 0 (Days)
 Contract Time before this Change: **0** (Days)
 Adjustment for this Change: **0** (Days)
 Revised Contract Time: **0** (Days)

Start Date: _____
 Original Final Completion Date: **#####**
 Revised Final Completion Date: **#####**

Contractor waives any claim for further adjustments of the Contract Sum and the Contract Time related to the above described change in the Work.

Accepted:

By: Contractor

 (Signature & Date)

 (Print Name & Title)

Recommended:

By: University's Representative

 (Signature & Date)
Tameesha Hayes
 Project Manager
Planning, Design & Construction
 (Print Name & Title)

Funds Sufficient:

By: Financial Administrative Officer

 (Signature & Date)
Susan McFadden
 Senior Financial Analyst
Planning, Design & Construction
 (Print Name & Title)

Approved:

University: The Regents of the University of California

 (Signature & Date)
Drew Hecht, Architect
 Director of Project Management
Planning, Design & Construction
 (Print Name & Title)

Account No.: _____ Activity Code: _____
 Fund: _____ Function: _____
 Cost Center: _____ Project Code: _____

CHANGE ORDER

Contract Date: _____

Change Order No.: _____

(Page 2)

DESCRIPTION OF CHANGE - CONTINUED

		Contract Sum Adjustment	Contract Time Adjustment
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Subtotals: \$0.00 0

CLAIM CERTIFICATION - GENERAL CONTRACTOR

Pursuant to Article 4.3.3 of the General Conditions, I certify as follows:

1. The Claim to which this certification is attached is made in good faith.
2. Amounts claimed for costs, expenses and damages incurred by Contractor are accurate and complete. Supporting data for amounts incurred by Contractor is accurate and complete. Any such supporting data, including any such new amounts, submitted after the execution of this certification, will be accurate and complete.
3. To the best of my knowledge and belief, amounts claimed, and supporting data submitted by Contractor on behalf of any and all subcontractors or suppliers, of all tiers, or any person or entity under Contractor, are accurate and complete. Contractor will not submit, after the date of execution of this certification, any such supporting data, including any such new amounts that, to the best of my knowledge and belief, is not accurate and complete.
4. The amount requested accurately reflects the adjustment of the Contract Sum for which the Contractor believes the University is liable.
5. Attached hereto is a certification that has been executed by each Subcontractor claiming not less than 5% of the total monetary amount sought by the claim to which this certification is attached.
6. I am duly authorized to certify the Claim on behalf of the Contractor.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration was executed at _____ ,
(Name of City if within a City, otherwise, Name of County)

in the State of _____ , on _____ .
(Name of State) (Date)

(Name of Contractor)

By: _____
(Signature)

(Print Name & Title)

CLAIM CERTIFICATION - SUBCONTRACTOR

Pursuant to Article 4.3.3 of the General Conditions, I certify as follows:

1. The portion of the Claim made on behalf of the Subcontractor to which this certification is attached is made in good faith.
2. Amounts claimed for costs, expenses and damages incurred by the Subcontractor are accurate and complete. Supporting data for amounts incurred by the Subcontractor is accurate and complete. Any such supporting data, including any such new amounts, submitted to Contractor after the execution of this certification, will be accurate and complete.
3. To the best of my knowledge and belief, amounts claimed, and supporting data submitted to Contractor by the Subcontractor on behalf of any and all subcontractors or suppliers to Subcontractor, of all tiers, or any person or entity under Subcontractor, are accurate and complete. Subcontractor will not submit, after the date of execution of this certification, any such supporting data, including any such new amounts that, to the best of my knowledge and belief, is not accurate and complete.
4. The amount requested accurately reflects the amount for which the Subcontractor believes the University is liable to Contractor.
5. I am duly authorized to certify the Claim on behalf of the Subcontractor.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration was executed at _____ ,
(Name of City if within a City, otherwise, Name of County)
in the State of _____ , on _____ .
(Name of State) (Date)

(Name of Subcontractor)

By: _____
(Signature)

(Print Name & Title)

**CONDITIONAL WAIVER AND RELEASE ON
FINAL PAYMENT**

NOTICE:

THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Identifying Information:

Name of Claimant: _____
Name of Customer: _____
Job Location: SOM ED1 Data Center Renovation, Project No. 950590
University of California, Riverside, City of Riverside, County of Riverside
Owner: The Regents of the University of California

Conditional Waiver and Release:

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is

Maker of Check: _____
Amount of Check: \$ _____
Check Payable to: _____

Exceptions:

This document does not affect any of the following: Disputed claims for extras in the amount of:

\$ _____ .

Signature:

Claimant's Signature & Date: _____

Claimant's Name & Title: _____

Prime Contractor's Application for Payment # _____

**CONDITIONAL WAIVER AND RELEASE ON
PROGRESS PAYMENT**

NOTICE:

THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Identifying Information:

Name of Claimant: _____
Name of Customer: _____
Job Location: **SOM ED1 Data Center Renovation, Project No. 950590**
University of California, Riverside, City of Riverside, County of Riverside
Owner: **The Regents of the University of California**
Through Date: _____

Conditional Waiver and Release:

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check: _____
Amount of Check: \$ _____
Check Payable to: _____

Exceptions:

This document does not affect any of the following:

- (1) Retentions.
- (2) Extras for which the claimant has not received payment.
- (3) The following progress payments for which the claimant has previously given a conditional waiver and release but has not received payment:

Date(s) of Waiver and Release: _____

Amount(s) of Unpaid Progress Payment(s): \$ _____

- (4) Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Signature:

Claimant's Signature & Date: _____

Claimant's Name & Title: _____

Prime Contractor's Application for Payment # _____

RETURN THIS AGREEMENT SIGNED BY CONTRACTOR AND ESCROW AGENT TO:
UNIVERSITY OF CALIFORNIA, RIVERSIDE
Planning, Design & Construction
1223 University Ave, Suite 240
Riverside, CA 92521
USE THIS ADDRESS FOR ALL CORRESPONDENCE

Escrow Account No.: _____

**ESCROW AGREEMENT FOR
DEPOSIT OF SECURITIES IN LIEU OF RETENTION
AND
DEPOSIT OF RETENTION**

This Escrow Agreement is made as of _____, and entered into by and between
(Date)
THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, hereinafter called "University," and

_____ ,

whose address is _____ ,

hereinafter called "Contractor," and _____ ,

a state or federally chartered bank in the state of California, whose address is

_____ ,

hereinafter called "Escrow Agent."

For consideration hereinafter set forth, University, Contractor, and Escrow Agent agree as follows:

(1) Contractor has the option to deposit securities with Escrow Agent as a substitute for retention required to be withheld by University pursuant to the Contract Documents, hereinafter referred to as "Contract," entered into between University and Contractor for the Project titled

_____ ,

Project Number _____ , in the amount of \$ _____ ,

dated _____. Alternatively, on written request of Contractor, University shall deposit retention directly with Escrow Agent. Contractor and its surety shall be at risk for failure of the Escrow Agent selected. When Contractor deposits the securities as a substitute for retention, Escrow Agent shall notify University within 5 days after the deposit. At all times, Contractor shall have on deposit securities the market value of which is at least equal to the cash amount then required to be withheld as retention under the terms of the Contract. Securities shall be held in the name of The Regents of the University of California, Riverside; and Contractor shall be designated as the beneficial owner.

(2) Escrow Agent shall review the market value of securities deposited in escrow under this Escrow Agreement as often as conditions of the securities market warrant, but in no case less than once per month. Escrow Agent shall promptly notify University and Contractor of the market value of the deposited securities if such market value is less than the total amount of retention required to be withheld under the terms of the

Contract. Contractor shall promptly deposit additional securities so that the current market value of the total of all deposited securities shall be at least equal to the total required amount of retention. Escrow Agent shall, within 5 days after University's request, provide a statement to University of the current market value of all securities deposited under this Escrow Agreement as of a date not earlier than 5 days prior to such request. The provisions of this Paragraph 2 shall not apply to securities consisting of monetary deposits as allowed by Paragraph 7 held by a bank as Escrow Agent, provided the bank provides monthly statements reflecting the status of the monetary deposits held by the bank to University and Contractor.

(3) Contractor shall not use any or all of the securities deposited in lieu of retention under this Escrow Agreement for any other obligations, including deposits in lieu of retention for other contracts. Contractor represents, covenants and warrants that all deposited securities shall be lien free when tendered to the Escrow Agents and shall remain lien free during their retention by the Escrow Agent.

(4) University shall make progress payments to Contractor for those funds which otherwise would be withheld from progress payments pursuant to the Contract provision, provided that Escrow Agent holds securities in the form and amount specified herein.

(5) Prior to Contractor's submission of each Application For Payment, Escrow Agent shall issue a current statement of (a) the value of the securities currently being deposited in lieu of retention and (b) the current value of all securities being held in escrow pursuant to this Escrow Agreement. Such statement shall be no more than 5 days old at the time of submission, shall be notarized or have a guarantee of signature, and shall be submitted to Contractor with a copy to University under separate cover. Contractor shall attach such original statement to each Application For Payment. The provisions of this Paragraph 5 shall not apply to securities consisting of monetary deposits as allowed by Paragraph 7 held by a bank as Escrow Agent, provided the bank provides monthly statements reflecting the status of the monetary deposits held by the bank to University and Contractor.

(6) If, at the request of Contractor, University deposits retention directly with Escrow Agent, Escrow Agent shall hold such retention for the benefit of Contractor until such time as the escrow created under the Contract is terminated. All terms and conditions of this Escrow Agreement and the rights and responsibilities of the parties shall be equally applicable and binding when University deposits retention directly with Escrow Agent.

(7) University will allow Contractor to deposit the following securities in lieu of retention and direct the investment of the retention deposits into any of the following which at the time of payment are legal investments under the laws of the State of California:

- a. Direct obligations of the United States of America (including obligations issued or held in book-entry form on the books of the Department of the Treasury of the United States of America or any Federal Reserve Bank), or obligations the timely payment of the principal of and interest on which are fully guaranteed by the United States of America, or tax-exempt obligations which are rated in the highest rating category of a nationally recognized bond rating agency.
- b. Obligations, debentures, notes or other evidence of indebtedness issued or guaranteed by any of the following: Banks for Cooperatives, Federal Intermediate Credit Banks, Federal Home Loan Bank System, Export-Import Bank of the United States, Federal Financing Bank, Federal Land Banks, Federal Farm Credits, Government National Mortgage Association, Farmer's Home Administration, Federal Home Loan Mortgage Corporation, or Federal Housing Administration.
- c. Bonds of the State of California or those for which the faith and credit of the State of California are pledged for the payment of principal and interest.
- d. Interest-bearing bankers acceptances and demand or time deposits (including certificates of deposit) in banks, provided such deposits are either (1) secured at all times, in the manner and to the extent provided by law, by collateral security described in clauses a or b of this Paragraph 7 continuously having a market value at least equal to the amount so invested so long as such

underlying obligations or securities are in the possession of the Securities Investors Protection Corporation, (2) in banks having a combined capital and surplus of at least One Hundred Million Dollars, or (3) fully insured by the Federal Deposit Insurance Corporation.

- e. Taxable government money market portfolios restricted to obligations with maturities of one (1) year or less, issued or guaranteed as to payment of principal and interest by the full faith and credit of the United States of America.
- f. Commercial paper rated in the highest rating category of a nationally recognized rating agency, and issued by corporations organized and operating within the United States of America and having total assets in excess of Five Hundred Million Dollars.

(8) Contractor shall be responsible for paying all fees, costs, and expenses incurred by Escrow Agent in administering the escrow account. These expenses and payment terms shall be determined by Contractor and Escrow Agent. All fees, costs, and expenses of this Escrow Agreement and any transactions carried out hereunder shall be billed by Escrow Agent to Contractor. In the event that any fees, costs, or expenses shall remain unpaid in excess of 30 days from the date due, Escrow Agent may withhold such unpaid amount from any income distributable to Contractor, but shall not withhold such unpaid amount from any income distributable to University.

(9) Interest earned on the securities or the money market accounts held in escrow and all interest earned on the interest shall be for the sole account of Contractor and shall be held in escrow. Interest may be withdrawn by Contractor from time to time, without notice to University, only to the extent that the total amount held in escrow meets or exceeds the required amount of retention.

(10) Except as provided in Paragraph 9, Contractor shall have the right to withdraw all or any part of the escrow account only by written notice to Escrow Agent accompanied by written authorization from University to Escrow Agent stating that University consents to the withdrawal of the amount sought to be withdrawn by Contractor. University shall not be obligated to consent to any withdrawal to the extent of stop notice claims which cannot be satisfied from other funds then due and payable to Contractor.

(11) University shall have the right to draw upon the securities, any interest earned on the securities, and any interest earned on the interest in the event of default by Contractor. Upon 7 days written notice to Escrow Agent from University, with a copy to Contractor, Escrow Agent shall immediately convert the securities, any interest earned on the securities, and all interest earned on the interest to cash and shall distribute the cash as instructed by University. Escrow Agent shall have no duty to determine whether a default has occurred and may rely solely upon the written notice of such default from University.

(12) Upon receipt of written notification from University certifying that final payment is due under the Contract, Escrow Agent shall release to Contractor the amount, if any, by which the value of all securities and interest on deposit less escrow fees and charges of the escrow account exceeds 125% of all stop notice claims on file. Escrow Agent shall pay the remaining amount to University or as directed by University. The escrow shall be closed immediately upon disbursement of all monies and securities on deposit and payment of fees and charges.

(13) Escrow Agent shall rely upon the written notifications from University and Contractor pursuant to this Escrow Agreement; and University and Contractor shall hold Escrow Agent harmless from Escrow Agent's release, conversion, and disbursement of the securities and interest as set forth herein.

(14) Escrow Agent shall have the right to terminate this Escrow Agreement upon 30 days notice to all parties hereunder. Upon receipt of such notice, University and Contractor shall appoint a successor Escrow Agent in writing and deliver written notice of such appointment to Escrow Agent. Thereupon, Escrow Agent shall deliver all assets in its custody to such successor Escrow Agent and all responsibility of Escrow Agent under this Escrow Agreement shall terminate; provided, however, if Contractor and University fail to appoint a successor Escrow Agent on or before the end of the 30 day notice period, then Escrow Agent is authorized and instructed to return all assets, documents, and other items in its custody to University and this Escrow Agreement shall be terminated without further instruction.

(15) The duties and responsibilities of Escrow Agent shall be limited to those expressly set forth in this Escrow Agreement; provided, however, that, with Escrow Agent's written consent, the duties and responsibilities in this Escrow Agreement may be amended at any time or times by an instrument in writing signed by all parties.

(16) Whenever Contractor tenders securities to be deposited in lieu of retention, an authorized representative of the Contractor shall declare under penalty of perjury that the securities are lien free and shall remain lien free during their retention by the Escrow Agent. The declaration shall be in the following form:

"The undersigned, on behalf of _____ whose address is _____,
(Name of Contractor)

(Street Address, City, State & Zip Code)

represents, covenants and warrants that the securities tendered herewith are lien free and shall remain lien free during their retention by the Escrow Agent.

I, _____, hereby declare that I am the
(Name)

(Title) of _____,
(Name of Contractor)

that I am duly authorized to make this representation, and that I declare under perjury under the laws of the State of California that the foregoing is true and correct."

(Signature) _____
(Date)

(17) The names of the persons authorized to give written notice or to receive written notice on behalf of University and on behalf of Contractor in connection with this Escrow Agreement, and exemplars of their respective signatures, are as set forth below. Such names may be changed by written notice to the other parties.

On behalf of University:

On behalf of Contractor:

1. _____
(Signature)
Drew Hecht, Architect
Director of Project Management
Planning, Design & Construction

(Print Name & Title)

951.827.1485
(Telephone Number)

2. _____
(Signature)
Bobbi McCracken
Associate Vice Chancellor and Controller
Business and Financial Services

(Print Name & Title)

951.827.3303
(Telephone Number)

1. _____
(Signature)

(Print Name & Title)

(Telephone Number)

2. _____
(Signature)

(Print Name & Title)

(Telephone Number)

Contractor, Escrow Agent, and University hereby agree to the covenants contained herein.

IN WITNESS WHEREOF, Contractor, Escrow Agent, and University have executed this Escrow Agreement, the day and year first written above.

University:

Contractor:

By: _____
(Signature)
Blythe R. Wilson, Architect
Director of Project Management
Planning, Design & Construction

(Print Name & Title)

951.827.1485
(Telephone Number)

By: _____
(Signature)
Bobbi McCracken
Associate Vice Chancellor and Controller
Business and Financial Services

(Print Name & Title)

951.827.3303
(Telephone Number)

By: _____
(Signature)

(Print Name & Title)

(Telephone Number)

By: _____
(Signature)

(Print Name & Title)

(Telephone Number)

Escrow Agent:

By: _____
(Signature)

(Print Name & Title)

(Telephone Number)

FIELD ORDER

Contract Date: _____

Field Order No. _____

To Contractor: _____

Attn: _____

Address: _____

Description of Work

**Estimated
Adjustment,
Contract
Sum**

**Estimated
Adjustment,
Contract
Time**

1.			
2.			
3.			

By University's Representative:

(Signature & Date)
Tameesha Hayes
 Project Manager
 Planning, Design & Construction

(Print Name & Title)

NOTE: If the work described above constitutes a change, this Field Order will be superseded by a Change Order that will include the scope of the change in the Work and any actual adjustments of the Contract Sum and the Contract Time.

cc: Director of Project Management, Planning, Design & Construction

FINAL INSPECTION ACCEPTANCE

Contract Date: _____ Final Inspection Date: _____

To Contractor: _____

Attn: _____

Address: _____

The above Project was inspected and accepted as of the above Final Inspection Date. No outstanding work remains to be performed. All required submittals have been received. All training has been performed pursuant to the Contract.

The following Change Orders for time and/or money ONLY remain unexecuted:

Upon receipt of this executed document for Final Inspection Acceptance, Contracts Administration will file a Notice of Completion with the county recorder's office. This action terminates the construction contract for this Project.

By: Inspector

By: Design Professional

(Signature & Date)
Carlos Madrid
Senior Construction Inspector
Planning, Design & Construction

(Print Name & Title)

(Signature & Date)

(Print Name & Title)

By: University's Representative

By: University's Responsible Administrator

(Signature & Date)
Tameesha Hayes
Project Manager
Planning, Design & Construction

(Print Name & Title)

(Signature & Date)
Drew Hecht, Architect
Director of Project Management
Planning, Design & Construction

(Print Name & Title)

Bond No. _____

PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENTS:

THAT WHEREAS, The Regents of the University of California ("The Regents") has awarded to

_____ as Principal

a contract dated the _____ day of _____, 20____, (the "Contract") for the work described as follows:

Project Name: SOM ED1 Data Center Renovation
Project No. 950590, Contract No. 950590-LF-2021-94

AND WHEREAS, the Principal is required to furnish a bond in connection with the Contract, to secure the payment of claims of laborers, mechanics, material suppliers, and other persons as provided by law;

NOW, THEREFORE, we, the undersigned Principal and _____
_____ as Surety, are held and firmly bound unto The Regents in the sum of _____ Dollars (\$ _____), for which payment well and truly to be made we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if Principal, or its heirs, executors, administrators, successors, or assigns approved by The Regents, or its subcontractors shall fail to pay any of the persons named in State of California Civil Code Section 9100, or amounts due under the State of California Unemployment Insurance Code with respect to work or labor performed under the Contract, or for any amounts required to be deducted, withheld, and paid over to the State of California Employment Development Department from the wages of employees of Principal and subcontractors pursuant to Section 13020 of the State of California Unemployment Insurance Code with respect to such work and labor, that Surety will pay for the same in an amount not exceeding the sum specified in this bond, otherwise the above obligation shall become and be null and void.

This bond shall inure to the benefit of any of the persons named in State of California Civil Code Section 9100 as to give a right of action to such persons or their assigns in any suit brought upon this bond.

Surety, for value received, hereby expressly agrees that no extension of time, change, modification, alteration, or addition to the undertakings, covenants, terms, conditions, and agreements of the Contract, or to the work to be performed thereunder, shall in any way affect the obligation of this bond; and it does hereby waive notice of any such extension of time, change, modification, alteration, or addition to the undertakings, covenants, terms, conditions, and agreements of the Contract, or to the work to be performed thereunder.

Surety's obligations hereunder are independent of the obligations of any other surety for the payment of claims of laborers, mechanics, material suppliers, and other persons in connection with the Contract; and suit may be brought against Surety and such other sureties, jointly and severally, or against any one or more of them, or against less than all of them without impairing The Regents' rights against the other.

In the event suit is brought upon this bond, the parties not prevailing in such suit shall pay reasonable attorneys' fees and costs incurred by the prevailing parties in such suit.

Correspondence or claims relating to this bond shall be sent to Surety at the address set forth below.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 20____.

PRINCIPAL:

SURETY:

(Name of Company)

(Name of Company)

By: _____
(Signature)

By: _____
(Signature)

(Print Name)

(Print Name)

(Title)

(Title)

Address for Notices:

(Street Address)

(City, State & Zip Code)

NOTE: Notary acknowledgement for Surety and Surety's Power of Attorney must be attached.

Bond No. _____

PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS:

THAT WHEREAS, The Regents of the University of California ("The Regents") has awarded to _____ as Principal a contract dated the _____ day of _____, 20 _____, (the "Contract"), which Contract is by this reference made a part hereof, for the work described as follows:

Project Name: SOM ED1 Data Center Renovation
Project No. 950590, Contract No. 950590-LF-2021-94

AND WHEREAS, Principal is required to furnish a bond in connection with the Contract, guaranteeing the faithful performance thereof;

NOW, THEREFORE, we, the undersigned Principal and _____ as Surety are held and firmly bound unto The Regents in the sum of _____ Dollars (\$ _____), to be paid to The Regents or its successors and assigns; for which payment, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if Principal, or its heirs, executors, administrators, successors, or assigns approved by The Regents, shall promptly and faithfully perform the covenants, conditions, and agreements of the Contract during the original term and any extensions thereof as may be granted by The Regents, with or without notice to Surety, and during the period of any guarantees or warranties required under the Contract, and shall also promptly and faithfully perform all the covenants, conditions, and agreements of any alteration of the Contract made as therein provided, notice of which alterations to Surety being hereby waived, on Principal's part to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify, defend, protect, and hold harmless The Regents as stipulated in the Contract, then this obligation shall become and be null and void; otherwise it shall be and remain in full force and effect.

No extension of time, change, alteration, modification, or addition to the Contract, or of the work required thereunder, shall release or exonerate Surety on this bond or in any way affect the obligation of this bond; and Surety does hereby waive notice of any such extension of time, change, alteration, modification, or addition.

Whenever Principal shall be and declared by The Regents to be in default under the Contract, Surety shall promptly remedy the default, or shall promptly:

1. Undertake through its agents or independent contractors, reasonably acceptable to The Regents, to complete the Contract in accordance with its terms and conditions and to pay and perform all obligations of Principal under the Contract, including without limitation, all obligations with respect to warranties, guarantees, and the payment of liquidated damages, or, at Surety's election, or, if required by The Regents,

2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and, upon determination by The Regents of the lowest responsible bidder, arrange for a contract between such bidder and The Regents and make available as work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract Sum, and to pay and perform all obligations of Principal under the Contract, including, without limitation, all obligations with respect to warranties, guarantees, and the payment of liquidated damages; but, in any event, Surety's total obligations hereunder shall not exceed the amount set forth in the third paragraph hereof. The term "balance of the Contract Sum," as used in this paragraph, shall mean the total amount payable by The Regents to the Principal under the Contract and any amendments thereto, less the amount paid by The Regents to Principal.

Surety's obligations hereunder are independent of the obligations of any other surety for the performance of the Contract, and suit may be brought against Surety and such other sureties, jointly and severally, or against any one or more of them, or against less than all of them without impairing The Regents' rights against the others.

No right of action shall accrue on this bond to or for the use of any person or corporation other than The Regents or its successors or assigns.

Surety may join in any arbitration proceedings brought under the Contract and shall be bound by any arbitration award.

In the event suit is brought upon this bond by The Regents, Surety shall pay reasonable attorney's fees and costs incurred by The Regents in such suit.

Correspondence or claims relating to this bond shall be sent to Surety at the address set forth below.

IN WITNESS WHEREOF, we have hereunto set our hands this _____ day of _____, 20____.

PRINCIPAL:

SURETY:

 (Name of Company)

 (Name of Company)

By: _____
 (Signature)

By: _____
 (Signature)

 (Print Name)

 (Print Name)

 (Title)

 (Title)

Address for Notices:

 (Street Address)

 (City, State & Zip Code)

NOTE: Notary acknowledgement for Surety and Surety's Power of Attorney must be attached.



REPORT OF SUBCONTRACTOR/SUBCONSULTANT INFORMATION

(NOTE: THIS EXHIBIT IS NOT TO BE SUBMITTED WITH BID)

Completed By: _____ (Signature) _____ (Print Name) _____ (Title) Date: _____

Provide the following information for each contracting party including the prime Contractor and each subcontractor regardless of tier*.

Sheet No. _____ of _____

Attach additional sheets if necessary.

1	2	3	4	5	6					7a	7b	8		
Full Name of Business	Street Address City, State & Zip Code	Telephone # & Fax #	Contact Name	Type of Owner- ship	Business Categories* (Check all that apply [X])					Portion of the Work	Amount \$	License Information**		
					SBE	DVBE	DBE	WBE	N/A			License Classification	License #	
Prime:														
Sub:														
Sub:														
Sub:														
					Column 5 – Type of Ownership					Column 6 – Business Categories				
					C = Corporation					SBE = Small Business Enterprise				
					JV = Joint Venture					DVBE = Disabled Veteran Business Enterprise				
					P = Partnership					DBE = Disadvantaged Business Enterprise				
					SP = Sole Proprietorship					WBE = Women-Owned Business Enterprise				
					O = Other					N/A = Not Applicable				

*Regardless of tier, a completed Self-Certification form must be submitted for the prime Contractor and each subcontractor shown on this Exhibit.

**List only those license classifications and numbers relevant to this Project.

SELECTION OF RETENTION OPTIONS

I (we): _____
(Contractor)

SELECT OPTION 1 _____ Initial and date here
 University will withhold retention. for OPTION 1

OR SELECT OPTION 2 _____ Initial and date here
 herewith elect to substitute securities in the form of: for OPTION 2

(Type of Security)
 in lieu of retention being withheld by University for the
 above-referenced project.

OR SELECT OPTION 3 _____ Initial and date here
 herewith elect to have retention on the above-
 referenced project paid directly into the Escrow
 Account. for OPTION 3

(Type of Security to be Purchased)

An Escrow Account will be opened with: _____
(Name of state or federally chartered bank in California)

whose address is: _____
(Street)

(City, County)

(State, Zip Code)

On Behalf of Contractor*:

On Behalf of University:
 Acknowledged and Approved

By: _____
(Signature)

By: _____
(Signature)

(Print Name & Title)

Drew Hecht, Architect
Director of Project Management
Planning, Design & Construction

(Print Name & Title)

* Signature shall be by the authorized party who signs the Escrow Agreement for Deposit of Securities in Lieu of Retention and Deposit of Retention ("Escrow Agreement").

Note: If a completed and signed Escrow Agreement is not submitted with this form, University will not allow deposit of securities in lieu of retention.

SELF-CERTIFICATION

For the Contractor and each subcontractor/subconsultant, the following must be completed.

Indicate all Business category(ies) that apply by initialing next to the applicable category(ies):

(Initial, if applicable) **Small Business Enterprise (SBE)** - an independently owned and operated concern certified, or certifiable, as small business by the Federal Small Business Administration (SBA). (Size standards by Standard Industrial Classification codes required by the Federal Acquisition Regulations, Section 19.102, may be found at <http://www.sba.gov/content/table-small-business-size-standards>.) The eligibility requirements for California contracting purposes is on the [Department of General Services website](http://www.dgs.ca.gov/pd/Programs/OSDS/SBEeligibilityBenefits.aspx) at <http://www.dgs.ca.gov/pd/Programs/OSDS/SBEeligibilityBenefits.aspx>. The University may rely on written representation by the vendors regarding their status.

(Initial, if applicable) **Disabled Veteran Business Enterprise (DVBE)** - a business that is at least 51% owned by one or more disabled veterans or, in the case of any publicly owned business, at least 51% of the stock of which is owned by such individuals and whose management and daily business operations are controlled by one or more of such individuals. A Disabled Veteran is a veteran of the military, naval, or air service of the United States with a service connected disability who is a resident of the State of California. To qualify as a veteran with a service connected disability, the person must be currently declared by the United States Veterans Administration to be 10% or more disabled as a result of service in the armed forces.

(Initial, if applicable) **Disadvantaged Business Enterprise (DBE)** - a business concern that is at least 51% owned by one or more socially and economically disadvantaged individuals or, in the case of any publicly owned business, at least 51% of the stock of which is owned by such individuals and whose management and daily business operations are controlled by one or more of such individuals. Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as members of a group without regard to their individual qualities. Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free private enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged. Business owners who certify that they are members of named groups (Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Asian-Indian Americans) are to be considered socially and economically disadvantaged.

(Initial, if applicable) **Women-Owned Business Enterprise (WBE)** - a business that is at least 51% owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management.

(Initial, if applicable) **None of the above categories apply.**

I hereby certify under penalty of perjury under the laws of the State of California that I have read this certification and know the contents thereof, and that the business category indicated above reflects the true and correct status of the business in accordance with Federal Small Business Administration criteria and Federal Acquisition Regulations, FAR 19 pertaining to small, disadvantaged, women-owned, and disabled veteran business enterprises. I understand that falsely certifying the status of this business, obstructing, impeding or otherwise inhibiting any University of California official who is attempting to verify the information on this form may result in suspension from participation in University of California business contracts for a period up to five (5) years and the imposition of any civil penalties allowed by law.

INFORMATION FURNISHED BY: _____
(Print Name of Owner and/or Principal)

(Name of Business or Firm)

a _____
(Insert type of business e.g. corporation, sole proprietorship, partnership, etc.)

By: _____
(Print Name) (Title)

(Signature) (Date)

PRIVACY NOTICE

The State of California Information Practices Act of 1977 (effective July 1, 1978) requires the University of California to provide the following information to individuals who are asked to supply personal information about themselves. Information furnished on the Self-Certification form may, in some cases, identify personal information of an individual.

- The University of California, Riverside, is requesting the information contained in this form and the accompanying Report of Subcontractor Information.
- The Small Business Outreach Program Manager at the University of California, Riverside, is responsible for maintaining the requested information. The contact information for the Small Business Outreach Program Manager may be found at: <http://www.ucop.edu/procurement-services/files/sbdrmgr.xlsx>.
- The maintenance of information is authorized in part by Public Contract Code section 10500.5.
- Furnishing the information requested on this form is mandatory. If SBE, DBE, WBE and/or DVBE status is applicable, furnishing such information is mandatory.
- Failure to provide the information may be a violation of bidding procedures and/or breach of the contract and the University may pursue any and all remedies permitted by the provisions of the Contract Documents.
- The information on this form is collected for monitoring and reporting purposes in accordance with state law and University policy.
- The individual may access information contained in this form and related forms by contacting the Small Business Outreach Program Manager(s).

SUBMITTAL SCHEDULE

Contract Date: _____

Subcontractor: _____

Specification Section: _____

Work Activity: _____

Event	Scheduled Completion Date	Actual Completion Date	Calendar Days Required to Complete
1. Received by Contractor and Time for Checking			
2. First Delivered to University's Representative and Time for Checking			
3. Return to Contractor			
4. Corrections Completed and Time for Corrections			
5. Next Delivered (1 st Resubmission) to University's Representative and Time for Checking			
6. Return to Contractor			
7. Approval for Job Information			
8. Approval for Fabrication and Time for Fabrication			
9. Fabrication Completed			
10. Shipping Date and Time In Route			
11. Delivery to Job			

*Contractor must revise Submittal Schedule to reflect number of resubmissions.

SUBSTITUTION OF SUBCONTRACTOR - INDEMNITY AGREEMENT and CONSENT

WHEREAS, on **Date**, **The Regents of the University of California** (University) and _____ (Contractor)

(Full Company Name & Address of Prime Contractor)
entered into an Agreement (Contract Number **950590-LF-2021-94**) for the construction of **SOM ED1 Data Center Renovation, Project No. 950590**, University of California, Riverside (Project); and

WHEREAS, Contractor's Bid, which was accepted by University for said Project, listed **Name of Listed Sub** as Subcontractor for the **work activity** work called for by the Bidding Documents and Contract Documents; and

WHEREAS, Contractor has represented and does hereby represent to University that **Name of Listed Sub** has **reasons for substitution**;

In consideration of the consent of University to the substitution of:

_____, for
(Full Company Name & Address of Substitute Subcontractor)

Name of Listed Sub, as
(Full Company Name of Listed Subcontractor)

Subcontractor to provide the **work activity** work called for in the Bidding Documents and Contract Documents for the Project, Contractor does hereby agree to indemnify the University and hold it harmless from any and all claims, expenses, losses or liabilities arising out of said substitution of subcontractor or said consent thereto, and to defend at Contractor's expense any and all claims, protests, suits, actions or other proceedings in connection therewith; provided, however, that the University shall be given prompt notice of all such proceedings and it shall be entitled, if it so desires, to participate in the response to or defense of any such proceedings. If any such proceedings causes or results in a delay in the completion of said Project, the loss to the University for such delay shall be deemed to be the amount determined by applying the liquidated damages provisions of said Agreement for the period of such delay.

IN WITNESS WHEREOF, this Indemnity Agreement has been executed on _____, *(Date)*
at _____, California.
(Location: City & County)

CONTRACTOR:

By: _____
(Signature)

(Typed or Printed Name & Title)

CONSENT TO SUBSTITUTION OF SUBCONTRACTOR

In consideration of the indemnification of University by Contractor, above, University agrees and does hereby consent to the substitution of:

_____, for
(Full Company Name & Address of Substitute Subcontractor)

Name of Listed Sub, as
(Full Company Name of Listed Subcontractor)

Subcontractor to provide the **work activity** work called for in the Bidding Documents and Contract Documents for the above named Project.

IN WITNESS WHEREOF, University and Contractor have executed this Consent to Substitution of Subcontractor as of the above date.

CONTRACTOR:

By: _____
(Signature)

(Typed or Printed Name & Title)

UNIVERSITY:

By: _____
(Signature)

(Typed or Printed Name & Title)

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

This document summarizes the Builder's Risk policy and is not intended to reflect all the terms, conditions, or exclusions of such policy as of the effective date of coverage. This document is not an insurance policy and does not amend, alter or extend the coverage afforded by the listed policy. The actual insurance policy defines all the terms, exclusions and conditions of coverage, and not this summary. Should any ambiguities or conflicts between the summary and policy exist, the policy terms and conditions will apply.

*Some projects may be excluded and/or must be underwritten separately and may be subject to different rates, deductibles, and terms and conditions (see end of summary). **Therefore, this document should be used as a guideline only.***

INSURANCE COMPANY: Liberty Mutual Fire Insurance Company

BEST'S RATING: A XV

NAMED INSURED: Regents of the University of California

INSURING AGREEMENT

This Policy, subject to the Limit of Liability and the terms, conditions, and limitations contained herein or endorsed hereon, insures against all risks of direct physical loss or damage to Covered Property while at the construction site, stored off-site, or in the course of transit within this policy's territory and occurring during the period of insurance of this policy.

LIMITS OF LIABILITY

SCHEDULE OF LIMITS

This Company shall not be liable for more than the Limit of Liability, as stated in Confirmation of Coverage, in any one Occurrence for any one Insured Project, subject to the following limits and sublimits:

MASTER POLICY LIMITS, BY CONSTRUCTION CLASS

\$150,000,000 per project, per occurrence; except,
\$ 25,000,000 per project, Joisted Masonry construction
\$ 10,000,000 per project, Wood Frame construction

NOTE: *The total estimated construction cost is estimated through project completion and reported on the original Builder's Risk Insurance Application. This Limit of Liability will correspond with the total estimated construction cost as shown on the original Builder's Risk Insurance Application. If the construction costs should increase, the Limit of Liability should be subsequently increased, once advance notice has been given to Willis Towers Watson by the University's representative.*

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
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Coverage Summary

KEY SUBLIMITS (Per Occurrence unless otherwise stated):

1. \$10,000,000 for **Wood Frame Construction**
2. \$25,000,000 for **Joisted Masonry Construction**
3. \$25,000,000 as respects **Demolition and Increased Cost of Construction**
4. \$5,000,000 as respects **Expediting Expense, Contractor's Extra Expense**, General Conditions Expense / \$500,000 Owner's Extra Expense / \$100,000 Infrastructure Extra Expense
5. \$10,000,000 as respects **Temporary Offsite Location** (per location)
6. \$10,000,000 as respects **Transit** (Inland only)
7. \$15,000,000 as respects **Debris Removal**
8. \$1,000,000 as respects **Construction Documentation, Valuable Papers and Records**
9. \$5,000,000 as respects **Design Professional Fees**
10. \$1,000,000 as respects **Claims Preparation Expenses**
11. \$1,000,000 as respects **Crane Re-Erection Expense**
12. \$500,000 as respects **Scaffolding, Forms and Falsework Re-Erection Expense**
13. \$500,000 as respects **Pollution Cleanup and Decontamination** (Per project aggregate)
14. \$750,000 as respects **Fire Protection Equipment Refills**
15. \$500,000 as respects **Governmental Authority Protection Services**
16. \$500,000 as respects **Fungus, Wet Rot, Dry Rot or Bacteria**
17. \$2,000,000 as respects **Preservation of Property Protection Expense – 30 Days**
18. \$50,000 as respects **Reward Payment**
19. Included for 30 Days as respects **Hot Testing**
20. No sublimit as respects **Off Premises Service Interruption – Direct Damage**
21. No Sublimit as respects **Green/LEED Rating System**
22. No Sublimit for **Landscaping Materials**
23. No Sublimit as respects **Water Damage (Includes Frost, Freeze, Falling of Ice)**

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

TERMS AND CONDITIONS

NAMED INSURED

The Regents of the University of California and all affiliated and subsidiary companies, corporations, ventures, partnerships or other organizations, all owned, controlled or managed by the Named Insured and all as now exist or may hereafter be constituted or acquired.

ADDITIONAL INSUREDS

Except noted above, this Policy recognizes owners, contractors, subcontractors of any tier, architects, engineers, and any other individual or entity, all as required by contract documents or subcontract documents executed with respect to the insured project prior to the date of loss or damage to covered property as an Additional Insured, and then only as to their respective financial interest in the coverage property.

Notwithstanding the foregoing sentence, architects, engineers, manufacturers and suppliers shall only be Additional Insureds with respect to their activities at the insured project location.

ATTACHMENT/TERMINATION

Insurance hereunder applies to all projects specifically declared under the Master Policy in a Quarterly Report Endorsement, where the project is scheduled to begin during the term of the Master Policy. The Master Policy term commences on September 1, 2020 at 12:01AM and ends on September 1, 2023 at 12:01AM.

Coverage for each Insured Project declared under the Master Policy will go into effect and continue in full force and effect during the Coverage Period specified in the Confirmation of Coverage.

NOTIFICATION OF COVERAGE/TERMINATION: *The Confirmation of Coverage period will correspond with the earliest estimated Notice to Proceed date for any construction phase and estimated Notice of Final Completion date as indicated on the original Builder's Risk Insurance Application. If construction is not completed on time and coverage beyond the previously reported estimated Notice of Final Completion date is required, prior notification must be given to Willis Towers Watson by the University Representative in order to ensure that coverage remains in force for the project.*

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Coverage Summary

DEDUCTIBLES

(Basis for determining deductible is the total project contract value for all construction phases, estimated through project completion.)

Deductible	All Other Perils	Water Damage
\$10,000	<ul style="list-style-type: none"> • All ≤\$1,000,000 projects • >\$1,000,000 and ≤\$25,000,000 Fire Resistive, Non-Combustible, Masonry Non- Combustible and Joisted Masonry projects • All Job Order Contracts (JOCs) • All Site Work Only (Outdoor Infrastructure / Utility / Hardscape / Landscape) projects 	<ul style="list-style-type: none"> • All ≤\$1,000,000 projects • All Job Order Contracts (JOCs) • All Site Work Only (Outdoor Infrastructure / Utility / Hardscape / Landscape) projects
\$25,000	<ul style="list-style-type: none"> • All projects >\$25,000,000 	<ul style="list-style-type: none"> • >\$1,000,000 and ≤\$25,000,000 Fire Resistive, Non-Combustible, Masonry Non-Combustible and Joisted Masonry projects
\$50,000	<ul style="list-style-type: none"> • Wood Frame projects >\$1,000,000 and ≤\$10,000,000 	<ul style="list-style-type: none"> • All projects >\$25,000,000 and ≤\$50,000,000
\$75,000		<ul style="list-style-type: none"> • All projects >\$50,000,000 and ≤\$150,000,000
\$100,000		<ul style="list-style-type: none"> • Wood Frame projects >\$1,000,000 and ≤\$10,000,000

NOTE: The contractor shall be responsible for the deductibles.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

KEY EXCLUSIONS

KEY PROPERTY NOT COVERED

Covered property does not include:

1. Land and land values and the value of cut, fill and backfill materials existing at the location of the insured project prior to project commencement. However, the following are covered to the extent identified in the contract documents and included in the Total Project Value:
 - Fill and backfill materials purchased for use in the completion of the insured project; and
 - Labor and material charges incurred to excavate land and to move, remove, place or otherwise handle cut, fill and backfill materials, whether such materials are insured or uninsured.
2. Any part of contractor's equipment including, tools, machinery, hoists, jacks, lifts, cranes or property of similar kind not intended to become a permanent part of the insured project;
3. Vehicles and equipment licensed for highway use, rolling stock, aircraft or watercraft;
4. Water, other than water that is contained within any enclosed tank, piping system, or any other processing equipment; standing timber including undisturbed natural wooded areas; growing crops; or animals;
5. Accounts, bills, currency, stamps, evidence of debts, checks, money, securities, precious metals, precious stones or other property of a similar nature;
6. Existing real property;
7. Property at a project site that stores, processes, handles or makes use of radioactive materials; however, this does not apply to project site making use of radioactive isotopes contained within equipment used for diagnostic or testing purposes;
8. Roadways, sidewalks or other paved or concrete surfaces at the project site that existed prior to the beginning of the Insured project;
9. Contraband or property in the course of illegal transportation or trade; or
10. Overhead transmission, distribution or communications lines, and their supporting structures, except to the extent identified in the contract documents and included in the total estimated construction cost.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
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Coverage Summary

KEY EXCLUDED CAUSES OF LOSS

1. This policy will not pay for loss or damage caused directly or indirectly by any of the following. Such loss or damage is excluded regardless of any other cause or event that contributes concurrently or in any sequence to the loss or damage, even if such other cause or event would otherwise be covered. These exclusions apply whether or not the loss event results in widespread damage or affects a substantial area:

a. Governmental Action

Seizure, confiscation, expropriation, nationalization or destruction of property by order of governmental authority.

This exclusion does not apply to seizure or destruction of property by order of governmental authority taken at the time of a fire to prevent its spread.

b. Nuclear Hazard

Nuclear reaction or radiation, or radioactive contamination, however caused, except as provided under Section E., Coverage Extensions, Radioactive Contamination. But if Nuclear reaction or radiation, or radioactive contamination results in fire, this policy will pay for the direct loss or damage caused by that fire.

c. Ordinance or Law

(1) The enforcement of or compliance with any ordinance or law:

- (a) Regulating the construction, use or repair of any property; or
- (b) Requiring the tearing down of any property, including the cost of removing its debris.

(2) This exclusion applies whether the loss or damage results from:

- (a) An ordinance or law that is enforced even if the property has not been damage; or
- (b) The increased costs incurred to comply with an ordinance or law in the course of construction, repair, renovation, remodeling or demolition of property, or removal of its debris, following a physical loss to that property.

This exclusion applies, except as provided under Section E., Coverage Extension, Ordinance or Law.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
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d. War and Military Action

War and military action, meaning:

- (1) War, including undeclared or civil war;
- (2) Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign, or other authority using military personnel or other agents; or
- (3) Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority by hindering or defending against any of these.

2. We will not pay for:

a. Consequential Loss

Loss, damage, cost or expense caused by, resulting from, or attributable to any of the following:

- (1) Loss of market or loss of use;
- (2) Liquidated damages, performances penalties or penalties for non-completion, except as provided under Section E., Coverage Extensions, Contract Penalties;
- (3) Non-Compliance with contract conditions;
- (4) Delay in completion of construction, except as provided under Time Element coverage, if endorsed to this Policy; or
- (5) Re-Sequencing or inefficiencies of construction activities.

b. Cracking and Settling

Loss or damage caused by, resulting from or attributable to normal or expected subsidence, settling, cracking, expansion, contraction or shrinkage of walls, floors, ceilings, buildings, foundations, patios, walkways, driveways or pavements.

But if loss or damage caused by a covered cause of loss results, we will pay for the resulting loss or damage caused by that covered cause of loss.

c. Disappearance or Shortage

Missing property when the only proof of loss is unexplained or mysterious disappearance of covered property, or shortage of property discovered on taking inventory, or any other instance where there is no physical evidence to show what happened to the covered property. This exclusion does not apply to covered property in the custody of a carrier for hire.

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d. Dishonest Acts

Loss or damage caused by or resulting from fraudulent, dishonest or criminal acts of any Insured or any of the Insured's partners, officers, directors, trustees, managers, employees (including leased or temporary employees) or others to whom the property is entrusted, except as provided under Section E., Coverage Extensions, Dishonest Acts.

This exclusion does not apply to:

- (1) Acts of destruction committed by the Insured's employees (including leased or temporary employees); or
- (2) Covered property in the custody of any carrier for hire or anyone claiming to be a carrier for hire at the time the property is entrusted to them.

This exclusion applies whether or not such persons are acting alone or in collusion with other persons, or whether such acts occur during the hours of employment.

e. Electronic Vandalism, Defects or Errors

Loss or damage to electronic hardware, software, programs or data caused by or resulting from:

- (1) Computer virus;
- (2) Willful or malicious electronic alteration, manipulation, tampering, or destruction by authorized or unauthorized users;
- (3) Failure, malfunction, deficiency, deletion, errors, or omissions in:
 - (a) Programming;
 - (b) Instructions to a machine; or
 - (c) Installation or maintenance of electronic hardware; or
- (4) Mysterious disappearance of code;

Except as provided by Section E. Coverage Extensions, Electronic Vandalism.

But if loss or damage caused by a specified cause of loss results, this policy will pay for the resulting loss or damage caused by that specified cause of loss.

f. Expected, Preventable or Accumulated Losses

Loss or damage caused by or resulting from wear and tear, deterioration, inherent vice, hidden or latent defect, corrosion, rust or dampness or dryness of the atmosphere.

But if loss or damage caused by a covered cause of loss results, this policy will pay for the resulting loss or damage caused by that covered cause of loss.

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g. Faulty, Inadequate or Defective Workmanship or Design

Loss, damage, cost or expense caused by or resulting from faulty, inadequate or defective:

- (1) Planning, zoning, development, surveying, siting;
- (2) Design, specifications, workmanship, repair, construction, renovation, remodeling, grading or compaction;
- (3) Materials used in repair, construction, renovation, remodeling, grading or compaction;
or
- (4) Maintenance;

Of part or all of any property on or off the project site described in the Declarations.

But if loss or damage caused by a covered cause of loss results, this policy will pay for the resulting loss or damage caused by that covered cause of loss. However, in no event this policy will pay for the covered property that was faulty or defective; the costs or expense to improve or redesign the original materials; supplies, designs, plans or specifications; or to improve workmanship.

The mere existence of any faulty, inadequate or defective conditions listed in paragraphs g. (1). Through g. (4)., above is not direct physical loss or damage.

h. Fines or Penalties

Fines or penalties imposed on the Insured at the order of any government agency, court or other authority.

i. Fungus, Wet Rot, Dry Rot or Bacteria

Loss or damage consisting of, directly or indirectly caused by, contributed to or aggravated by the presence, growth, proliferation, spread or any activity of fungus, wet rot, dry rot or bacteria, including any expense to remediate the presence or effects of any of the foregoing.

But if Fungus, wet or dry or bacteria result in a covered cause of loss, this policy will pay for the loss or damage caused by that covered cause of loss.

This exclusion does not apply:

- (1) When fungus, wet or dry rot or bacteria result from fire or lightning; or
- (2) To the extent that coverage is provided under Section E., Coverage Extensions, Fungus, Wet Rot, Dry Rot or Bacteria, with respect to loss or damage by a cause of loss other than fire or lightning.

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j. Pollutants

Loss, damage, cost or expense caused by or resulting from the actual, alleged or threatened discharge, dispersal, seepage, migration, release, or escape of pollutants, unless the discharge, dispersal, seepage, migration, release, or escape is directly caused by a specified cause of loss.

But if the discharge, dispersal, seepage, migration, release, or escape of pollutants results in a specified cause of loss, this policy will pay for the loss or damage caused by that specified cause of loss.

This policy will also not pay for loss, damage, cost or expense arising out of any request, demand, order or statutory or regulatory requirement that requires any Insured or others to test for, monitor, cleanup, remove, contain, treat, detoxify, or neutralize, or in any way respond to, or assess the effects of pollutants.

k. Landscaping Materials

Insurance Company will not pay for direct physical loss or damage to landscaping materials caused by or resulting from:

- a. Infestation, disease, freezing, drought, lack of moisture, hail or weight of ice or snow; or
- b. Insects, vermin, rodents or animals.

l. Terrorism: Coverage has not been endorsed to this policy.

m. Damage to Existing Property: Coverage has not been endorsed to this policy.

n. Delay in Completion: Coverage has not been endorsed to this policy.

o. Earth Movement – Coverage has not been endorsed to this policy.

p. Flood – Coverage has not been endorsed to this policy.

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SELECT EXTENSIONS OF COVERAGE

1. Expediting and Contractor's Extra Expense

a. In the event of direct physical loss or damage to covered property caused by or resulting from a covered cause of loss, this Company will pay for the reasonable and necessary:

(1) Expediting expenses, including:

(a) Wages for overtime, night work, and work on public holidays;

(b) Extra costs of express freight or other rapid means of transportation; and

(c) Extra costs of rental equipment;

Which are necessary to make temporary repairs or to expedite the permanent repair or replacement of the covered property sustaining such loss or damage;

(2) Owner's Extra Expense; and

(3) Contractor's extra expense and general conditions expense in excess of the total expense that would normally have been incurred during the period of time required to repair or replace covered property with reasonable speed and similar quality for the purpose of continuing the scheduled progress of undamaged work, and only to the extent such expenses are necessary to continue as nearly as practicable the normal operation of the work in progress.

2. Demolition and Increased Cost of Construction

a. In the event of direct physical loss or damage caused by a covered cause of loss to a building or structure that is covered property, the Company will pay for the:

(1) Cost to demolish and clear the project site of the undamaged portion of the constructed, erected or installed covered property as a consequence of a requirement to comply with an ordinance or law that required demolition of such undamaged property;

(2) Cost for recycling debris from the undamaged portion of the constructed, erected or installed covered property at a recycling facility, including the associated transportation costs, when those costs are incurred as a result of the demolition of the undamaged portion of the constructed, erected or installed covered property as a consequence of a requirement to comply with an ordinance or law that requires demolition of such undamaged property;

(3) Increase costs incurred by the Insured to repair, rebuild or replace the damaged and undamaged portions of that covered property for the same intended use as per the written contract in place at the time of direct physical loss or damage when the increased cost is a consequence of a requirement to comply with the minimum standards of an ordinance or law; and

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- (4) Loss to the undamaged portion of the constructed, erected or installed covered property as a consequence of a requirement to comply with an ordinance or law that requires demolition of undamaged parts of the same building.

Any income generated from debris recycling will reduce the Company loss payment.

- b. We will not pay under this Ordinance or Law Coverage Extension for:

- (1) Costs associated with the enforcement of any ordinance or law which required any Insured or others to test for, monitor, clean up, remove, contain, treat, detoxify, or neutralize, or in any way respond to, or assess the effects of, pollutants, fungus, wet rot, dry rot or bacteria;
- (2) Enforcement of any ordinance or law which required the demolition, repair, replacement, reconstruction, remodeling, or remediation of property due to contamination by pollutants or due to the presence, growth, proliferation, spread or any activity of fungus, wet rot, dry rot or bacteria; or
- (3) Costs to comply with any ordinance or law that was required to be complied with in the absence of the loss or damage.

3. Preservation of Property Protection Expense

- a. If in the event of actual or imminent physical loss or damage to covered property caused by a covered cause of loss, this policy will pay for the reasonable and necessary expenses incurred by the Insured to protect the covered property by:
- (1) Removing it from the project site or a temporary offsite location;
- (2) Storing it away from the project site or a temporary offsite location for up to the number of days shown in the Builder's Risk Coverage Extensions Supplemental Declarations from the date it was first moved; and
- (3) Returning it to the project site or temporary offsite location after the threat of actual or imminent loss or damage has passed.
- b. This policy will reimburse the Insured for the reasonable and necessary expenses to protect covered property at the project site or temporary offsite location from actual or imminent physical loss or damage from fire, named storm or flood that has been forecast by the National Weather Service or the U.S. Army Corps of Engineers, but only if coverage is provided under this Policy for that cause of loss.

The Insured must keep a record of the expenses incurred.

No Deductible applies to this Coverage Extension.

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4. Construction Documentation, Valuable Papers and Records

Subject to the stated sublimit, this Policy is extended to cover direct physical loss or damage to construction documentation, valuable papers, and records caused by a covered cause of loss.

This Company will value construction documentation, valuable papers, and records at the full cost necessary to research and reproduce the lost construction documentation, valuable papers, and records, plus the cost of the blank materials on which it resides. However, this company will only pay for costs of research and reproduction if the Insured reproduces the construction documentation, valuable papers, and records.

5. Crane Re-Erection Expense

If a tower or pole crane is lost or damaged by a covered cause of loss at the project site, this policy will pay the reasonable and necessary costs incurred by the Insured to re-erect a tower or pole crane necessary to complete the insured project. However, this policy will not cover any loss or damage to the tower or pole crane itself, unless such tower or pole crane is scheduled on a Contractor's Equipment Coverage endorsement, attached to this Policy.

6. Scaffolding, Forms or Falsework Re-Erection Expense

If scaffolding, forms or falsework covered under this policy is lost or damaged by a covered cause of loss at the project site, the Insurance Company will pay the reasonable and necessary costs incurred by the insured to re-erect scaffolding, forms or falsework necessary to complete the insured project.

7. Debris Removal

Subject to the Sublimit of Liability, in the event of direct physical loss or damage by a covered cause of loss occurs to covered property, this policy will pay:

- a. The cost the Insured incurs to demolish, clear and remove debris of covered property, including such property while in transit or at a temporary offsite location; and
- b. The reasonable and necessary expense incurred by the Insured for:
 - (1) Recycling debris of covered property at a recycling facility, including the associated transportation costs; and
 - (2) Removing debris of uncovered property from the project site.

The expenses will be paid only if reported to the Company in writing within three hundred sixty-five (365) days of the date of loss or damage.

Any income generated from debris recycling will reduce the Company loss payment

In no event will there be coverage under this Debris Removal Coverage Extension for any costs to:

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
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- (1) Extract pollutants from land, water or debris;
- (2) Remove, restore, or replace polluted land or water; or
- (3) Transport, store, decontaminate or recycle contaminated debris.

8. Design Professional Fees

Subject to the stated sublimit, this policy will reimburse the first Named Insured for reasonable and necessary expenses incurred for design professional services to repair, rebuild or replace the lost or damaged covered property to the original design, if it has been damaged by a covered cause of loss.

9. Claims Preparation Expense

This Company will reimburse you for the reasonable and necessary claim preparation expenses you incur in preparing claim information, when it's required, for the purpose of determining the amount of loss or damage prior to finalizing a claim adjustment.

- a. Claim preparation expense means the expenses incurred by the Insured for only the following:
 - (1) The Insured's employees to produce or certify any particulars or details contained within the Insured's books or documents, or such other proofs, information or evidence required by us;
 - (2) Taking inventory, conducting independent appraisals, or gathering and preparing other data to substantiate the amount of loss or damage; and
 - (3) Services provided by accountants, auditors, contractors, architects and engineers or other professionals solely for the purpose of determining the amount of loss or damage.
- b. Claim preparation expense does not mean the expenses incurred for:
 - (1) Negotiating or presenting any claim that we have disputed or denied;
 - (2) Attorneys, public adjusters, loss appraisers or loss consultants or their affiliates;
 - (3) Examinations under oath, even if requested by this Company
 - (4) Travel; or
 - (5) Insurance brokers or insurance agents, or their affiliates, without our written consent prior to such expenses being incurred.

This Coverage extension does not apply until a claim for covered loss or damage to covered property has been submitted to and accepted by the Insurance Company. In the event that the amount of covered loss or damage does not exceed the applicable Deductible, no coverage will apply under this Coverage Extension.

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10. Fungus, Wet Rot, Dry Rot or Bacteria

If fungus, wet rot, dry rot or bacteria is caused by or results from a covered cause of loss, other than fire or lightning, this Company will pay for:

- a. Direct physical loss or damage to covered property at the project site or a temporary offsite location caused by or resulting from fungus, wet rot, dry rot or bacteria, including the cost of removal of the fungus, wet rot, dry rot or bacteria; and
- b. The reasonable and necessary expenses to:
 - (1) Test for, monitor or assess the existence, concentration or effects of fungus, wet rot, dry rot or bacteria;
 - (2) Tear out and replace any part of covered property needed to gain access to the fungus, wet rot, dry rot or bacteria; and
 - (3) Clean up, remove or remediate fungus, wet rot, dry rot or bacteria.

The coverage described in paragraphs 9.a and 9.b, of this Coverage Extension only applies if the Insured takes all reasonable steps to save and preserve property from further loss or damage at the time of, and after the discovery of the fungus, wet rot, dry rot or bacteria.

If there is covered loss or damage to covered property, not caused by fungus, wet rot, dry rot or bacteria loss payment will not be limited by the terms of this Coverage Extension, except to the extent that fungus, wet rot, dry rot or bacteria, causes an increase in the loss. Any such increase in the loss will be subject to the terms of this Coverage Extension. The most this Company will pay under this Coverage Extension is the Sub-Limit of Liability shown for Fungus, Wet Rot, Dry Rot or Bacteria. This is the most we will pay for the total of all loss or damage under this Coverage Extension, even if the fungus, wet rot, dry rot or bacteria continues to be present or active, or recurs, in a later Policy Term.

11. Governmental Authority Protection Service Charges

When the fire department, policy department or other governmental authority is called to save or protect covered property from a covered cause of loss at the project site or a temporary offsite location, this policy will pay the Insured's liability for service charges assessed that are:

- A. Assumed by written contract or written agreement prior to loss or damage; or
- B. Required by local ordinance, law or statute.

This policy will also pay for those costs incurred by the Insured's fire brigade to save or protect covered property from fire, but not including the costs to refill fire protective equipment.

The most this policy will pay for this Coverage Extension in any one occurrence, regardless of the number of responding departments or authorities or number of services performed, is the Sub-Limit of Liability shown for Government Authority Protection Service Charges.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

No Deductible applies to this Coverage Extension.

12. Fire Protection Equipment Refills

Insurance Company will pay the reasonable and necessary costs the Insured incurs to refill fire protection equipment which has been discharged accidentally or in the course of saving or protecting covered property from a covered cause of loss.

13. Pollutant Clean-Up and Decontamination

- a. This policy will pay the reasonable and necessary costs incurred by you to extract pollutants from land or water at the project site or a temporary offsite location if the discharge, dispersal, seepage, migration, release or escape of pollutants is directly caused by a covered cause of loss.
- b. When required by ordinance, law or regulation in effect at the time of loss or damage, this policy will pay the reasonable and necessary costs incurred by you to extract pollutants from debris at the project site or a temporary offsite location if the discharge, dispersal, seepage, migration, release or escape of pollutants is directly caused by a covered cause of loss.
- c. When paragraph a. above applies, this policy will also pay the Insured's reasonable and necessary costs incurred for:
 - (1) Restoring or replacing that contaminated land or water; and
 - (2) Testing performed in the course of extracting those pollutants from the land or water.
- d. When paragraph b. above applies, this policy will also pay the Insured's reasonable and necessary costs incurred for transporting that contaminated debris to a temporary storage or decontamination facility.

These costs will be paid only if they are reported to the Insurance Company in writing within one hundred eighty (180) days of the date on which the covered cause of loss occurs.

This Coverage Extension does not apply to any other costs to test for, monitor or assess the existence, concentration or effects of pollutants.

14. Prevention of Access

Civil Authority / Ingress or Egress

The Insurance Company will pay for the reasonable and necessary contractor's extra expense, owner's extra expense and general conditions expense incurred by the insured, in excess of the total expense that would normally have been incurred during the same period of time had no loss or damage occurred, for the purpose of continuing the scheduled progress of undamaged work, but only to the extent such expenses are necessary to continue as nearly as practicable the normal operation of the work in progress.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

Civil Authority

When an order of civil authority restricts or prohibits access to the project site in response to direct physical loss or damage caused by a covered cause of loss to property not insured under this policy and located within 2-miles of the project site. Coverage begins 72-hours after the time of direct physical loss or damaged caused by a covered cause of loss.

Ingress or Egress Coverage

When ingress or egress to the project site by suppliers, contractors, or employees is physically obstructed due to direct physical loss or damage caused by a covered cause of loss to property not insured under this policy and located within 2-miles of the project site. Coverage begins 72-hours after the time of direct physical loss or damaged caused by a covered cause of loss.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

SELECTED GENERAL CONDITIONS

1. REQUIREMENTS IN CASE OF LOSS

In the event of loss or damage to Insured Property the Insured shall:

- A. Notify the police if a law may have been broken
- B. Give Insurance Company prompt notice of the loss or damage. Include a description of the property involved.
- C. As soon as possible, give the Insurance Company a description of how, when and where the loss or damage occurred.
- D. Take all reasonable steps to protect the Covered Property from further damage.
- E. Not voluntarily make a payment, assume any obligation, or incur any expense without our consent.
- F. Permit the Insurance Company to inspect the property.
- G. Submit to examinations under oath about any matter relating to this insurance of the claim.
- H. Send the Insurance Company a signed, sworn proof of loss containing the information they request to settle the claim, within 60-days after the Insurance Company's request.
- I. Immediately send the Insurance Company copies of any demands, notices, summonses or legal papers received in connection with the claim or suit.
- J. Cooperate with the Insurance Company in the investigation or settlement of the claim.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

2. VALUATION

1. Except as provided in paragraphs 2., 3., and 4., below, the cost to repair, rebuild or replace covered property by the Insured as the time of direct physical loss or damage will be based on the following:
 - A. Direct payroll cost for labor directly chargeable and related to the repair, rebuild or replacement of the damaged covered property;
 - B. Contractors' profit, overhead charges and construction management fees as included in the original contract, or in any subsequent change order contract, as applicable;
 - C. Expenses for the dismantling, transportation and reassembly of damaged covered property;
 - D. General conditions expense; and
 - E. Property under construction at the Insured's cost.

For a green building, the valuation will include applicable green standards in force at the time of loss or damage in the cost to repair, rebuild or replace the lost or damaged green building. If applicable green standards, or equivalent standards, are not available, this policy will replace the lost or damaged green building with construction materials and equipment of like kind and quality.

2. Property under construction owned by others at the lesser of the following:
 - a. The cost to repair, rebuild or replace property under construction at the time of direct physical loss or damage with materials of like kind and quality; or
 - b. The amount the Insured is legally obligated to pay for direct physical loss or damage by reason of the Insured's assumption of liability for such loss or damage in written agreement executed prior to the loss or damage of that property.
3. Property under construction owned by the Insured that was refurbished, reconditioned or recertified, at the lesser of the cost to repair or replace the property under construction or the price which that property might be expected to realize if offered for sale in a fair market on the date of loss or damage.
4. Landscaping materials at the cost to repair or replace landscaping materials at the time of direct physical loss or damage with readily available commercial nursery stock.
5. Office contents, other than the contents of construction trailers, at a temporary offsite location, at the cost to repair or replace the covered property at the time of direct physical loss or damage with similar property intended to perform the same function. Office contents not replaced will be valued at actual cash value, at the time and place of loss or damage.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

Insurance provided for office contents while at a temporary offsite location, is excess over any other valid and collectible insurance available to the owner of such property.

6. Property in transit at the invoice cost of the lost or damage covered property plus accrued shipping charges less shipper's liability, if any.

3. INCREASED HAZARD

If the circumstances in which this insurance was entered into are altered, or if the risk materially increases, the Insured shall give notice in writing to the Insurance Company within thirty (30) days of the Insured's knowledge of the same.

4. OTHER INSURANCE

1. This insurance is primary, except when paragraphs 2., 3., or 4, below apply.
2. This insurance is excess over any underlying insurance, including any insurance that you purchased for all or any part of a Deductible in this Policy. The existence of underlying insurance shall not prejudice the Insured's rights under this Policy. The Deductible and any amount paid under such underlying insurance will apply to the applicable Deductible under this policy.
3. To the extent others are responsible for loss of or damage to covered property while in transit under terms Free on Board, this insurance will be excess insurance and will not contribute with such other insurance.
4. If there is other insurance, whether purchased by the Insured or others, subject to the same plan, terms, conditions and provisions as the insurance provided under this Policy, the Company will pay their share of the covered loss or damage. The company share is the proportion that the applicable Limit of Liability or Sub-Limit of Liability under this Policy bears to the sum of all the Limits of Liability or Sub-Limits of Liability covering on the same basis.

Insured can purchase excess insurance commencing on or after the inception of this Policy that is specifically excess over the Limit of Liability or Sub-Limits of Liability under this policy without prejudice to this Policy. The existence of such insurance shall not reduce any liability under this policy.

5. PERMISSION TO OCCUPY IS GRANTED

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

SELECTED DEFINITIONS

The following terms have been defined in the policy – the policy definitions will be applied in the event of a loss.

1. FLOOD:

Flood means:

- (1) Surface waters; rising waters; storm surge; wave wash; waves; tsunami; tide or tidal water; the release of water, the rising, overflowing or breaking of boundaries of natural or man-made bodies of water; or the spray therefrom; all whether driven by wind or not;
- (2) Water or other material that backs up or overflows from any sewer, septic tank, sump or drain resulting *from any of the foregoing*; or
- (3) Mudslide or mudflow caused by or resulting from surface water, runoff or accumulation of water on or under the ground;

Regardless of any other cause or event, whether natural or man-made, contributing concurrently or in any other sequence of loss.

Loss or damage from flood associated with a storm or weather disturbance whether or not identified by name by any meteorological authority is considered to be flood within the terms of this Policy. However, physical loss or damage, from fire, explosion, theft or sprinkler leakage caused by flood will not be considered to be loss by flood within the terms and conditions of this Policy.

2. POLLUTANTS:

Pollutants means any solid, liquid, gaseous or thermal irritant or contaminant, including but not limited to, lead, asbestos, PCB's, petroleum products, silica, smoke, vapor, soot, fumes, acids, alkalis, chemicals, and waste. Waste includes materials to be recycled, reconditioned or reclaimed.

3. EARTH MOVEMENT:

- a. Earth movement means earthquake, landslide, subsidence or earth sinking (other than sinkhole collapse), rising or shifting of the earth, avalanche, whether natural or man-made, or volcanic eruption; regardless of any other cause or event contributing concurrently or in any other sequence of loss.

However, physical loss or damage, from fire, explosion, theft, sprinkler leakage, or flood caused by earth movement will not be considered to be loss by earth movement within the terms and conditions of this Policy.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

4. OCCURRENCE:

Means all loss or damage attributable directly or indirectly to one (1) cause or series of similar causes. All such loss or damage will be added together and the total loss or damage will be treated as one (1) occurrence.

Unless otherwise amended by an endorsement attached to this Policy:

- a. All loss or damage resulting from a continuous flood event, irrespective of the amount of time or area over which such loss or damage occurs, will be considered a single occurrence.

All loss or damage from earth movement or named storm within the time period specified in the Occurrence Time Specifications shown on the Declarations will be considered a single occurrence. The first Named Insured may elect the point in time when the time period specified in the Occurrence Time Specifications begins.

An occurrence that commences during the Policy term will not be limited by the expiration of this Policy.

5. WATER DAMAGE:

All water damage excluding flood, however caused, whether by natural event or manmade, including but not limited to interior water damage, damage due to water from pipe breakage or sprinkler leakage, damage from rainfall and/or resulting runoff; all whether wind driven or not.

6. TESTING:

COLD TESTING - means testing, exclusive of Hot Testing as defined in this Policy, including but not limited to electrical, mechanical, hydraulic, hydrostatic and pneumatic testing and includes the testing of systems and equipment that are intended to service a building, such as boilers, chillers, pumps and similar equipment.

HOT TESTING – means the testing of machinery or equipment that will be used in manufacturing, processing or power generation operations, when such machinery or equipment involves the use of feedstock, fuel, catalysts or similar materials, for the purpose of simulating load, operating or production conditions to train personnel or to verify the machinery or equipment functions according to the design specifications. Hot testing does not mean electrical, mechanical, hydraulic, hydrostatic or pneumatic testing, including the startup and testing of systems and equipment that are intended to service a building, including boilers, chillers, pumps, and similar equipment.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Master Builder's Risk Program
Coverage Summary

EXCLUDED PROJECT TYPES

Examples of projects that may require separate underwriting, including (but not limited to):

<ul style="list-style-type: none">• Wood Frame construction where the values are estimated to exceed \$10,000,000 by project completion date
<ul style="list-style-type: none">• Joisted Masonry construction where values are estimated to exceed \$25,000,000 by project completion date
<ul style="list-style-type: none">• Any Fire Resistive; Non-Combustible; or Masonry Non-Combustible construction where the values are estimated to exceed \$100,000,000 by project completion date
<ul style="list-style-type: none">• Structural / Seismic Renovation construction where the values are estimated to exceed \$50,000,000 by project completion date
<ul style="list-style-type: none">• Power generation, Utility plants, Co-Generation facilities, Waste water and Waste treatment facilities, etc.
<ul style="list-style-type: none">• Stadiums
<ul style="list-style-type: none">• Bridges
<ul style="list-style-type: none">• Cleanroom construction (both new and renovation) of any size
<ul style="list-style-type: none">• Directional drilling
<ul style="list-style-type: none">• Gas turbines
<ul style="list-style-type: none">• Any project involving prototypical design or the use of unproven technology
<ul style="list-style-type: none">• Any project with hot-testing where the values are estimated to exceed \$100,000,000 by project completion date
<ul style="list-style-type: none">• Projects with any other Construction Type, beyond Fire Resistive; Non-Combustible; Masonry Non-Combustible; Joisted Masonry; or Wood Frame, that are constructed of non-combustible materials or fire-resistive materials having a fire resistant rating of less than two hours

**UNCONDITIONAL WAIVER AND RELEASE ON
FINAL PAYMENT**

NOTICE TO CLAIMANT:

THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Identifying Information:

Name of Claimant: _____
Name of Customer: _____
Job Location: **SOM ED1 Data Center Renovation, Project No. 950590**
University of California, Riverside, City of Riverside, County of Riverside
Owner: **The Regents of the University of California**

Unconditional Waiver and Release:

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for all labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has been paid in full.

Exceptions:

This document does not affect the following: Disputed claims for extras in the amount of:
\$ _____ .

Signature:

Claimant's Signature & Date: _____

Claimant's Name & Title: _____

Prime Contractor's Application for Payment # _____

**UNCONDITIONAL WAIVER AND RELEASE ON
PROGRESS PAYMENT**

NOTICE TO CLAIMANT:

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT NOTICE TO CLAIMANT: THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Identifying Information:

Name of Claimant: _____
Name of Customer: _____
Job Location: SOM ED1 Data Center Renovation, Project No. 950590
University of California, Riverside, City of Riverside, County of Riverside
Owner: The Regents of the University of California
Through Date: _____

Unconditional Waiver and Release:

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has received the following progress payment: \$ _____

Exceptions:

This document does not affect any of the following:

- (1) Retentions.
- (2) Extras for which the claimant has not received payment.
- (3) Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Signature:

Claimant's Signature & Date: _____

Claimant's Name & Title: _____

Prime Contractor's Application for Payment # _____

LIST OF DRAWINGS

SHEET NO.	TITLE	DATE
G0.01	INDEX SHEET	05/14/2021
A2.01	DEMOLITION PLAN	05/14/2021
A2.02	FIRST FLOOR PLAN & CODE PLAN	05/14/2021
A2.03	DATA CENTER ENLARGED PLAN	05/14/2021
A2.04	FIRST FLOOR REFLECTED CEILING PLAN	05/14/2021
A2.05	ROOF PLAN	05/14/2021
A5.01	DETAILS	05/14/2021
M0.01	GENERAL NOTES, LEGENDS, ABBREVIATIONS AND SHEET INDEX	05/14/2021
M0.02	SCHEDULES	05/14/2021
M2.11	FIRST FLOOR HVAC PLAN	05/14/2021
M2.12	FIRST FLOOR PIPING PLAN	05/14/2021
M2.31	ROOF PLAN	05/14/2021
M5.01	DETAILS AND DIAGRAMS	05/14/2021
MD2.11	FIRST FLOOR HVAC DEMOLITION PLAN	05/14/2021
MD2.12	FIRST FLOOR PIPING DEMOLITION PLAN	05/14/2021
P0.01	GENERAL NOTES, LEGEND, ABBREVIATIONS AND SHEET INDEX	05/14/2021
P0.02	SCHEDULES	05/14/2021
P2.01	BASEMENT FLOOR PLAN	05/14/2021
P2.11	FIRST FLOOR PLAN	05/14/2021
E0.01	GENERAL NOTES, LEGENDS, ABBREVIATIONS AND SHEET INDEX	05/14/2021
E0.02	SCHEDULES	05/14/2021
E0.03	SCHEDULES	05/14/2021
E0.04	SCHEDULES	05/14/2021
E0.11	FIRST FLOOR POWER PLAN	05/14/2021
E2.12	FIRST FLOOR DEMO LIGHTING PLAN	05/14/2021
E2.31	ROOF POWER PLAN	05/14/2021
E6.01	SINGLE LINE DIAGRAM	05/14/2021
xE1.01	SITE PLAN	05/14/2021
T0.01	TECHNOLOGY GENERAL NOTES, LEGEND, ABBREVIATIONS AND SHEET INDEX	05/14/2021
T2.11	FIRST FLOOR PLAN	05/14/2021
T4.01	ENLARGED EQUIPMENT PLAN	05/14/2021
T4.02	ENLARGED LADDER RACK PLAN	05/14/2021
T5.01	DETAILS	05/14/2021
S0.01	STRUCTURAL NOTES AND ABBREVIATIONS	05/14/2021
S0.02	STRUCTURAL NOTES	05/14/2021
S2.02	FIRST FLOOR FRAMING PLAN	05/14/2021
S2.05	ROOF FRAMING PLAN	05/14/2021
S3.01	SECTIONS AND DETAILS	05/14/2021

END OF LIST OF DRAWINGS



1 FIRST FLOOR DEMOLITION PLAN
Scale: 1/8" = 1'-0"

DEMOLITION PLAN GENERAL NOTES

1. THE CONTRACTOR SHALL OBTAIN RECORD DRAWINGS FROM THE UNIVERSITY PRIOR TO THE START DEMOLITION FOR USE AS REFERENCE. DURING DEMOLITION, COMPARE RECORD DRAWING TO AS-BUILT CONDITIONS AND IMMEDIATELY REPORT DISCREPANCIES THAT AFFECT THE SCOPE OF DEMOLITION.
2. PERFORM REMOVAL TO THE EXTENT REQUIRED TO ACCOMMODATE NEW CONSTRUCTION EVEN THOUGH NOT SPECIFICALLY INDICATED OR SPECIFIED.
3. INFORM UNIVERSITY OF ANTICIPATED UTILITY DISRUPTIONS CAUSED BY THE WORK. SCHEDULE POWER, WATER, SEWER OR LOW VOLTAGE DISRUPTIONS WITH THE UNIVERSITY TO MINIMIZE DISRUPTION TO OCCUPIED BUILDINGS OR SPACES.
4. PRIOR TO START OF DEMOLITION DISCUSS ITEMS TO BE SALVAGED WITH THE UNIVERSITY AND CAREFULLY REMOVE THESE ITEMS AND STORE IN A SAFE PLACE TO BE DESIGNATED BY THE UNIVERSITY.
5. SEE PLUMBING PLANS FOR PIPE PENETRATION LOCATIONS. PROVIDE CONCRETE CORING FOR PIPES AS SHOWN ON PLUMBING. PROVIDE X-RAY OF CONCRETE SLAB PRIOR TO CORING TO ENSURE THAT EXISTING STEEL REINFORCEMENT IS NOT CUT.

DEMOLITION PLAN CODED NOTES

1. EQUIPMENT REMOVAL, SEE MECHANICAL
2. EXISTING TECHNOLOGY EQUIPMENT TO REMAIN, SEE TECHNOLOGY DRAWINGS.
3. REMOVE RAISED FLOOR AS REQUIRED TO PROVIDE RACK SUPPORT TO CONCRETE SLAB.



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UNIVERSITY OF CALIFORNIA, RIVERSIDE
**950590 SCHOOL OF MEDICINE EDUCATION 1
 DATA CENTER RENOVATION**
 900 UNIVERSITY AVE., RIVERSIDE, CA 92521

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DATE:	5/14/21
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DEMOLITION PLAN

A2.01



REVISIONS

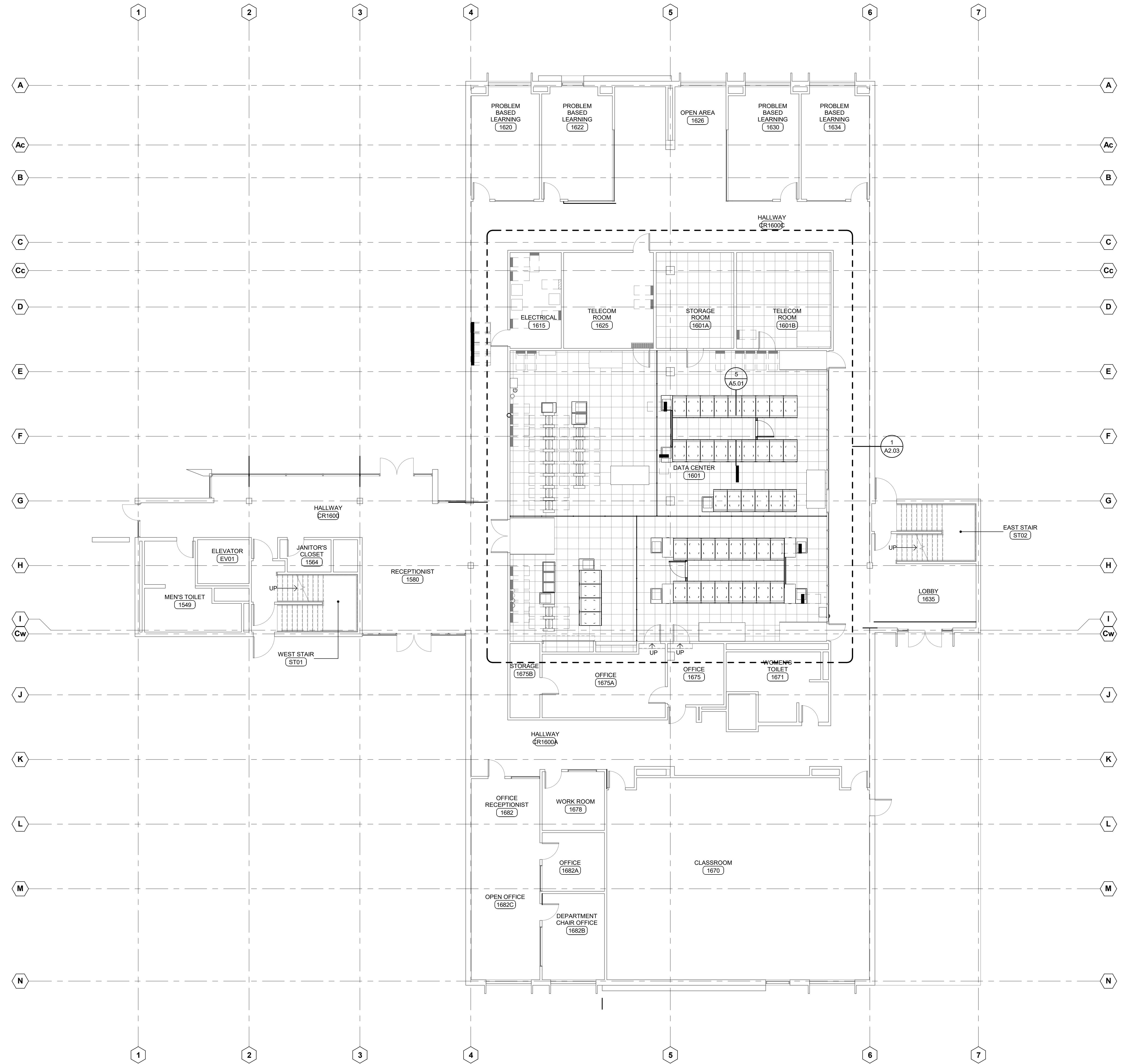
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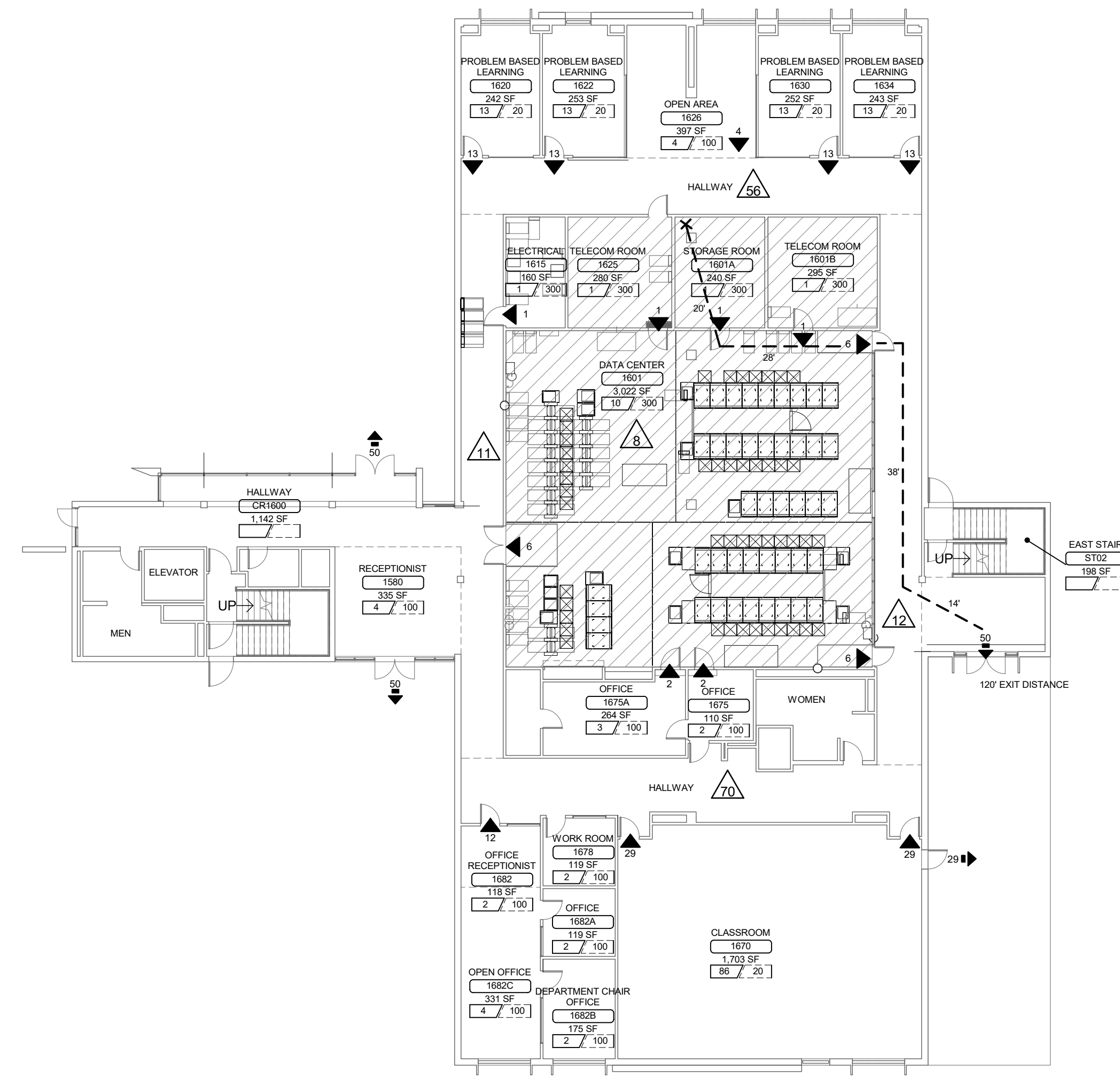
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DATE: 5/14/21
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FIRST FLOOR
PLAN & CODE
PLAN

A2.02



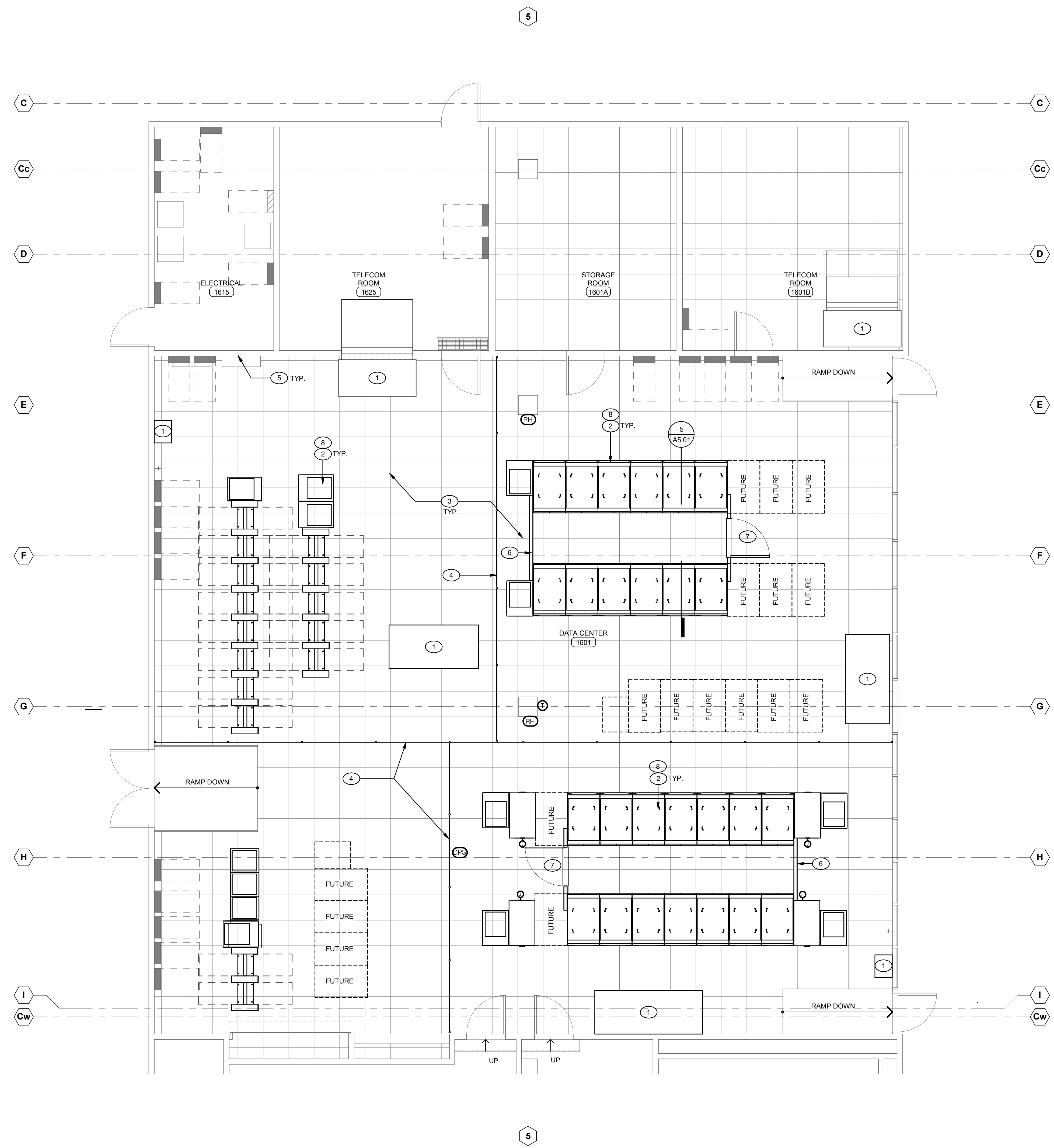
1 FIRST FLOOR PLAN
Scale: 1/8" = 1'-0"



2 FIRST FLOOR EGRESS PLAN
Scale: 1/16" = 1'-0"

EGRESS PLAN LEGEND

- ACCUMULATED OCCUPANT LOAD FROM ROOMS DIRECTLY TO EXTERIOR
- EXIT FROM ROOMS. NUMBER INDICATES THE CALCULATED ACCUMULATED LOAD AT THAT ROOM OR BUILDING EXIT. ARROW INDICATES EXIT DIRECTION.
- OCCUPANT LOAD FACTOR - TABLE 1004.1.2
OCCUPANT LOAD
- PANIC HARDWARE (EXISTING)
- EXIT SIGN. SEE ELECTRICAL
- 2A.108.C FIRE EXTINGUISHER WITH RECESSED CABINET
- AREA OF WORK

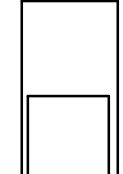


1 DATA CENTER ENLARGED PLAN
Scale: 1/4" = 1'-0"

1 FIRST FLOOR PLAN CODED NOTES

1. MECHANICAL EQUIPMENT, SEE MECHANICAL DRAWINGS
2. DATA RACKS, SEE TECHNOLOGY DRAWINGS.
3. EXISTING RAISED FLOOR TO REMAIN.
4. WELDED WIRE FENCE TO CEILING (ADDITIVE ALTERNATE #1)
5. PAINT WALLS TO MATCH EXISTING (ADDITIVE ALTERNATE #2)
6. CONTAINMENT PANEL.
7. CONTAINMENT PANEL WITH DOOR
8. PROVIDE RAISED FLOOR RACK SUPPORT TO CONCRETE SLAB. MODIFY EXISTING RAISED FLOOR AS REQUIRED TO ACCOMMODATE RACK SUPPORT.

FLOOR PLAN LEGEND

- 1** FLOOR PLAN CODED NOTE
- 123A** DOOR TAG, SEE DOOR SCHEDULE A302
-  DATA RACK SEE TELECOMMUNICATIONS DRAWINGS



REVISIONS

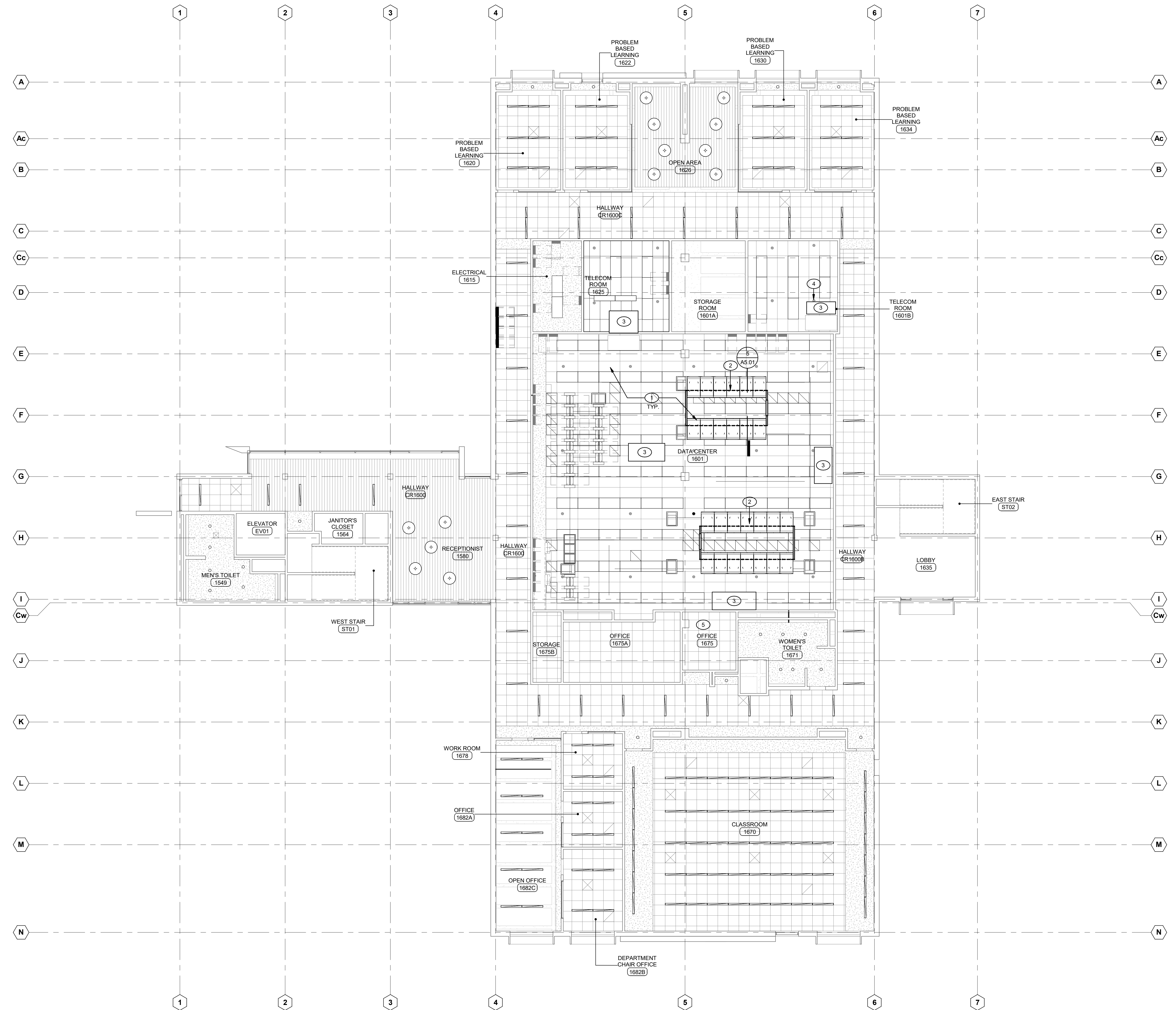
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**950590 SCHOOL OF MEDICINE EDUCATION 1
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900 UNIVERSITY AVE. RIVERSIDE, CA 92521

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DATA CENTER ENLARGED PLAN

A2.03



- # REFLECTED CEILING PLAN CODED NOTES
- EXISTING CEILING TO REMAIN. REPLACE CEILING TILES (ADDITIVE ALTERNATE #3)
 - CONTAINMENT PANEL. NOTE, FUTURE RACKS ARE SHOWN PLEASE ADJUST SIZE OF MODULAR CONTAINMENT TO ACTUAL SCOPE AREA TO BE PROVIDED WITH THIS PROJECT PER THE TECHNOLOGY DRAWINGS.
 - MODIFY/REMOVE CEILING AT DUCT PENETRATION. MODIFY CEILING MEMBERS TO TERMINATE AT DUCT AND PROVIDE NEW PERIMETER ANGLE. MODIFY CEILING TILES TO MATCH GRID MODIFICATIONS.
 - COORDINATE EXACT LOCATION WITH EXISTING SPRINKLER HEAD. PROTECT IN PLACE EXISTING SPRINKLER HEAD.
 - PROVIDE CEILING TILE WHERE LIGHTS REMOVED.
- NOTE: SEE TECHNOLOGY DRAWINGS FOR CABLE TRAY LOCATIONS TYPICAL. COORDINATE FINAL LOCATION OF CABLE TRAYS SO THAT THEY DO NOT CONFLICT WITH THE CONTAINMENT PANELS.



REVISIONS

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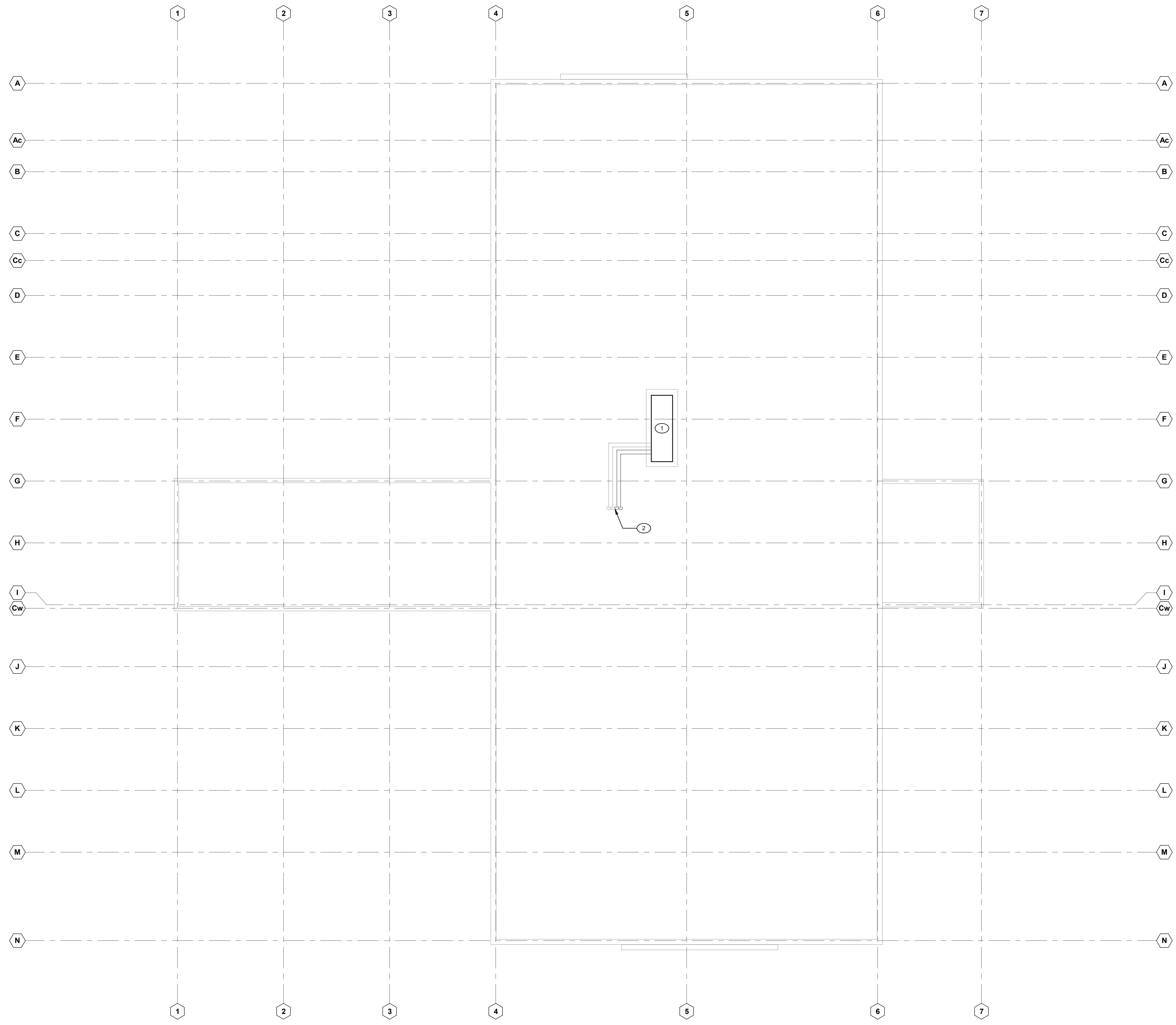
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950590 SCHOOL OF MEDICINE EDUCATION 1
DATA CENTR RENOVATION
900 UNIVERSITY AVE, RIVERSIDE, CA 92521

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FIRST FLOOR
REFLECTED
CEILING PLAN

A2.04

FIRST FLOOR REFLECTED CEILING PLAN
Scale: 1/8" = 1'-0"



- ROOF PLAN CODED NOTES**
- MECHANICAL EQUIPMENT MOUNTED TO EXISTING PAD. SEE MECHANICAL.
 - SEAL ROOF PENETRATIONS.



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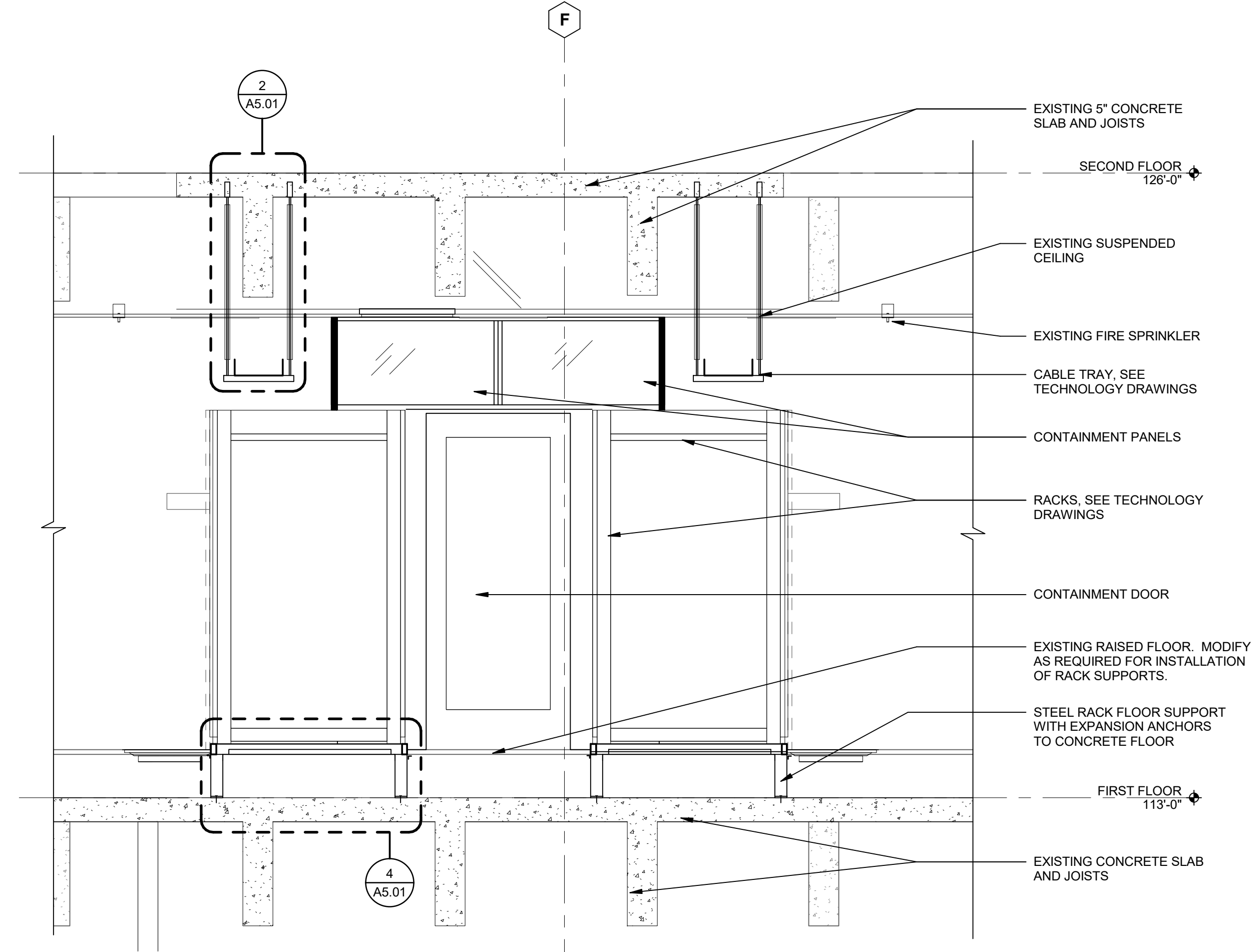
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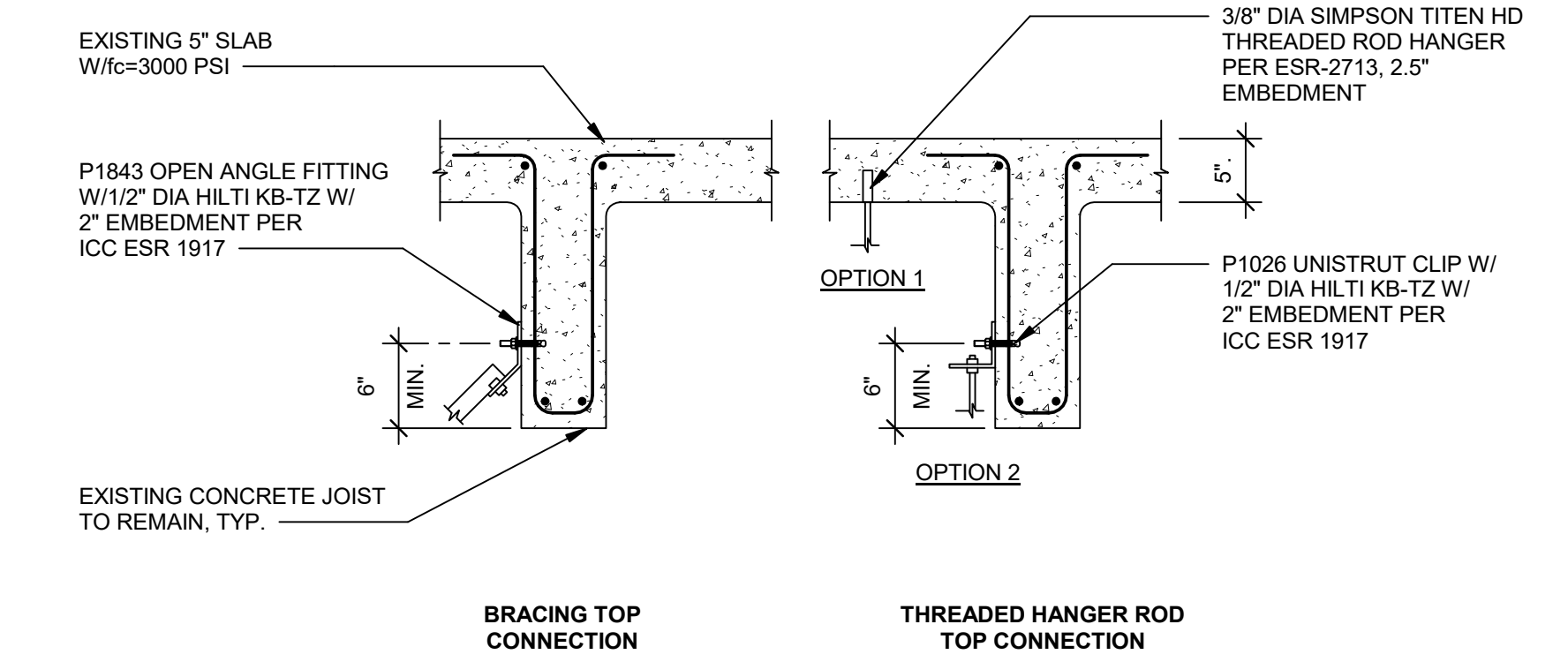
ROOF PLAN

A2.05

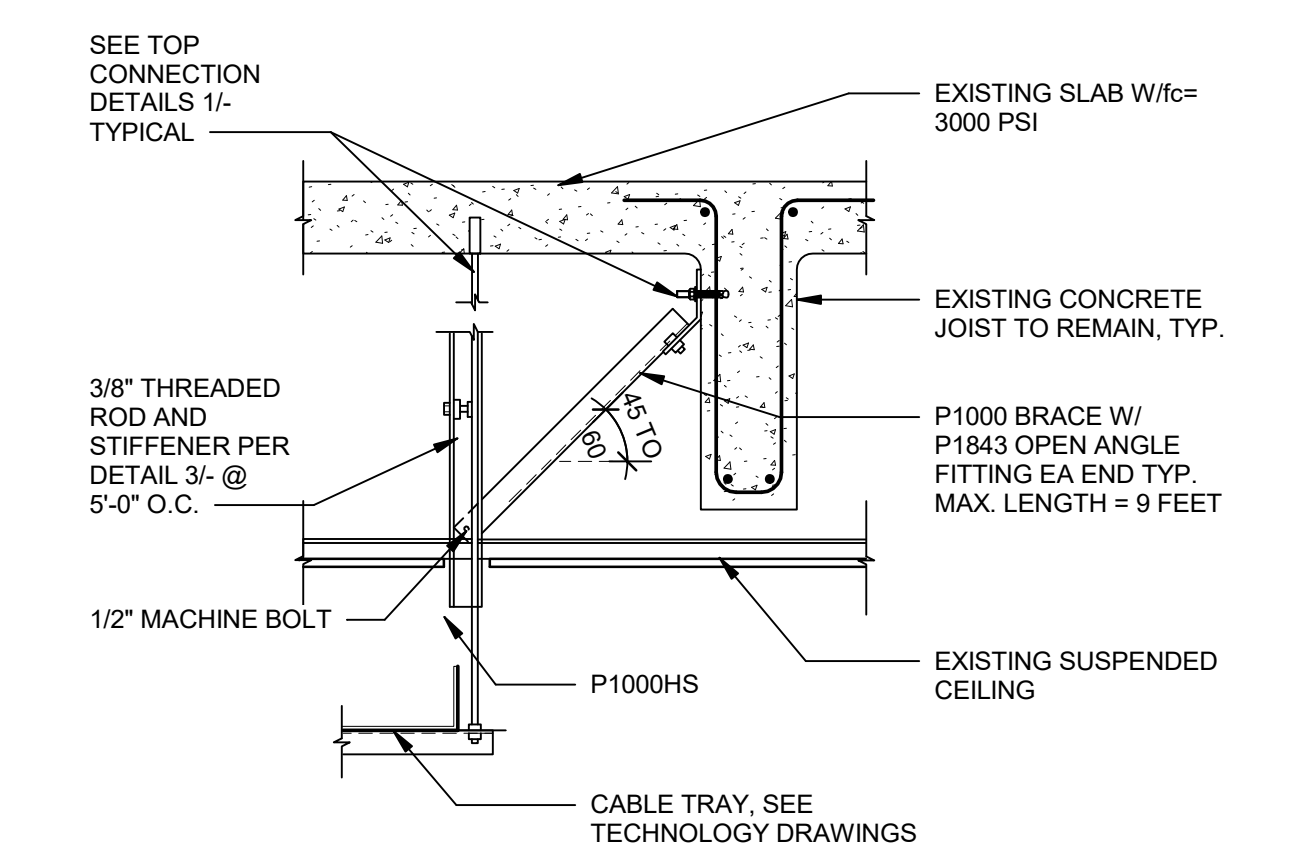
ROOF PLAN
 Scale: 1/8" = 1'-0"



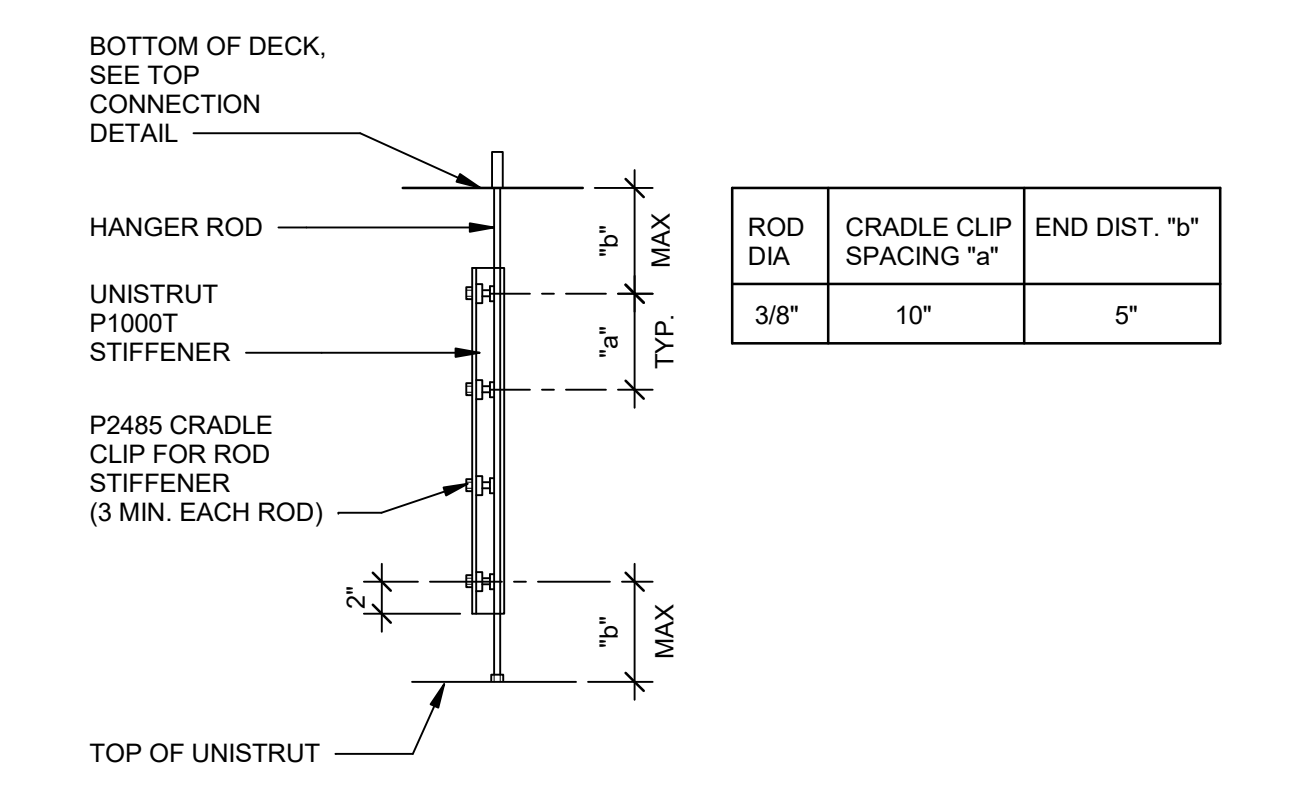
5 TYPICAL SECTION AT RACKS CONTAINMENT
 Scale: 1/2" = 1'-0"



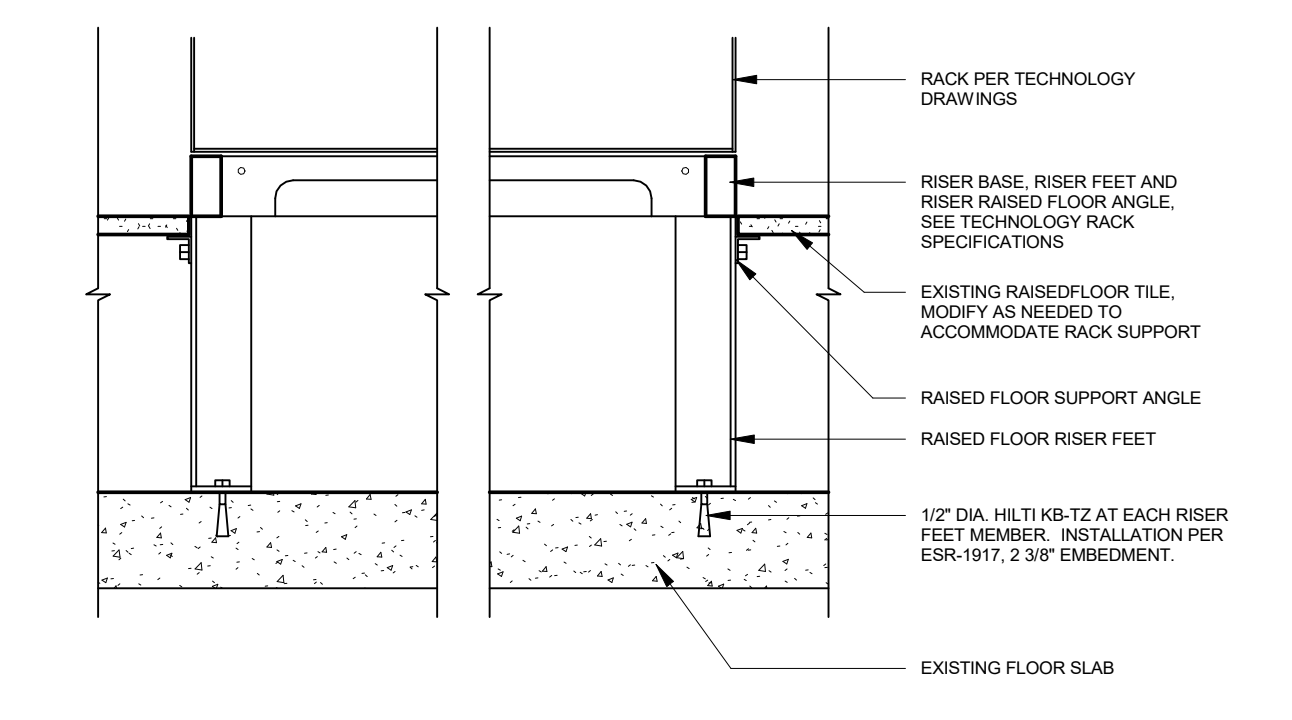
1 TOP CONNECTION DETAIL
 Scale: 1" = 1'-0"



2 OVERHEAD CABLE TRAY SUPPORT
 Scale: 1" = 1'-0"



3 TYPICAL HANGER ROD STIFFENER
 Scale: 1" = 1'-0"



4 TYPICAL RAISED FLOOR RACK SUPPORT
 Scale: 1 1/2" = 1'-0"



REVISIONS

100% CD

UNIVERSITY OF CALIFORNIA, RIVERSIDE
950590 SCHOOL OF MEDICINE EDUCATION 1
DATA CENTR RENOVATION
 900 UNIVERSITY AVE., RIVERSIDE, CA 92521

MMAN NO: 20222
 DATE: 5/14/21
 DRAWN: DAM
 CHECKED: DAM

DETAILS

A5.01

GENERAL NOTES

- ALL WORK SHALL COMPLY WITH THE 2019 EDITIONS OF THE CALIFORNIA BUILDING, MECHANICAL, PLUMBING, AND OTHER APPLICABLE FEDERAL, STATE, OR LOCAL CODES AS ADOPTED AND ENFORCED BY THE LOCAL JURISDICTION. IN CASE THE PLANS SHOW MORE STRINGENT REQUIREMENTS, THE PLANS SHALL GOVERN THE DESIGN, YET NOTHING ON THE DESIGN DOCUMENTS SHALL BE INTERPRETED AS AUTHORITY TO VIOLATE CODE(S) OR REGULATIONS.
- SUBMISSION OF BID IN CONNECTION WITH THIS WORK SHALL IMPLY THAT THE BIDDER HAS EXAMINED THE JOB SITE UNDER WHICH THE CONTRACTOR WILL BE OBLIGATED TO OPERATE UNDER THIS CONTRACT. NO EXTRA CHARGE WILL BE ALLOWED FOR FAILURE OF ANY BIDDER TO EXAMINE THE SITE PRIOR TO BID.
- WHERE USED, THE TERM "PROVIDE" SHALL MEAN "FURNISH AND INSTALL".
- IN THE EVENT OF A CONFLICT OR INCONSISTENCY BETWEEN ITEMS INDICATED ON DRAWINGS AND SPECIFICATIONS WITH CODE REQUIREMENTS, THE MORE STRINGENT STANDARD SHALL PREVAIL.
- CARE SHALL BE EXERCISED TO MINIMIZE ANY INCONVENIENCE OR DISTURBANCE TO OTHER AREAS OF THE BUILDING WHICH ARE TO REMAIN IN OPERATION. ISOLATE WORK AREAS TO KEEP DUST AND DIRT WITHIN THE CONSTRUCTION AREA.
- NO PIPING, EQUIPMENT, ETC. SHALL BE REMOVED, DISCONNECTED OR SHUT DOWN WITHOUT PRIOR REVIEW WITH THE OWNER TO CONFIRM THAT AREAS TO REMAIN IN OPERATION WILL NOT BE AFFECTED. IF ANY AREAS NOT WITHIN THE SCOPE OF WORK ARE AFFECTED BY ANY SHUTDOWN, REMOVAL OR DISCONNECTION, SUFFICIENT ADVANCE NOTICE MUST BE GIVEN TO THE OWNER INDICATING WHICH AREAS WILL BE AFFECTED, WHEN THE PROPOSED SHUTDOWN WILL OCCUR, AND FOR HOW LONG A PERIOD OF TIME.
- THE ARRANGEMENT OF EQUIPMENT AND PIPING SHOWN ON THE DRAWINGS IS BASED UPON INFORMATION AVAILABLE TO THE ENGINEER AT THE TIME OF DESIGN AND IS NOT INTENDED TO SHOW EXACT DIMENSIONS. THIS CONTRACTOR SHALL VERIFY ALL DIMENSIONS AT THE SITE MAKING FIELD MEASUREMENTS AND SHOP DRAWINGS NECESSARY FOR FABRICATION OR ERECTION OF HVAC SYSTEMS. MAKE ALLOWANCE FOR BEAMS, PIPES AND OTHER OBSTRUCTIONS IN BUILDING CONSTRUCTION. CHECK DRAWINGS SHOWING WORK OF OTHER TRADES AND CONSULT WITH THE OWNER'S REPRESENTATIVE IN THE EVENT OF POTENTIAL INTERFERENCE. SHOP DRAWINGS SHALL BE MINIMUM 1/4" = 1'-0" SCALE, INDICATING FITTINGS, SIZES, WELDS AND CONFIGURATIONS AND SUBMITTED TO ENGINEER FOR REVIEW.
- THIS CONTRACTOR SHALL COORDINATE HIS WORK WITH ALL OTHER TRADES PRIOR TO FABRICATION, PURCHASE AND/OR INSTALLATION OF ALL WORK.
- EXISTING MATERIALS THAT ARE REMOVED SHALL NOT BE REUSED IN NEW SYSTEMS, EXCEPT WHERE INDICATED AS BEING RELOCATED.
- ALL EQUIPMENT SHALL BE INSTALLED IN STRICT COMPLIANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
- THIS CONTRACTOR SHALL NOT BORE, NOTCH, CUT, OR PENETRATE INTO A STRUCTURAL MEMBER WITHOUT WRITTEN APPROVAL FROM A DESIGNATED STRUCTURAL ENGINEER AND THE OWNER.
- ALL PIPE ELBOWS SHALL BE LONG RADIUS UNLESS OTHERWISE SPECIFICALLY NOTED ON THE DRAWINGS.
- INSTALL MANUAL VOLUME DAMPERS WITHIN DUCT BRANCHES TO BALANCE AIRFLOW CFM ON INSULATED DUCTS, MOUNT DAMPER REGULATOR ON 2" STAND-OFF BRACKET TO CLEAR INSULATION.
- ALL MATERIAL EXPOSED WITHIN RA PLENUMS SHALL BE NON-COMBUSTIBLE OR SHALL HAVE A FLAME SPREAD INDEX NOT GREATER THAN 25 AND SMOKE DEVELOPED INDEX NOT GREATER THAN 50. COMPLY WITH CMC-602.2.
- COORDINATE ACCESS TO EQUIPMENT WITH WORK OF OTHER TRADES. PROVIDE DUCT ACCESS DOORS AND CEILING ACCESS DOORS TO ALLOW ACCESS FOR FILTER CHANGEOUT, CONTROLS ACCESS AND ACCESS TO SERVICE/REMOVE COMPONENTS INCLUDING, BUT NOT LIMITED TO, FANS, PULLEYS, SHEAVES, BELTS, ETC.

ABBREVIATIONS

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
(E)	EXISTING	HT	HEIGHT
AAV	AUTOMATIC AIR VENT	HZ	HERTZ
AFF	ABOVE FINISHED FLOOR	ID	INSIDE DIAMETER
AHU	AIR HANDLING UNIT	IN	INCHES
AP	ACCESS PANEL	KW	KILOWATTS
APD	AIR PRESSURE DROP	LAT	LEAVING AIR TEMPERATURE
BD	BLOWDOWN	LBS	POUNDS
BDD	BACK DRAFT DAMPER	LF	LINEAR FEET
BFC	BELOW FINISHED CEILING	LIO	REFRIGERANT LIQUID LINE
BFP	BACK FLOW PREVENTER	LWT	LEAVING WATER TEMPERATURE
BHP	BREAK HORSEPOWER	LX	MAXIMUM
BLOG	BUILDING	MBH	THOUSAND BTU PER HOUR
BOB	BOTTOM OF BEAM	MC	MECHANICAL CONTRACTOR
BOP	BOTTOM OF PIPE	MCA	MINIMUM CIRCUIT AMPS
BTL	BRIGHT THERMAL UNIT	MH	MANHOLE
CFM	CUBIC FEET PER MINUTE	MN	MINIMUM
CHWR	CHILLED WATER RETURN	MOC	MAXIMUM OVERLOAD CIRCUIT PROTECTION
CHWS	CHILLED WATER SUPPLY	NFA	NET FREE AREA
CI	CAST IRON	NIC	NOT IN CONTRACT
CL	CENTER LINE	NPSHR	NET POSITIVE SUCTION HEAD REQUIRED
CP	CONDENSATE PUMP	OA	OUTSIDE AIR
CT	COOLING TOWER	OAT	OUTSIDE AIR TEMPERATURE
CU	CONDENSING UNIT	OB	OPPOSED BLADE DAMPER
CV	CONSTANT VOLUME BOX	OC	ON CENTER
CWFR	CONDENSER WATER FILTER RETURN	OD	OUTSIDE DIAMETER
CWFS	CONDENSER WATER FILTER SUPPLY	PD	PRESSURE DROP
CWR	CONDENSER WATER RETURN	PERF	PERFORATED
CWS	CONDENSER WATER SUPPLY	PH	PHASE
DB	DRY BULB	POD	POINT OF DISCONNECT
DEG	DEGREES	PR	PRESSURE RELIEF
DIA	DIAMETER	PRV	PRESSURE REDUCING VALVE
DL	DOOR LOUVER	PSID	POUNDS PER SQUARE INCH DIFFERENTIAL
DN	DOWN	PSIG	POUNDS PER SQUARE INCH GAUGE
DX	DIRECT EXPANSION	PVC	POLYVINYL CHLORIDE
EA	EACH	RA	RETURN AIR
EAT	ENTERING AIR TEMPERATURE	RF	RETURN FAN
EC	ELECTRICAL CONTRACTOR	RLA	RATED LOAD AMPS
EFF	EFFICIENCY	RPM	REVOLUTIONS PER MINUTE
EL	ELEVATION	SA	SUPPLY AIR
ESP	EXTERNAL STATIC PRESSURE	SF	SUPPLY FAN
EWT	ENTERING WATER TEMPERATURE	SPEC	SPECIFICATION
FD	FIRE DAMPER	SS	STAINLESS STEEL
FG	FILTER GRILLE	STD	STANDARD
FLA	FULL LOAD AMPS	TAD	TRANSFER AIR DUCT
FLR	FLOOR	TDH	TOTAL DYNAMIC HEAD
FOB	FLAT ON BOTTOM	TEFC	TOTALLY ENCLOSED FAN COOLED
FOT	FLAT ON TOP	TSP	TOTAL STATIC PRESSURE
FR	FANS PER INCH	TYP	TYPICAL
FFM	FEET PER MINUTE	UC	UNDERCUT
FSD	FIRE SMOKE DAMPER	V	VOLTS
FT	FEET OR FOOT	VAV	VARIABLE AIR VOLUME
FX	FLEXIBLE CONNECTION	VD	VOLUME DAMPER
GA	GAUGE	VFD	VARIABLE FREQUENCY DRIVE
GALV	GALVANIZED	VTR	VENT THRU ROOF
GAS	REFRIGERANT GAS LINE	W	WITH
GC	GENERAL CONTRACTOR	W/O	WITHOUT
GPH	GALLONS PER HOUR	WB	WET BULB
GPM	GALLONS PER MINUTE	WC	WATER COLUMN
HB	HOSE BIBB	WG	WATER GAUGE
HD	HEAD	WPD	WATER PRESSURE DROP
HHWR	HEATING HOT WATER RETURN	WT	WEIGHT
HHWS	HEATING HOT WATER SUPPLY	F	DEGREES FAHRENHEIT
HP	HEAT PUMP		
HP	HORSEPOWER		

IN THE EVENT ABBREVIATIONS NOT MENTIONED HEREIN ARE USED, REFERENCE WILL BE MADE TO ANSI Y1.1, MILITARY STANDARD ABBREVIATIONS AND OTHER STANDARD INDUSTRY CONVENTIONS.

CONTROL ABBREVIATIONS

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
A	ALARM	PS	PRESSURE SWITCH
AFMS	AIRFLOW MONITORING STATIONS	PT	PRESSURE TRANSMITTER
AI	ANALOG INPUT	RH	RELATIVE HUMIDITY
AO	ANALOG OUTPUT	S	STATUS
CS	CURRENT SWITCH	SC	SPEED CONTROL
DI	DIGITAL INPUT	SI	SPEED INDICATOR
DO	DIGITAL OUTPUT	SP	SETPOINT
DP	DIFFERENTIAL PRESSURE	SS	START/STOP
FM	FLOW METER	T	TEMPERATURE
FS	FLOW SWITCH	TI	TEMPERATURE INDICATOR
HOA	HANDS-OFF-AUTO	VA	DAMPER/VALVE ACTUATOR
KW	KILOWATTS	VP	VELOCITY PRESSURE
LA	LEVEL ALARM	VSB	VIBRATION SWITCH
MCD	MOTOR OPERATED DAMPER	ZC	CLOSED END SWITCH
NC	NORMALLY CLOSED	ZI	POSITION INDICATOR
NO	NORMALLY OPEN	ZO	OPEN END SWITCH

IN THE EVENT ABBREVIATIONS NOT MENTIONED HEREIN ARE USED, REFERENCE WILL BE MADE TO ANSI Y1.1, MILITARY STANDARD ABBREVIATIONS AND OTHER STANDARD INDUSTRY CONVENTIONS.

CONTROL LEGEND

SYMBOLS	DESCRIPTION
XX	DDC PHYSICAL POINT
XX	SENSOR
XX	SWITCH
COMM	COMMUNICATION GATEWAY CONNECTION TO DDC
ECM	ELECTRONICALLY COMMUTATED MOTOR
VFD	VARIABLE FREQUENCY DRIVE
[Valve Symbol]	ELECTRONIC 3-WAY VALVE
[Valve Symbol]	ELECTRONIC 2-WAY VALVE
[Valve Symbol]	ELECTRONIC BUTTERFLY VALVE
[Damper Symbol]	DAMPER WITH ACTUATOR, OPPOSED BLADE
[Damper Symbol]	DAMPER WITH ACTUATOR, PARALLEL BLADE
[Coil Symbol]	COOLING COIL
[Coil Symbol]	HEATING COIL
[Filter Symbol]	AIR FILTER BANK
TS	AVERAGING AIR TEMPERATURE SENSOR
[Wiring Symbol]	FIELD CONTROL WIRING
[Wiring Symbol]	FIELD POWER WIRING

PIPING LEGEND

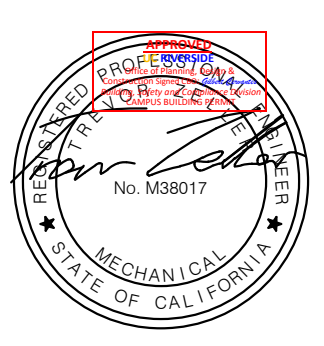
SYMBOL	DESCRIPTION
[Pipe Symbol]	NEW PIPING (SIZE-SERVICE)
[Pipe Symbol]	EXISTING PIPING (SIZE-SERVICE)
[Pipe Symbol]	ELBOW FACING AWAY FROM VIEWER
[Pipe Symbol]	ELBOW FACING TOWARD VIEWER
[Pipe Symbol]	TEE FACING AWAY FROM VIEWER
[Pipe Symbol]	TEE FACING TOWARD VIEWER
[Pipe Symbol]	PIPE CAP
[Transition Symbol]	TRANSITION, ASYMMETRIC
[Transition Symbol]	TRANSITION, SYMMETRIC
[Expansion Symbol]	EXPANSION JOINT (COMPENSATOR)
[Guide Symbol]	PIPE GUIDE
[Anchor Symbol]	PIPE ANCHOR
[Union Symbol]	UNION, SCREWED
[Drain Symbol]	DRAIN, FUNNEL
[Pump Symbol]	PUMP
[Ball Valve Symbol]	BALL VALVE
[Ball Valve Symbol]	BALL VALVE W/ ACTUATOR
[Butterfly Valve Symbol]	BUTTERFLY VALVE
[Butterfly Valve Symbol]	BUTTERFLY VALVE W/ ACTUATOR
[Gate Valve Symbol]	GATE VALVE
[Gate Valve Symbol]	GATE VALVE W/ ACTUATOR
[Globe Valve Symbol]	GLOBE VALVE
[Globe Valve Symbol]	GLOBE VALVE W/ ACTUATOR
[Three-Way Valve Symbol]	THREE-WAY VALVE
[Three-Way Valve Symbol]	THREE-WAY VALVE W/ ACTUATOR
[Check Valve Symbol]	CHECK VALVE, SWING
[Check Valve Symbol]	CHECK VALVE, SPRING LOADED
[Multi-Purpose Valve Symbol]	MULTI-PURPOSE VALVE
[Flow Measuring Valve Symbol]	FLOW MEASURING AND BALANCING VALVE
[Hose Bibb Symbol]	HOSE BIBB VALVE
[Lock Shield Valve Symbol]	LOCK SHIELD MANUAL VALVE
[Plug Valve Symbol]	PLUG VALVE
[Pressure Regulator Symbol]	PRESSURE REGULATOR
[Strainer Symbol]	STRAINER, Y-TYPE
[Strainer Symbol]	STRAINER WITH HOSE CONNECTION
[Pressure Gauge Symbol]	PRESSURE GAUGE WITH SHUTOFF COCK
[Pressure Gauge Symbol]	PRESSURE GAUGE WITH SHUBBER AND SHUTOFF COCK
[Self-Sealing Symbol]	SELF-SEALING PRESSURE AND TEMPERATURE TAP
[Thermometer Symbol]	THERMOMETER
[Thermowell Symbol]	THERMOWELL
[Flow Meter Symbol]	FLOW METER
[Flow Regulator Symbol]	FLOW REGULATOR AND FLOW LIMITING VALVE
[Pump Suction Diffuser Symbol]	PUMP SUCTION DIFFUSER
[Vacuum Breaker Symbol]	VACUUM BREAKER
[Air Vent Symbol]	AIR VENT, AUTOMATIC
[Flexible Connection Symbol]	FLEXIBLE CONNECTION
[Combination Flex-Vane Symbol]	COMBINATION FLEX-VANE STRAIGHTENER
[Safety Valve Symbol]	SAFETY OR RELIEF VALVE
[Steam Trap Symbol]	STEAM TRAP
[Air Separator Symbol]	AIR SEPARATOR

GENERAL LEGEND

SYMBOL	DESCRIPTION
[Callout Symbol]	NOTE CALLOUT
[Detail Callout Symbol]	DETAIL CALLOUT - NUMBER ON TOP DENOTES DETAIL NUMBER - NUMBER ON BOTTOM DENOTES SHEET DETAIL IS SHOWN
[Mechanical Plans Symbol]	MECHANICAL EQUIPMENT CALLOUT. SEE MECHANICAL PLANS FOR EXACT LOCATION AND REQUIREMENTS
[Section Callout Symbol]	SECTION CALLOUT
[Point of Connection Symbol]	POINT OF CONNECTION
[Point of Disconnection Symbol]	POINT OF DISCONNECTION
[New Linework Symbol]	NEW LINEWORK
[Existing Linework Symbol]	EXISTING LINEWORK
[Demolition Linework Symbol]	DEMOLITION LINEWORK
[Direction of Flow Symbol]	DIRECTION OF FLOW
[Diffuser Label Symbol]	DIFFUSER LABEL - NECK SIZE AND DIFFUSER TYPE - CUBIC FEET PER MINUTE

DUCTWORK LEGEND

SYMBOL	DESCRIPTION
[Sheet Metal Duct Symbol]	SHEET METAL DUCT
[Hidden Sheet Metal Duct Symbol]	HIDDEN SHEET METAL DUCT
[Internally Insulated Sheet Metal Duct Symbol]	INTERNALLY INSULATED SHEET METAL DUCT CLEAR INSIDE DIMENSION SHOWN, LINER THICKNESS IN PARENTHESES
[Standard Branch Symbol]	STANDARD BRANCH FOR SUPPLY AND RETURN
[Round Elbow Down Symbol]	ROUND ELBOW DOWN
[Round Elbow Up Symbol]	ROUND ELBOW UP
[Rectangular to Round Transition Symbol]	RECTANGULAR TO ROUND TRANSITION
[Flexible Duct Symbol]	FLEXIBLE DUCT
[Flex Connection Symbol]	FLEX CONNECTION
[Back Draft Damper Symbol]	BACK DRAFT DAMPER
[Fire Damper Symbol]	FIRE DAMPER
[Combination Fire and Smoke Damper Symbol]	COMBINATION FIRE AND SMOKE DAMPER
[Motorized Damper Symbol]	MOTORIZED DAMPER
[Balancing Damper Symbol]	BALANCING DAMPER
[Supply Diffuser Symbol]	SUPPLY DIFFUSER: 2-WAY/3-WAY/4-WAY
[Grille Symbol]	GRILLE: RETURN/EXHAUST
[Supply Air Duct Section Symbol]	SUPPLY AIR DUCT SECTION
[Return Air Duct Section Symbol]	RETURN AIR DUCT SECTION
[Exhaust Air Duct Section Symbol]	EXHAUST AIR DUCT SECTION
[Undercut Door Symbol]	UNDERCUT DOOR
[Transfer Grille or Louver Symbol]	TRANSFER GRILLE OR LOUVER
[Door Grille or Louver Symbol]	DOOR GRILLE OR LOUVER
[Single Duct VAV Box with Reheat Coil Symbol]	SINGLE DUCT VAV BOX WITH REHEAT COIL
[Single Duct VAV Box without Reheat Coil Symbol]	SINGLE DUCT VAV BOX WITHOUT REHEAT COIL
[Filter Symbol]	FILTER
[Humidifier Dispersion Grid Symbol]	HUMIDIFIER DISPERSION GRID
[Louver Symbol]	LOUVER
[Access Door or Access Panel Symbol]	ACCESS DOOR OR ACCESS PANEL (AP) IN DUCTWORK
[Static Pressure Change Tag Symbol]	STATIC PRESSURE CHANGE TAG
[Turning Vanes Symbol]	TURNING VANES (RECTANGULAR)



REVISIONS

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MMA NO: 20222
 DATE: 5/14/21
 DRAWN: T. ZELLER
 CHECKED: T. ZELLER

SCHEDULES

M0.02

COMPUTER ROOM AIR CONDITIONING UNIT (DX COIL)

MARK	MANUFACTURER & MODEL	TYPE	SERVICE	SUPPLY FAN										COOLING COIL										ELECTRICAL					FILTERS			OPERATING WEIGHT [LBS]	ACCESSORIES		REMARKS					
				QTY	TOTAL [CFM]	CODE OSA [CFM]	ESP [IN WC]	RPM	MOTOR					FV [FPM]	MBH		AIR SIDE				REFRIGERANT TYPE	COIL DESCRIPTION				PIPING CONNECTIONS		VOLTAGE	PHASE	HZ	MCA [AMPS]		MCOP [AMPS]	TYPE		QUANTITY/SIZE	MERV			
									BHP	HP	RPM	VOLTS	PHASE		TOTAL [MBH]	SENS [MBH]	EAT [°F]	LAT [°F]	ΔP [IN WC]	QTY		SIZE [IN.]	ROWS /FPI	LIQUID [IN.]	GAS [IN.]	CONDENSATE [IN.]														
AC-3	DATA AIRE GFAD-09134	DOWNFLOW	DATA CENTER 1601	2	9,000	N/A	0.5	-	-	4	-	460	3	368.9	298.0	298.0	84.0	60.0	53.0	47.9	-	R-410A	2	-	5/12	7/8	7/8	3/4	460	3	60	56.5	70.0	PLEATED	(4) 16"X20"X4 (4) 20"X20"X4	8	2,000	A	B	-

- A PROVIDE FLOOR STAND.
- B PROVIDE BACNET CARD.

CONDENSER

MARK	MANUFACTURER & MODEL	LOCATION	SERVICE	TYPE	COOLING			EFFICIENCY	ELECTRICAL					PIPING CONNECTIONS [IN.]		REFRIGERANT TYPE	NET UNIT WEIGHT [LBS.]	ACCESSORIES	REMARKS
					COOLING CAPACITY [MBH]	TONS	AMBIENT [°F]		VOLTAGE	PHASE	HZ	MCA [AMPS]	MCOP [AMPS]	LIQUID	GAS				
C-3	DATA AIRE GHRC-15534	ROOF	AC-3	COOLING ONLY	318	28	105	2.17	460	3	60	9.2	15.0	1-1/8	1-5/8	R-410A	1,100	-	-

COMPUTER ROOM AIR HANDLING UNITS (CHILLED WATER COIL)

MARK	MANUFACTURER & MODEL	TYPE	SERVICE	SUPPLY FAN										COOLING COIL										FILTERS			ELECTRICAL					OPERATING WEIGHT [LBS]	ACCESSORIES		REMARKS				
				QTY	TOTAL [CFM]	CODE OSA [CFM]	ESP [IN WC]	RPM	MOTOR (EACH)					FV [FPM]	MBH		AIR SIDE				WATER SIDE		COIL DESCRIPTION		TYPE	QUANTITY/SIZE	MERV	FLA	MCA	MCOP									
									BHP	HP	RPM	VOLTS	PHASE		TOTAL [MBH]	SENS [MBH]	EAT [°F]	LAT [°F]	ΔP [IN WC]	GPM	EWT [°F]	LWT [°F]	ΔP [FT]	QTY							SIZE [IN.]		ROWS /FPI						
FCU-1	DATA AIRE GFCD-09134	DOWNFLOW	DATA CENTER 1601	2	10,000	N/A	0.5	-	-	4	-	460	3	398.0	308.9	308.9	84.0	60.0	55.4	48.5	-	33.0	45.0	65.0	14.2	2	-	8/12	PLEATED	(4) 16"X20"X4 (4) 20"X20"X4	8	8.0	9.0	15.0	1,800	A	B	C	D
FCU-2	DATA AIRE GFCD-09134	DOWNFLOW	DATA CENTER 1601	2	10,000	N/A	0.5	-	-	4	-	460	3	398.0	308.9	308.9	84.0	60.0	55.4	48.5	-	33.0	45.0	65.0	14.2	2	-	8/12	PLEATED	(4) 16"X20"X4 (4) 20"X20"X4	8	8.0	9.0	15.0	1,800	A	B	C	D
(E)FCU-4	MAGIC AIRE BMB 60	DOWNFLOW	DATA CENTER 1601	2	6,000	N/A	-	-	-	-	-	-	-	190.9	178.2	75.0	61.0	53.0	50.7	-	60.0	45.0	-	24.1	-	-	-	-	-	-	-	-	770	-	-	-	-		
(E)FCU-5	MAGIC AIRE BMB 60	DOWNFLOW	DATA CENTER 1601	2	8,000	N/A	-	-	-	-	-	-	-	267.9	249.6	75.0	61.0	51.7	50.0	-	85.4	45.0	-	22.8	-	-	-	-	-	-	-	-	840	-	-	-	-		

- A PROVIDE FLOOR STAND.
- B PROVIDE BACNET CARD.
- C PROVIDE 2-WAY CHILLED WATER CONTROL VALVE. VALVE SHALL BE FURNISHED AND PRE-WIRED BY THE MANUFACTURER. SEE CONTROL VALVE SCHEDULE BELOW FOR DETAILED INFORMATION.
- D FACTORY SPECIAL 8-ROW COIL OPTION.

COMPUTER ROOM IN-ROW COOLING UNITS (CHILLED WATER COIL) - ALTERNATE #4

MARK	MANUFACTURER & MODEL	TYPE	SERVICE	SUPPLY FAN										COOLING COIL										FILTERS			ELECTRICAL					OPERATING WEIGHT [LBS]	ACCESSORIES		REMARKS				
				QTY	TOTAL [CFM]	CODE OSA [CFM]	ESP [IN WC]	RPM	MOTOR (EACH)					FV [FPM]	MBH		AIR SIDE				WATER SIDE		COIL DESCRIPTION		TYPE	QUANTITY/SIZE	MERV	FLA	MCA	MCOP									
									BHP	HP	RPM	VOLTS	PHASE		TOTAL [MBH]	SENS [MBH]	EAT [°F]	LAT [°F]	ΔP [IN WC]	GPM	EWT [°F]	LWT [°F]	ΔP [FT]	QTY							SIZE [IN.]		ROWS /FPI						
FCU-6	DATA AIRE GICW-06032	IN-ROW	DATA CENTER 1601	3	4,600	N/A	N/A	-	-	3	-	208	3	525.7	163.0	163.0	92.0	60.0	59.2	46.5	-	30.0	45.0	57.4	14.8	1	-	5/12	PLEATED	-	8	15.5	16.7	20.0	900	A	B	C	D
FCU-7	DATA AIRE GICW-06032	IN-ROW	DATA CENTER 1601	3	4,600	N/A	N/A	-	-	3	-	208	3	525.7	163.0	163.0	92.0	60.0	59.2	46.5	-	30.0	45.0	57.4	14.8	1	-	5/12	PLEATED	-	8	15.5	16.7	20.0	900	A	B	C	D
FCU-8	DATA AIRE GICW-06032	IN-ROW	DATA CENTER 1601	3	4,600	N/A	N/A	-	-	3	-	208	3	525.7	163.0	163.0	92.0	60.0	59.2	46.5	-	30.0	45.0	57.4	14.8	1	-	5/12	PLEATED	-	8	15.5	16.7	20.0	900	A	B	C	D
FCU-9	DATA AIRE GICW-06032	IN-ROW	DATA CENTER 1601	3	4,600	N/A	N/A	-	-	3	-	208	3	525.7	163.0	163.0	92.0	60.0	59.2	46.5	-	30.0	45.0	57.4	14.8	1	-	5/12	PLEATED	-	8	15.5	16.7	20.0	900	A	B	C	D

- A PROVIDE FLOOR STAND.
- B PROVIDE BACNET CARD.
- C PROVIDE 2-WAY CHILLED WATER CONTROL VALVE. VALVE SHALL BE FURNISHED AND PRE-WIRED BY THE MANUFACTURER. SEE CONTROL VALVE SCHEDULE BELOW FOR DETAILED INFORMATION.
- D PROVIDE FACTORY SPECIAL COIL TO ACHIEVE WATER PRESSURE DROP SHOWN.

HUMIDIFIERS

MARK	MANUFACTURER & MODEL	LOCATION	TYPE	SERVICE	CAPACITY LBS STEAM/HR	ELECTRICAL					OPERATING WEIGHT LBS.	ACCESSORIES			REMARKS	
						VOLT	PH	HZ	KW	MCA		MCOP	A	B		C
H-1	CONDAIR US-20	DATA CENTER 1601	ULTRASONIC	DATA CENTER 1601	20	120	1	60	0.74	6.2	15.0	100	A	B	C	-
H-2	CONDAIR US-20	DATA CENTER 1601	ULTRASONIC	DATA CENTER 1601	20	120	1	60	0.74	6.2	15.0	100	A	B	C	-

- A PROVIDE DIRECT-MOUNTED BLOWER PACK.
- B PROVIDE CONDAIR RO-U REVERSE OSMOSIS UNIT.
- C PROVIDE ANALOG CONTROL HUMIDISTAT WITH MODULATING OPERATION.

GRILLES, REGISTERS, DIFFUSERS

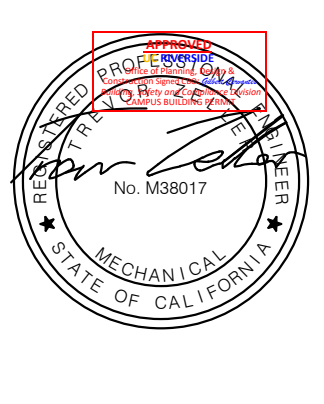
MARK	MANUFACTURER & MODEL	DESCRIPTION	NOMINAL SIZE [IN.]	INLET SIZE [IN.]	MATERIAL	BORDER	INTEGRATED DAMPER	FINISH	ACCESSORIES	REMARKS
SG-1	TATE DIRECTAIRE	SUPPLY AIRFLOW FLOOR TILE	24 x 24	N/A	STEEL	LAY-IN	MZ DAMPER ACCESSORY	WHITE	-	A
SG-2	TATE DIRECTAIRE X2	SUPPLY AIRFLOW FLOOR TILE	24 x 24	N/A	STEEL	LAY-IN	MZ DAMPER ACCESSORY	WHITE	-	B
SG-3	TATE DIRECTPERF 32%	PERFORATED SUPPLY AIRFLOW FLOOR TILE	24 x 24	N/A	STEEL	LAY-IN	MZ DAMPER ACCESSORY	WHITE	-	A
RG-1	TITUS PXP	PERFORATED CEILING RETURN PANEL	24 x 24	N/A	STEEL	LAY-IN	NONE	WHITE	-	-

- A 1-WAY PATTERN.
- B 2-WAY PATTERN.

CONTROL VALVES

MARK	MANUFACTURER & MODEL	TYPE	SERVICE	FLOW RATE [GPM]	VALVE CV	CLOSE-OFF [PSI]	PRESSURE DROP [PSID]	VALVE SIZE [IN.]	PIPE SIZE [IN.]	VOLTAGE [IN.]	VALVE FAIL POSITION	ACTUATOR	MATERIAL	ACCESSORIES	REMARKS
CV-1	BELIMO B238	2-WAY CCV	FCU-1	33	19	200	3.02	1-1/2	2	24	LAST	NON-SPRING RETURN	BRASS BALL BRASS STEM	-	A
CV-2	BELIMO B238	2-WAY CCV	FCU-2	33	19	200	3.02	1-1/2	2	24	LAST	NON-SPRING RETURN	BRASS BALL BRASS STEM	-	A
CV-3	BELIMO B238	2-WAY CCV	FCU-6	30	19	200	2.49	1-1/2	2	24	LAST	NON-SPRING RETURN	BRASS BALL BRASS STEM	-	B
CV-4	BELIMO B238	2-WAY CCV	FCU-7	30	19	200	2.49	1-1/2	2	24	LAST	NON-SPRING RETURN	BRASS BALL BRASS STEM	-	B
CV-5	BELIMO B238	2-WAY CCV	FCU-8	30	19	200	2.49	1-1/2	2	24	LAST	NON-SPRING RETURN	BRASS BALL BRASS STEM	-	B
CV-6	BELIMO B238	2-WAY CCV	FCU-9	30	19	200	2.49	1-1/2	2	24	LAST	NON-SPRING RETURN	BRASS BALL BRASS STEM	-	B

- A FURNISH CONTROL VALVE WITH MODULATING ELECTRONIC ACTUATOR. SEE CONTROLS DIAGRAM FOR REQUIRED ACTUATOR CONTROL POINTS.
- B ALTERNATE #4.



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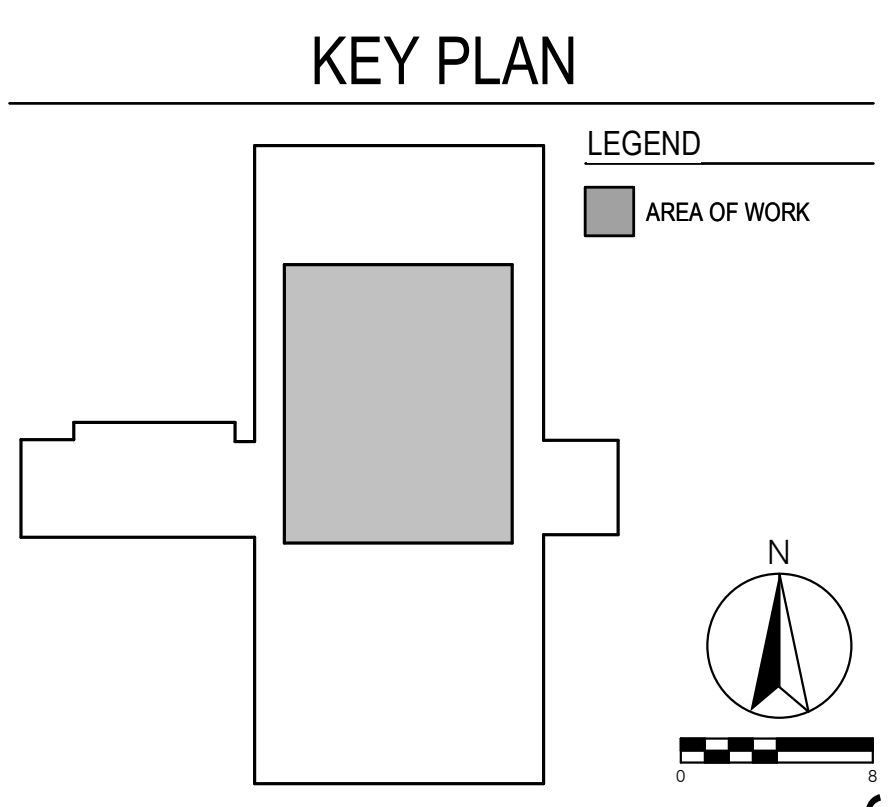
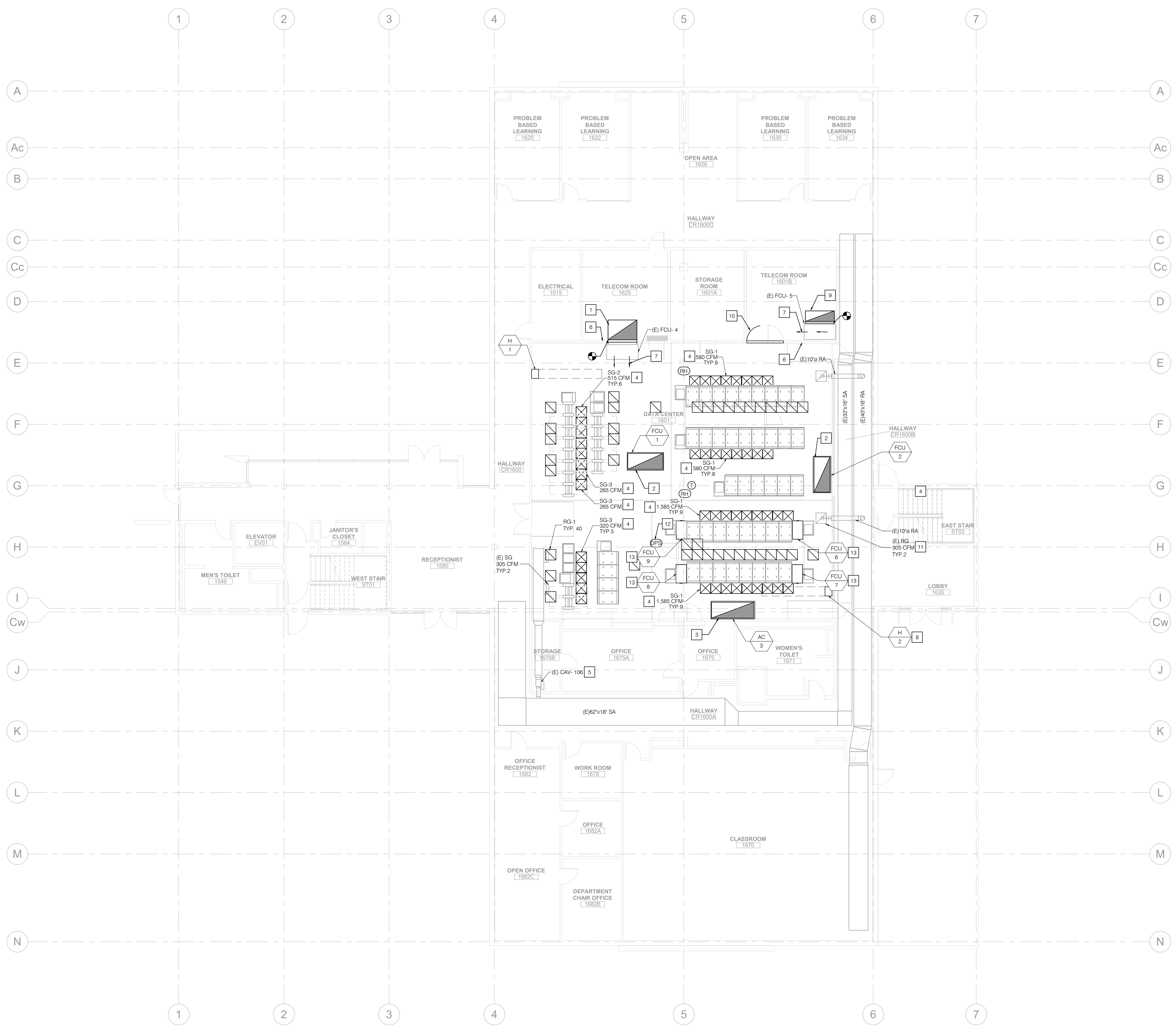
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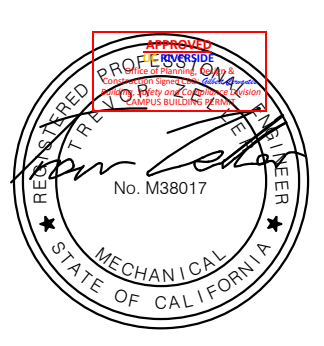
FIRST FLOOR
HVAC PLAN

M2.11

- NOTES**
- 1 PROVIDE 66"x45" RA DUCT OFF OF FCU SIDE RETURN AND UP TO CEILING PLENUM. RETURN AIR ENTERS DUCT FROM CEILING PLENUM.
 - 2 PROVIDE 80"x36" RA DUCT UP TO CEILING PLENUM FROM FCU TOP RETURN OPENING. RETURN AIR ENTERS DUCT FROM CEILING PLENUM.
 - 3 PROVIDE 96"x38" RA DUCT UP TO CEILING PLENUM FROM FCU TOP RETURN OPENING. RETURN AIR ENTERS DUCT FROM CEILING PLENUM.
 - 4 ADJUST DIFFUSER BLADES TO DIRECT AIR TOWARDS DATA RACKS.
 - 5 AIR TERMINAL UNIT AIRFLOW SETPOINT SHALL BE ADJUSTED TO 610 CFM AS SHOWN.
 - 6 CONTRACTOR TO REMOVE 20 SF OF GYP FROM THE WALL ABOVE THE CEILING TO ALLOW FOR PASSAGE OF RETURN AIR BACK TO FCU.
 - 7 ROTATE EXISTING AIR DEFLECTOR TO DIRECT AIR IN DIRECTION SHOWN.
 - 8 CONTRACTOR TO PROVIDE FIELD-FABRICATED FLOOR STAND TO MOUNT H-2 AND ASSOCIATED RO SYSTEM.
 - 9 PROVIDE 66"x45" RA DUCT OFF OF FCU SIDE RETURN BELOW THE RAISED FLOOR IN APPROXIMATE LOCATION SHOWN TO ALLOW PASSAGE OF SUPPLY AIR FROM (E) FCU-5 TO DATA CENTER. PROVIDE CUSTOM SHEET METAL TURNING VANE AS SHOWN.
 - 10 CONTRACTOR TO REMOVE 8 SF OF GYP FROM THE WALL BELOW THE RAISED FLOOR IN APPROXIMATE LOCATION SHOWN TO ALLOW PASSAGE OF SUPPLY AIR FROM (E) FCU-5 TO DATA CENTER. PROVIDE CUSTOM SHEET METAL TURNING VANE AS SHOWN.
 - 11 REBALANCE RETURN GRILLE TO AIRFLOW SHOWN.
 - 12 UNDERFLOOR PLENUM DIFFERENTIAL PRESSURE SENSOR.
 - 13 ALTERNATE #4: CHW IN-ROW COOLING UNIT. SET AIRFLOW TO DIRECT INWARD TOWARDS RACKS. EXTEND CHW PIPING FROM THE TAPS IN THE UNDERFLOOR PLENUM AND CONNECT TO UNITS.

- GENERAL NOTES**
1. THE DATA RACKS ARE SHOWN ON THE FLOOR PLANS FOR REFERENCE ONLY. SEE TELECOM DRAWINGS FOR DETAILS.
 2. SUPPLY DIFFUSERS SHOWN ON FLOOR PLAN ARE LOCATED IN RAISED FLOOR. RETURN GRILLES SHOWN ON FLOOR PLAN ARE LOCATED IN CEILING.
 3. EQUIPMENT ANCHORAGE TO BE A DEFERRED SUBMITTAL THROUGH THE MECHANICAL CONTRACTOR.





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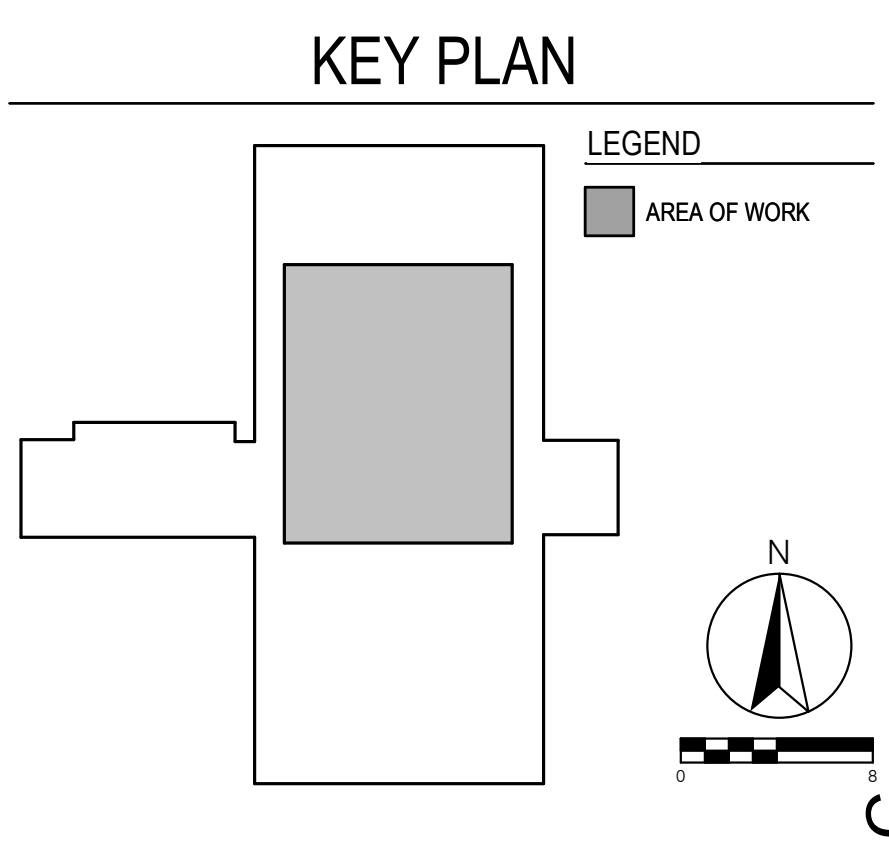
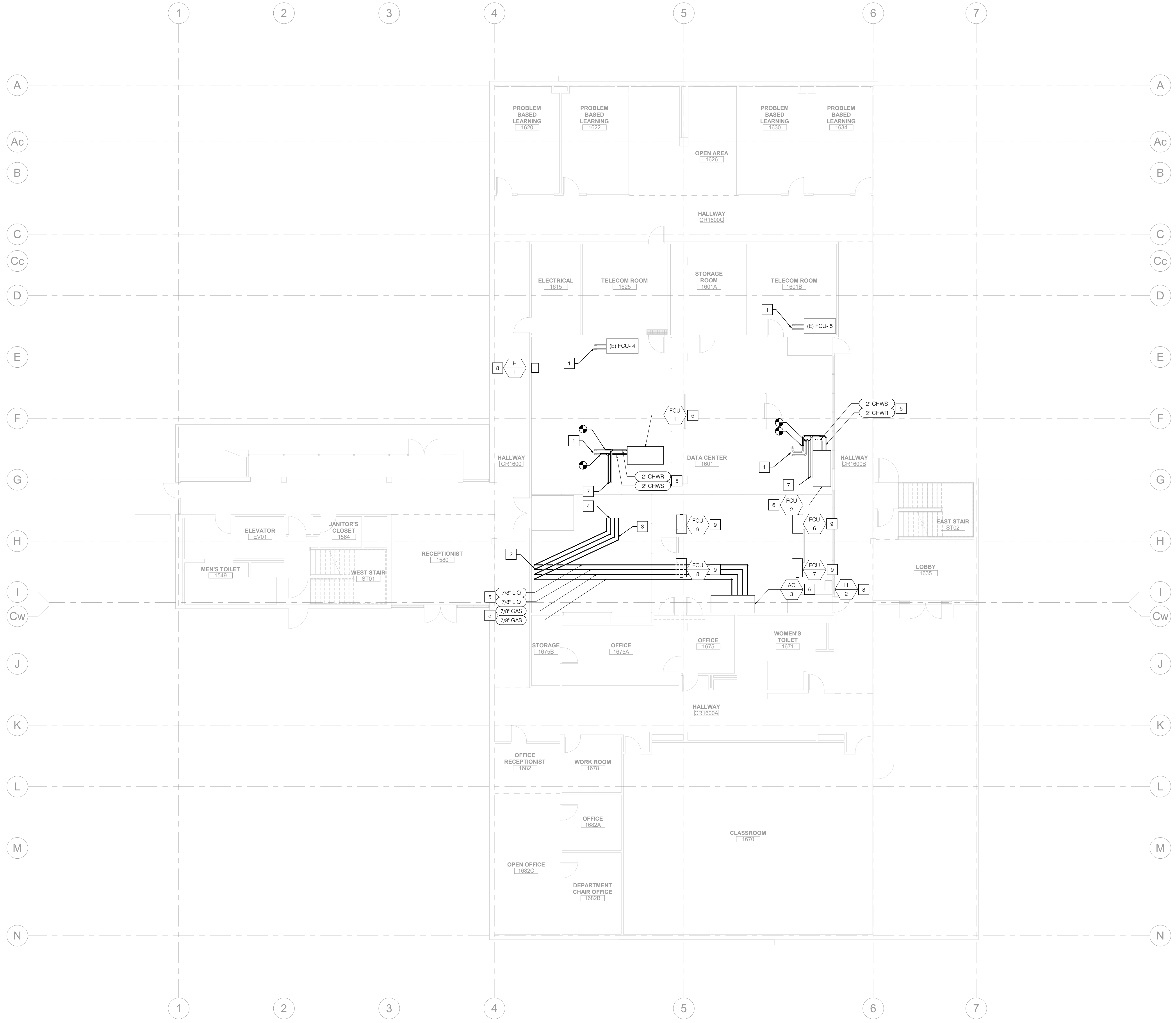
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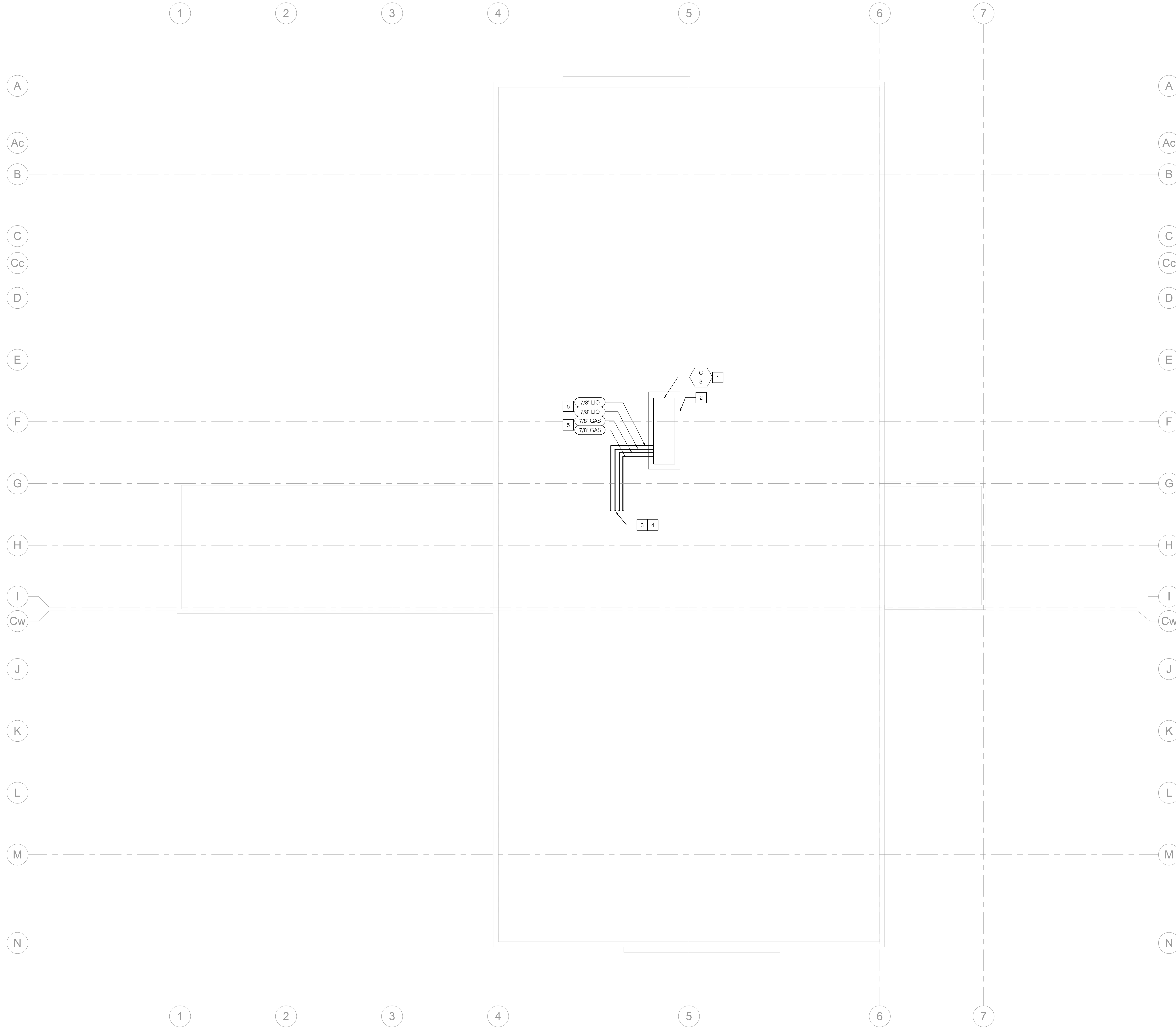
FIRST FLOOR
PIPING PLAN

M2.12

- NOTES**
- EXISTING CHW PIPES DOWN.
 - 7/8" REFRIGERANT PIPES UP IN SHEET METAL CHASE.
 - 7/8" REFRIGERANT PIPES IN THE CEILING SPACE.
 - 7/8" REFRIGERANT PIPES UP TO ROOF. CONTRACTOR SHALL COORDINATE PIPE ROUTING ON THE 2ND FLOOR AS NEEDED.
 - PIPING IN UNDERFLOOR PLENUM.
 - RECONNECT UNIT TO EXISTING CONDENSATE PIPING. PROVIDE CONDENSATE TRAP PER MANUFACTURERS INSTALLATION INSTRUCTIONS.
 - PROVIDE 2-1/2" CAPPED BRANCHES WITH ISOLATION BALL VALVES FOR FUTURE CONNECTION.
 - SEE PLUMBING DRAWINGS FOR COLD WATER AND DRAIN CONNECTIONS.
 - ALTERNATE #4 - PROVIDE CONDENSATE PIPING FROM IN-ROW UNIT DRAIN CONNECTION. PROVIDE CONDENSATE TRAP PER MANUFACTURERS INSTALLATION INSTRUCTION. CONNECT TO NEAREST EXISTING CONDENSATE DRAIN.

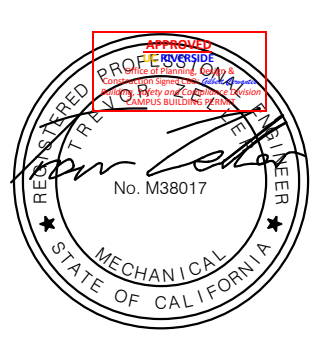
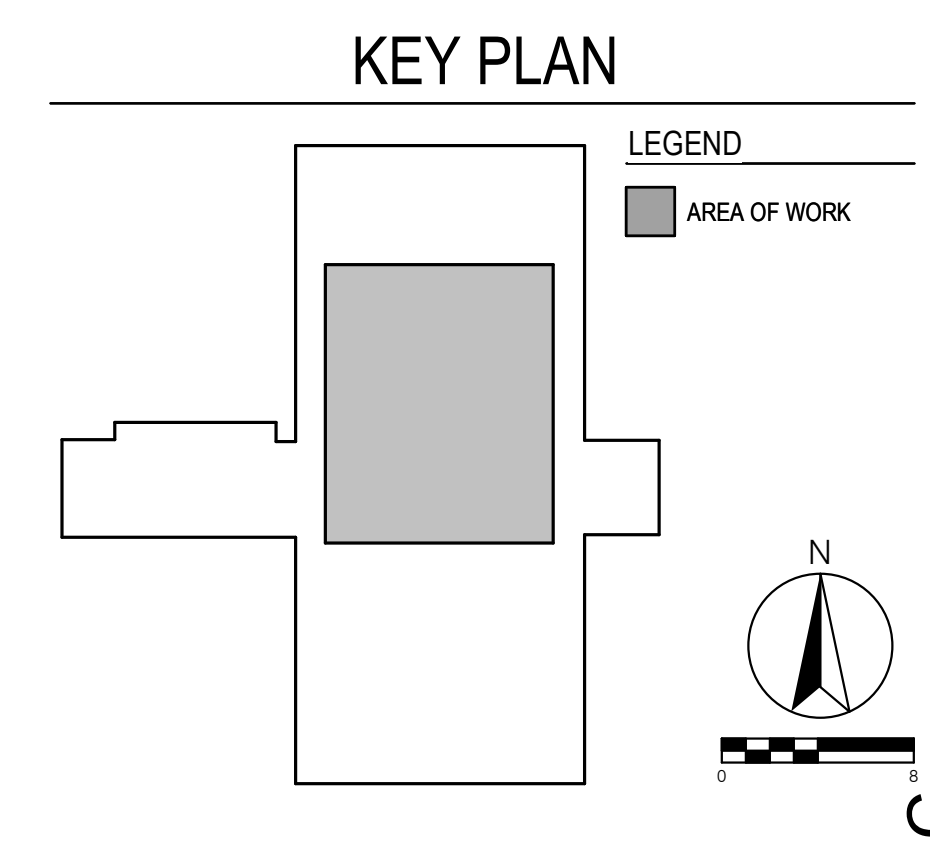
- GENERAL NOTES**
- REPLACE ALL EXISTING CHW PIPE INSULATION FROM FLOOR SLAB PENETRATION TO POC OF NEW FCUS AND FROM FLOOR SLAB PENETRATION TO EXISTING FCUS. RE-USE EXISTING CONTROL VALVES FOR FCU-4 AND FCU-5.
 - INSULATE ALL CONDENSATE PIPING.





- NOTES**
- 1 LOCATE C-3 ON EXISTING ROOF PAD.
 - 2 EXISTING ROOF PAD.
 - 3 TWO PAIRS OF REFRIGERANT LINES FROM DATA CENTER AC-3.
 - 4 RE-USE EXISTING ROOF PENETRATION.
 - 5 PROVIDE ALUMINUM JACKET FOR OUTDOOR REFRIGERANT PIPING.

- GENERAL NOTES**
1. EQUIPMENT ANCHORAGE TO BE A DEFERRED SUBMITTAL THROUGH THE MECHANICAL CONTRACTOR.



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ROOF PLAN

M2.31

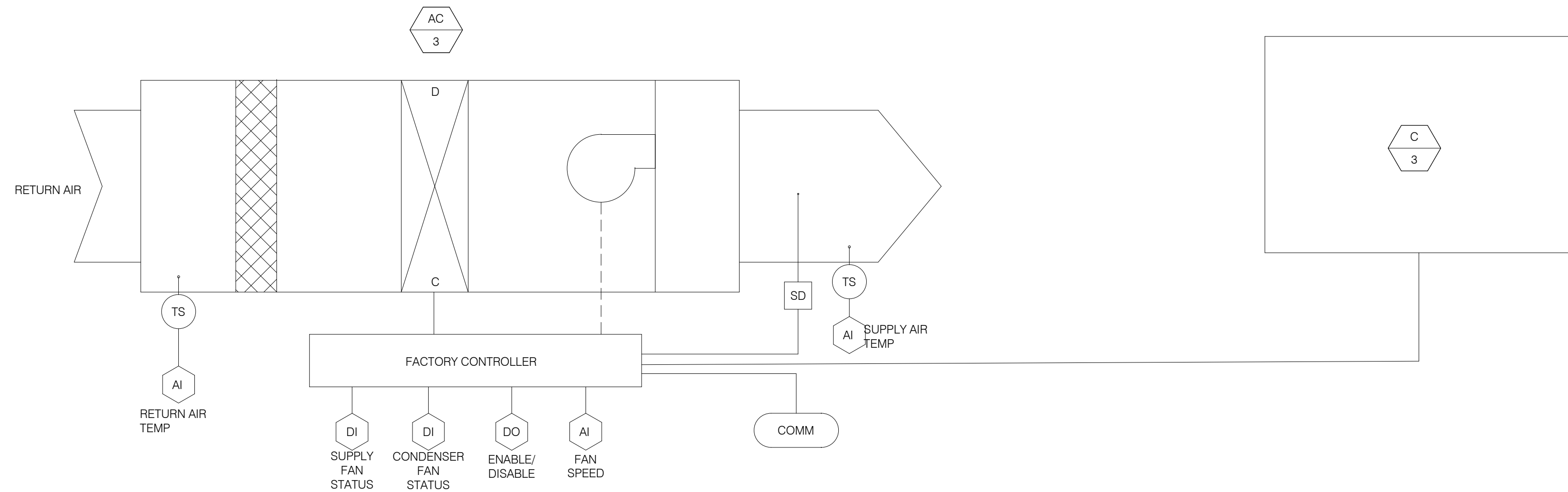
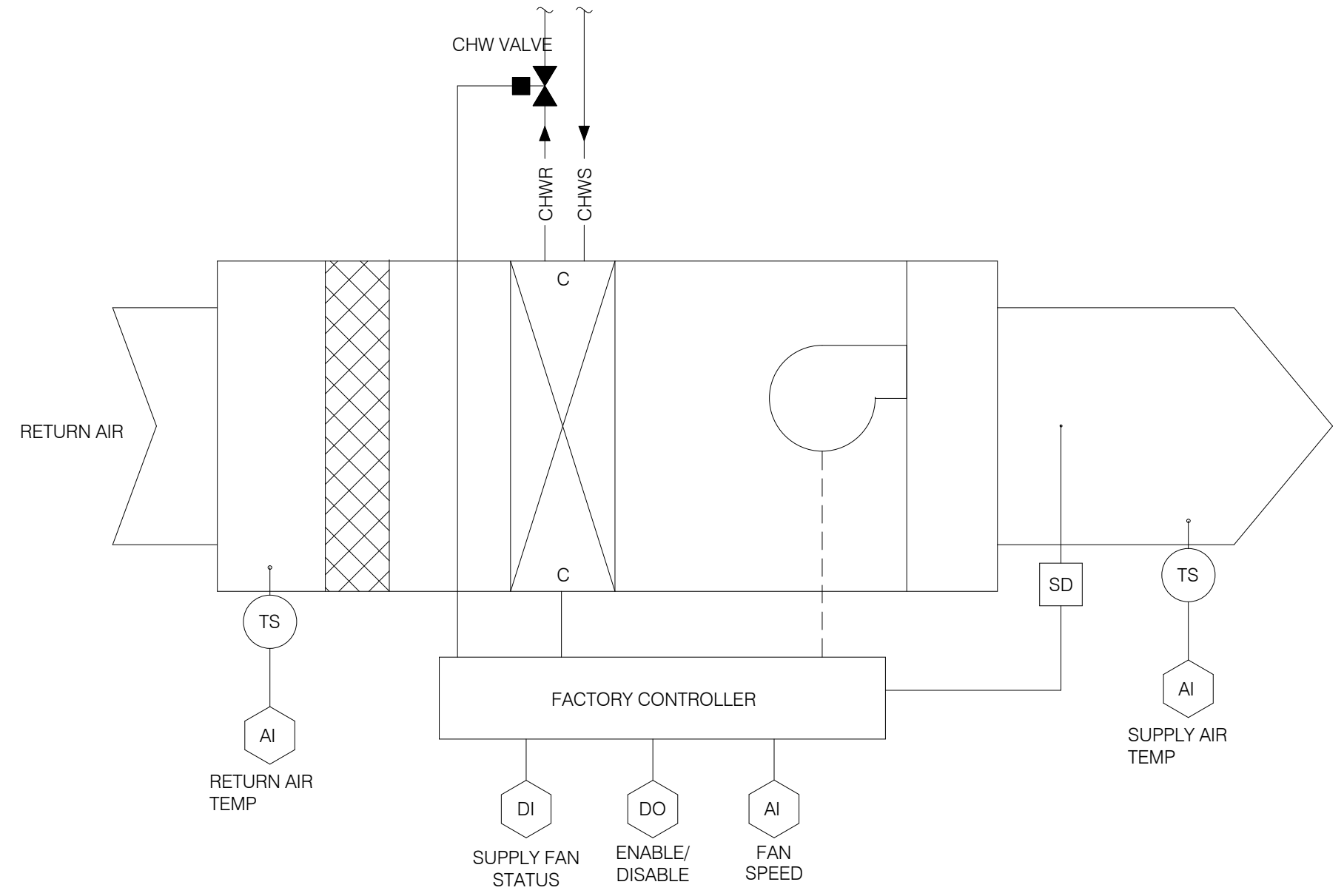
GENERAL NOTES

- CONTROLS CONTRACTOR TO PROVIDE NEW CONTROLLER FOR THE EXISTING FAN COIL UNITS AND INTEGRATE THE CONTROLS INTO EXISTING BUILDING DDC CONTROL SYSTEM. CONTROLS CONTRACTOR TO PROVIDE REQUIRED MODULE(S) AND DEVICES/ACCESSORIES FOR CONNECTION OF NEW SYSTEM TO EXISTING CONTROL SYSTEM.

COMMUNICATION POINTS
RETURN TEMPERATURE SETPOINT
DIRTY FILTER ALARM
NO AIR FLOW ALARM
WATER DETECTION ALARM
COMPRESSOR STATUS

GENERAL NOTES

- CONTROLS CONTRACTOR TO INTEGRATE THE HVAC CONTROLS INTO EXISTING BUILDING DDC CONTROL SYSTEM. CONTROLS CONTRACTOR TO PROVIDE REQUIRED MODULE(S) AND DEVICES/ACCESSORIES FOR CONNECTION OF NEW SYSTEM TO EXISTING CONTROL SYSTEM.



5 EXISTING CHW UNIT CONTROL (FCU-4 & 5)
 NO SCALE

3 DX SYSTEM CONTROL (AC-3 & C-3)
 NO SCALE

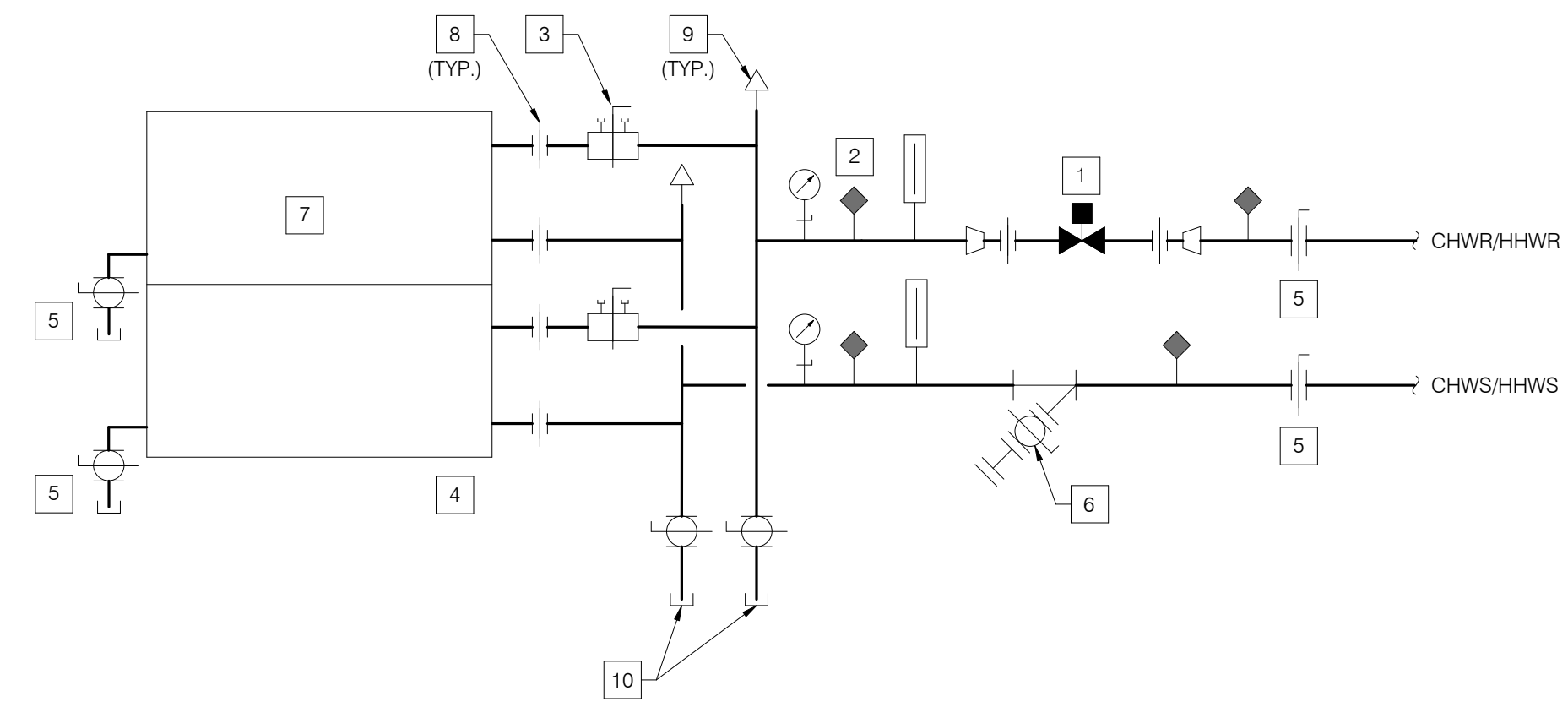
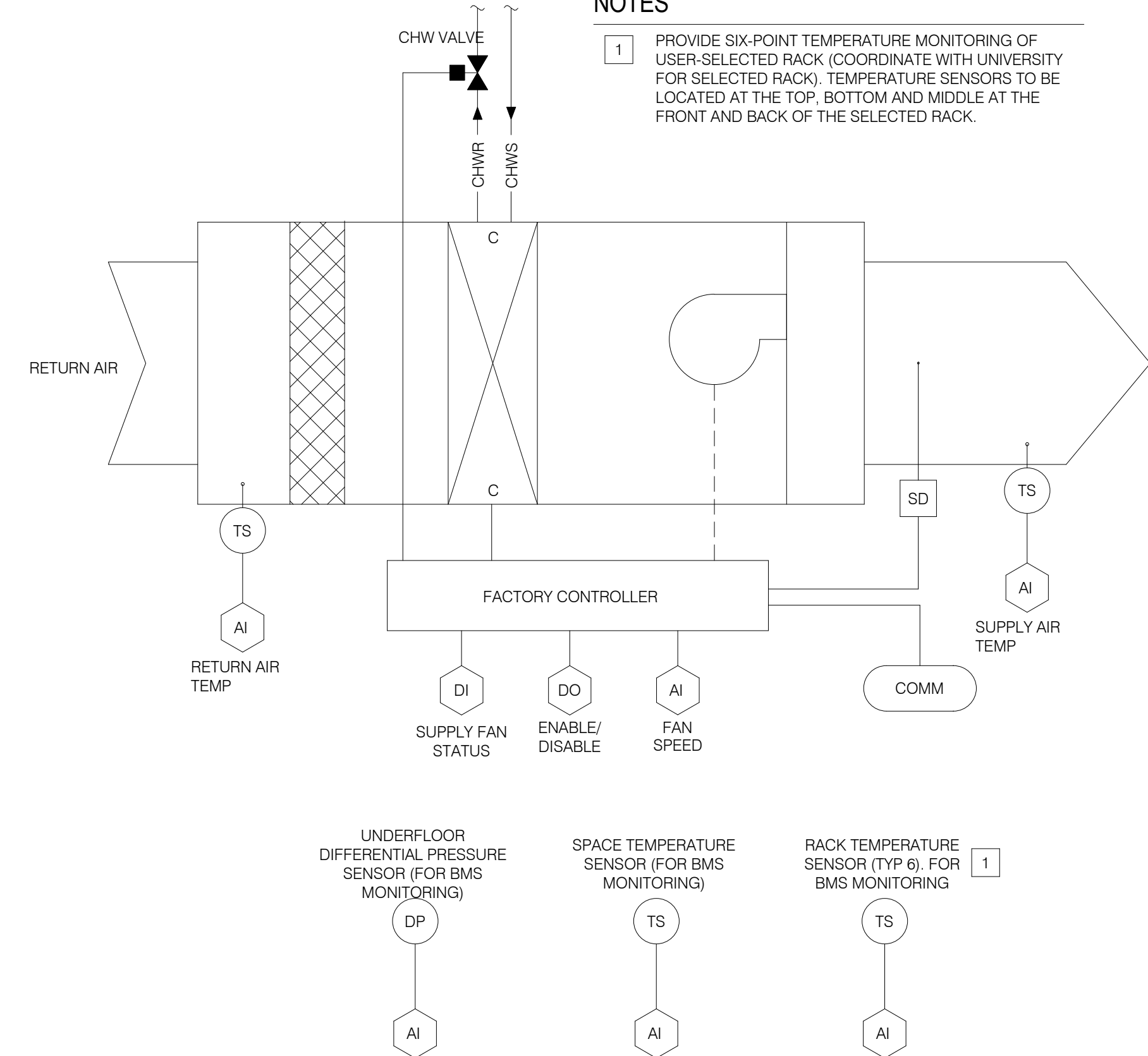
COMMUNICATION POINTS
RETURN TEMPERATURE SETPOINT
DIRTY FILTER ALARM
NO AIR FLOW ALARM
WATER DETECTION ALARM
CHILLED WATER VALVE POSITION

GENERAL NOTES

- CONTROLS CONTRACTOR TO INTEGRATE THE HVAC CONTROLS INTO EXISTING BUILDING DDC CONTROL SYSTEM. CONTROLS CONTRACTOR TO PROVIDE REQUIRED MODULE(S) AND DEVICES/ACCESSORIES FOR CONNECTION OF NEW SYSTEM TO EXISTING CONTROL SYSTEM.
- CONTROL DIAGRAM TO ALSO APPLY TO FCU-6, 7, 8 AND 9 AS PART OF ALTERNATE #4

NOTES

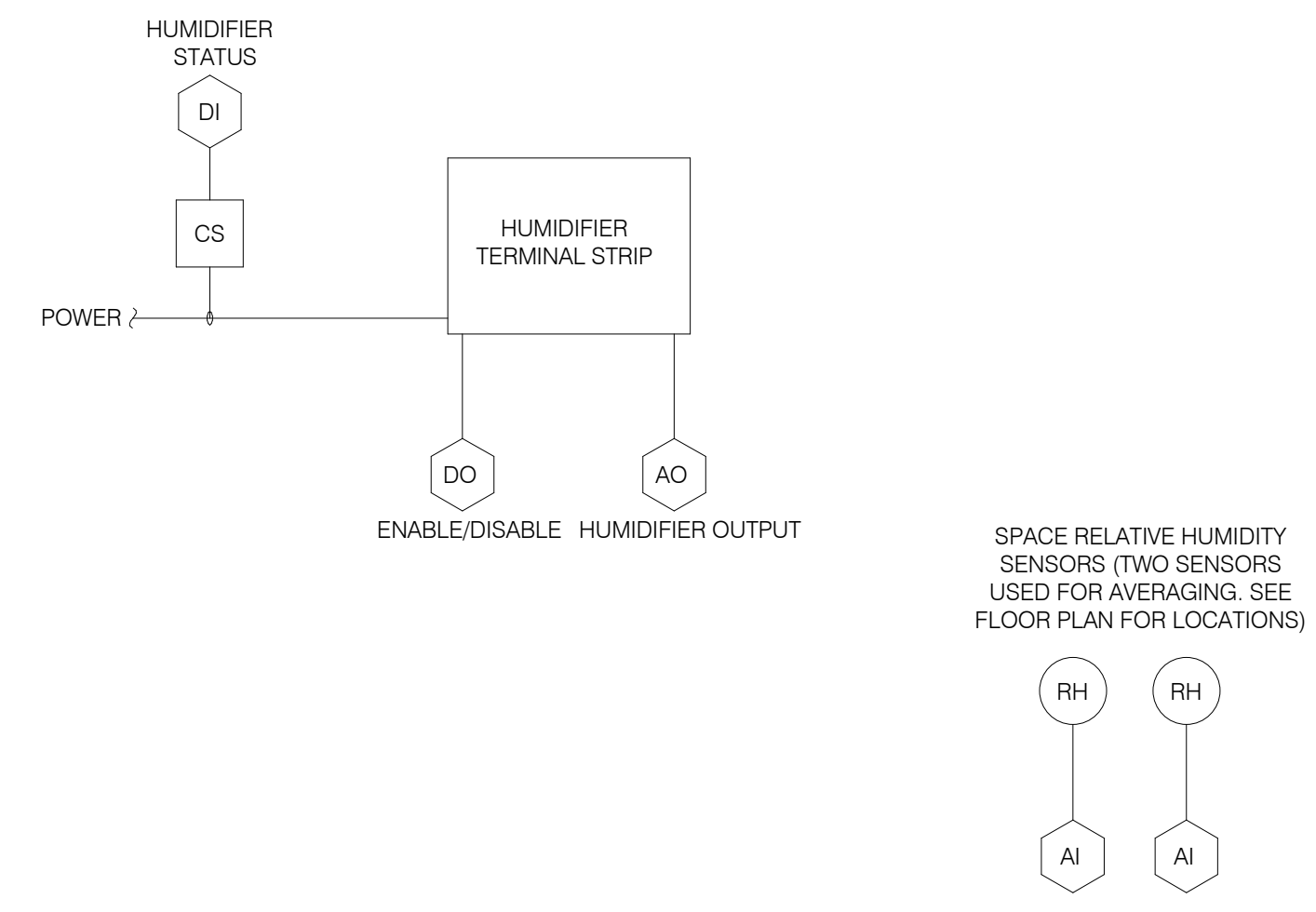
- PROVIDE SIX-POINT TEMPERATURE MONITORING OF USER-SELECTED RACK (COORDINATE WITH UNIVERSITY FOR SELECTED RACK). TEMPERATURE SENSORS TO BE LOCATED AT THE TOP, BOTTOM AND MIDDLE AT THE FRONT AND BACK OF THE SELECTED RACK.



NOTES

- CONTROL VALVE AND ACTUATOR SHALL BE PROVIDED BY THE CONTROLS SUB-CONTRACTOR.
- PROVIDE PRESSURE/TEMPERATURE PORTS ON THE SUPPLY AND RETURN LINES AND ENSURE THEY ARE POINTED NO LOWER THAN HORIZONTAL (TYP.)
- PROVIDE CALIBRATED BALANCING VALVE FOR COIL BALANCING.
- INSULATION FOR COIL HOOK-UP SHALL BE 1/2" THICK.
- PROVIDE DRAIN VALVE WITH HOSE END AT ALL COIL LOW POINTS. VALVE SHALL BE SAME SIZE AS COIL DRAIN SIZE.
- STRAINER WITH BALL VALVE AND HOSE END
- CONNECT CHILLED OR HEATING HOT WATER SUPPLY IN COUNTERFLOW CONFIGURATION WITH RELATION TO AIRFLOW DIRECTION.
- UNION/FLANGE
- AUTOMATIC AIR VENT
- 3/4" DRAIN WITH BALL VALVE AND HOSE COUPLING
- MANUAL SHUT-OFF VALVE.

4 HUMIDIFIER CONTROL (H-1 AND H-2)
 NO SCALE



2 CHW UNIT CONTROL (FCU-1 & 2)
 NO SCALE

1 CHW COIL PIPING DIAGRAM
 NO SCALE

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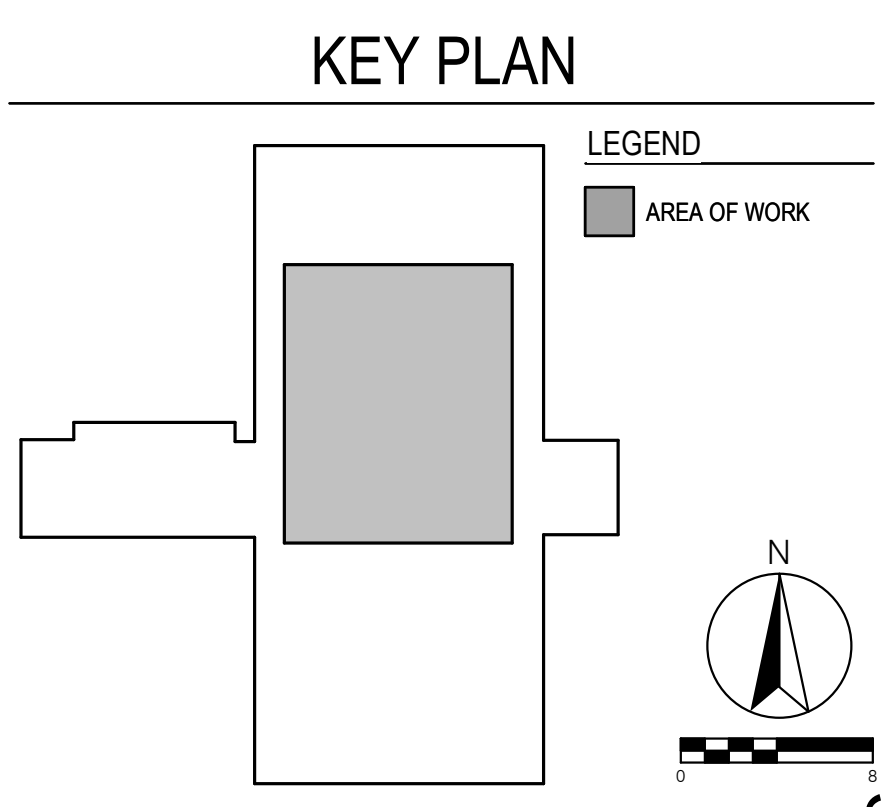
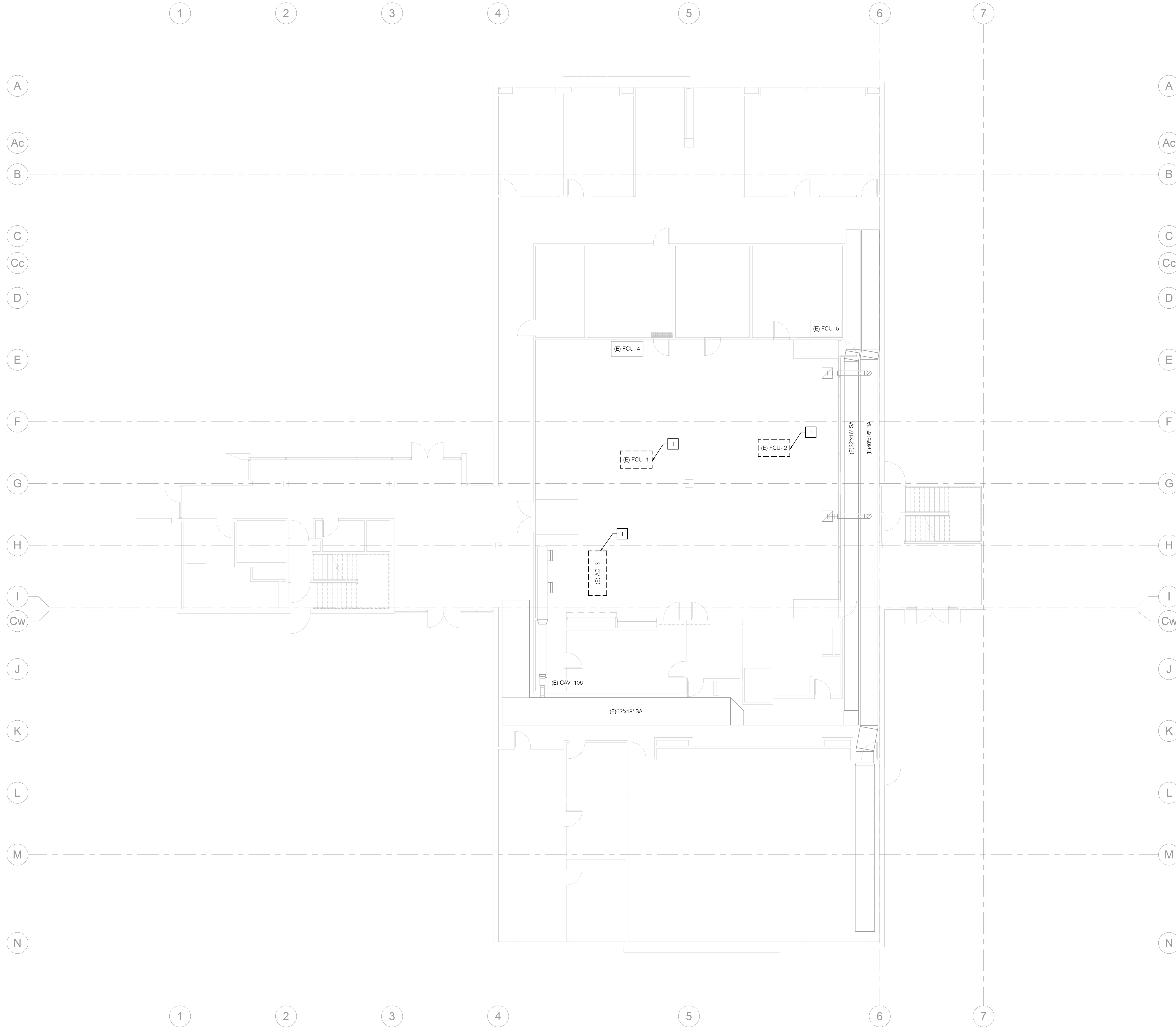
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FIRST FLOOR
HVAC
DEMOLITION
PLAN

MD2.11

NOTES
1 DISCONNECT AND REMOVE EXISTING HVAC UNIT.



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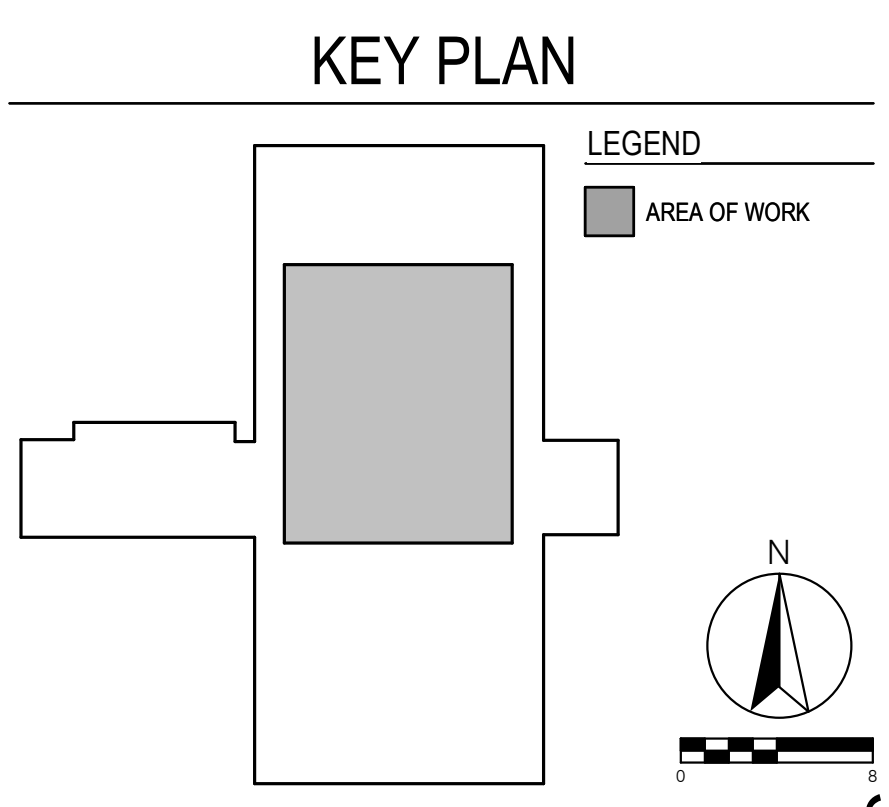
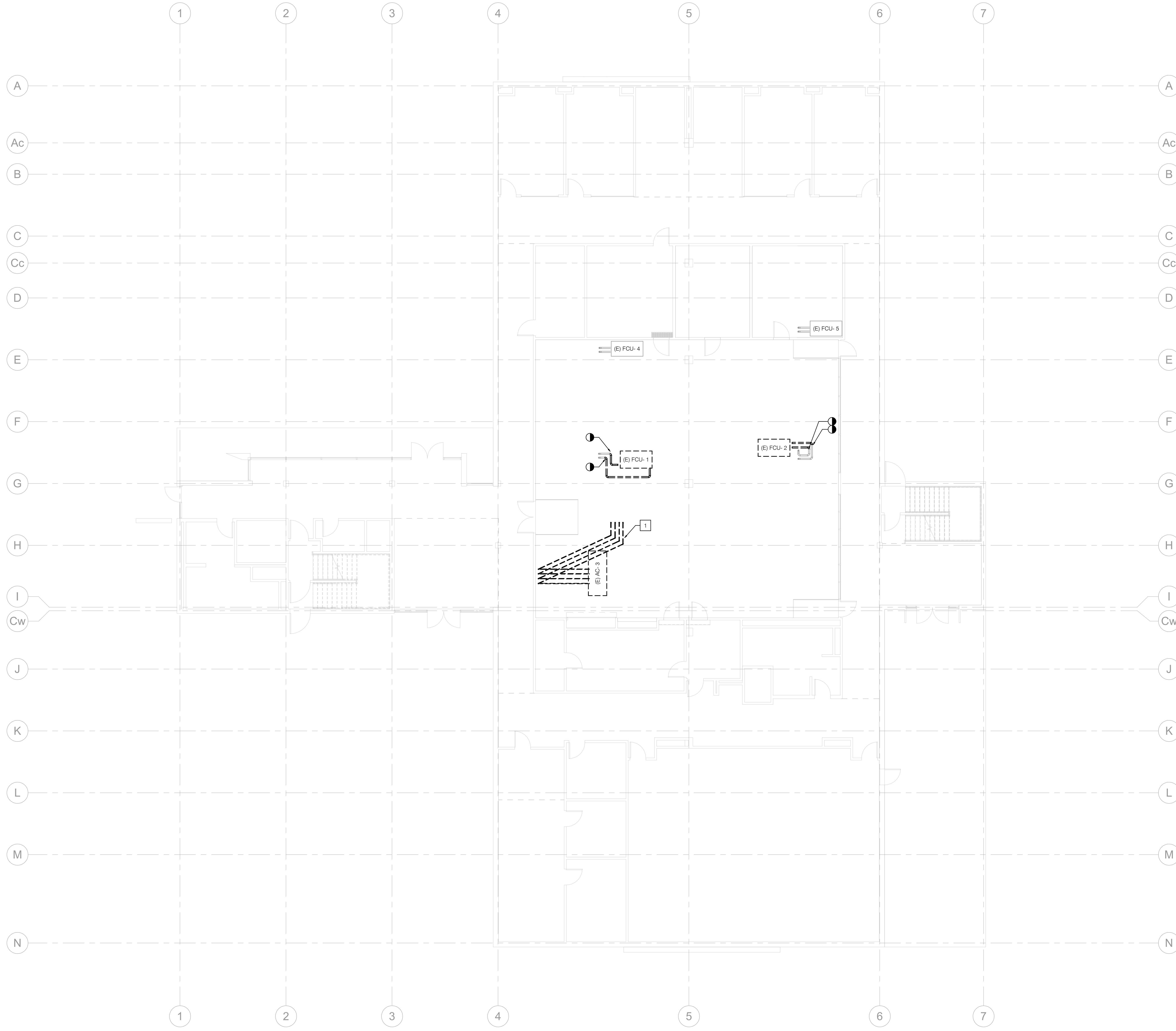
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FIRST FLOOR
PIPING
DEMOLITION
PLAN

MD2.12

NOTES
1 DISCONNECT AND REMOVE EXISTING REFRIGERANT LINES FROM DATA CENTER UP TO ROOF. TRACE LINES UP TO ROOF AND COORDINATE DEMOLITION ON 2ND FLOOR AS NEEDED.



LEGEND

SYMBOL	DESCRIPTION
	NOTE CALLOUT
	DETAIL CALLOUT - NUMBER ON TOP DENOTES DETAIL NUMBER - NUMBER ON BOTTOM DENOTES SHEET DETAIL IS SHOWN
	PLUMBING FIXTURE CALLOUT, SEE PLUMBING PLANS FOR EXACT LOCATION AND REQUIREMENTS
	EQUIPMENT CALLOUT, SEE PLUMBING PLANS FOR EXACT LOCATION AND REQUIREMENTS
	SECTION CALLOUT
	POINT OF CONNECTION
	POINT OF DISCONNECTION
	NEW PIPE (SIZE-SERVICE)
	EXISTING PIPE/EQUIPMENT
	DEMOLISHED PIPE/EQUIPMENT
	SANITARY VENT
	DOMESTIC / INDUSTRIAL HOT WATER RETURN
	DOMESTIC / INDUSTRIAL HOT WATER SUPPLY
	DOMESTIC / INDUSTRIAL COLD WATER
	VALVE AT DROP
	VALVE AT RISE
	ELBOW DOWN
	PIPE TEE UP & DOWN OR ELBOW UP
	PIPE TEE DOWN
	PIPE TEE UP
	SOLENOID VALVE
	GATE VALVE
	BALL VALVE
	BALANCING VALVE
	PRESSURE REDUCING VALVE
	CHECK VALVE, SWING
	PLUG VALVE
	STRAINER, Y-TYPE
	FLOW METER
	BACKFLOW PREVENTER
	HOSE BIBB
	FLOOR DRAIN
	FLOOR SINK, 1/2 GRATE
	AREA DRAIN / INDUSTRIAL RECEPTOR
	SHUT-OFF VALVE IN YARDBOX
	FLOOR CLEANOUT
	CLEANOUT TO GRADE
	WALL CLEANOUT

ABBREVIATIONS

ABBREVIATION	DESCRIPTION
@	AT
A/C	ABOVE CEILING
ABV	ABOVE
AD	AREA DRAIN
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AFSR	AUTOMATIC FIRE SPRINKLER RISER
B/F	BELOW FLOOR
B/G	BELOW GRADE
BEL	BELOW
BFP	BACKFLOW PREVENTER
BTM	BOTTOM
BY	BALL VALVE
CI	CAST IRON
CLG	CAST IRON PIPE
CEILING	CEILING
CLG	CLEAN-OUT TO GRADE
CU	CUBIC
DEPT	DEPARTMENT
DF	DRINKING FOUNTAIN
DIA	DIAMETER
DN	DOWN
DS	DOWNSPOUT
DWG	DRAWING(S)
EQUIP	EQUIPMENT
EWC	ELECTRICAL WATER COOLER
EXIST / (E)	EXISTING
F/A	FROM ABOVE
F/B	FROM BELOW
FCC	FLOOR CLEAN-OUT
FD	FLOOR DRAIN
FF	FINISHED FLOOR
FM	FORCE MAIN
FS	FLOOR SINK
FT	FEET
GPM	GALLONS PER MINUTE
GPR	GAS PRESSURE REGULATOR
HSCW	HOT AND COLD WATER
HL	HIGH LEVEL
HDR	HEADER
IN	INCHES
L or LAV	LAVATORY
MAX	MAXIMUM
MIN	MINIMUM
MTD	MOUNTED
NTS	NOT TO SCALE
OS & Y	OPEN SCREW AND YOKE
POC	POINT OF CONNECTION
POD	POINT OF DISCONNECTION
PSI	POUNDS PER SQUARE INCH
RD	ROOF DRAIN
Ri & C	ROUGH-IN AND CONNECT
SOV	SHUT-OFF VALVE
SQ	SQUARE
SS	SERVICE SINK
T/A	TO ABOVE
T/B	TO BELOW
TP	TRAP PRIMER
TYP	TYPICAL
U	UNDERGROUND
UG	UNDERGROUND
UON	UNLESS OTHERWISE NOTED
VTR	VENT THRU ROOF
W	WITH
WC	WATER CLOSET
WCO	WALL CLEAN-OUT
WH	WATER HEATER
WHA	WATER HAMMER ARRESTOR

PIPE SYSTEM ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AR	ARGON
AW	ACID WASTE
AV	ACID VENT
C02	CARBON DIOXIDE
C2H4	METHANE
CA	COMPRESSED AIR
CD	CONDENSATE DRAIN
CW	DOMESTIC COLD WATER
DI	DEIONIZED WATER
F	FIRE PROTECTION WATER SUPPLY
G	LOW PRESSURE NATURAL GAS
GW	GREASE WASTE
GWV	GREASE WASTE VENT
H	HYDROGEN
HE	HELIUM
HPA	HIGH PRESSURE COMPRESSED AIR
HPG	HIGH PRESSURE GAS
HW	DOMESTIC HOT WATER
HWR	DOMESTIC HOT WATER RETURN
ICW	INDUSTRIAL COLD WATER
IHW	INDUSTRIAL HOT WATER
IHWV	INDUSTRIAL HOT WATER RETURN
IW	INDIRECT WASTE
LN2	LIQUID NITROGEN
MFG	MEDIUM PRESSURE GAS
N2	NITROGEN
O2	OXYGEN
OD	OVERFLOW DRAIN
RW	RO WASTE
S	SANITARY
SD	STORM DRAIN
SSD	SUB SOIL DRAINAGE
TW	TEMPERED WATER
TWR	TEMPERED WATER RETURN
V	VENT
VAC	VACUUM
W	WASTE

GENERAL NOTES

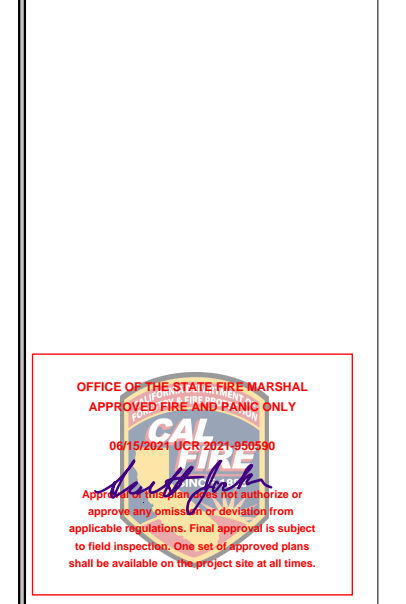
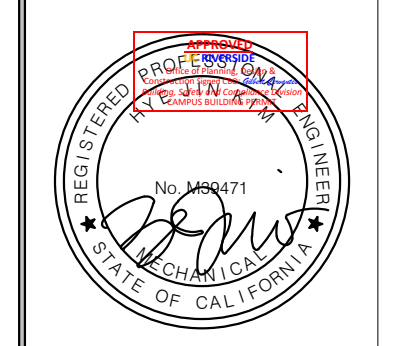
- ALL WORK SHALL COMPLY WITH THE 2019 EDITIONS OF THE CALIFORNIA BUILDING, MECHANICAL PLUMBING AND OTHER APPLICABLE FEDERAL, STATE, OR LOCAL CODES AS ADOPTED AND ENFORCED BY THE LOCAL JURISDICTION. IN CASE THE PLANS SHOW MORE STRINGENT REQUIREMENTS, THE PLANS SHALL GOVERN THE DESIGN. YET NOTHING ON THE DESIGN DOCUMENTS SHALL BE INTERPRETED AS AUTHORITY TO VIOLATE CODE(S) OR REGULATIONS(S).
- SUBMISSION OF BID IN CONNECTION WITH THIS WORK SHALL IMPLY THAT THE BIDDER HAS EXAMINED THE JOB SITE UNDER WHICH THE CONTRACTOR WILL BE OBLIGATED TO OPERATE UNDER THIS CONTRACT. NO EXTRA CHARGE WILL BE ALLOWED FOR FAILURE OF ANY BIDDER TO EXAMINE THE SITE PRIOR TO BID.
- WHERE USED, THE TERM "PROVIDE" SHALL MEAN "FURNISH AND INSTALL".
- IN THE EVENT OF A CONFLICT OR INCONSISTENCY BETWEEN ITEMS INDICATED ON DESIGN PLANS / SPECIFICATIONS WITH CODE REQUIREMENTS, THE MORE STRINGENT STANDARD SHALL PREVAIL.
- CONTRACTOR SHALL COORDINATE HIS WORK WITH ALL OTHER TRADES PRIOR TO FABRICATION, PURCHASE AND/OR INSTALLATION OF ALL WORK.
- CONTRACTOR SHALL FURNISH LABOR, MATERIALS, EQUIPMENT, AND TRANSPORTATION AS REQUIRED TO PROPERLY INSTALL ALL PLUMBING SYSTEMS OR RELATED COMPONENTS AS INDICATED ON PLANS AND SPECIFIED HEREIN.
- CONTRACTOR SHALL DOCUMENT AND RELAY ANY MAJOR DEVIATIONS FROM THE DESIGN DOCUMENTS, AND ATTAIN APPROVAL FROM THE MECHANICAL ENGINEER BEFORE PROCEEDING. AS-BUILT COPIES SHALL BE PROVIDED INDICATING ALL CHANGES / DEVIATIONS MADE DURING CONSTRUCTION. CONTRACTOR SHALL PROVIDE COMPLETED AS-BUILT DRAWINGS IN THE LATEST VERSION OF AUTOCAD OR REVIT.
- NO PIPING, EQUIPMENT, ETC. SHALL BE REMOVED, DISCONNECTED OR SHUT DOWN WITHOUT PRIOR REVIEW WITH THE FACILITY TO CONFIRM THAT AREAS TO REMAIN IN OPERATION WILL NOT BE AFFECTED. IF ANY AREAS NOT WITHIN THE SCOPE OF WORK ARE AFFECTED BY ANY SHUTDOWN, REMOVAL OR DISCONNECTION, SUFFICIENT ADVANCE NOTICE MUST BE GIVEN TO THE FACILITY INDICATING WHICH AREAS WILL BE AFFECTED, WHEN THE PROPOSED SHUTDOWN WILL OCCUR, AND FOR HOW LONG A PERIOD OF TIME.
- THE ARRANGEMENT OF EQUIPMENT AND PIPING SHOWN ON THE DRAWINGS IS BASED UPON INFORMATION AVAILABLE TO THE ENGINEER AT THE TIME OF DESIGN AND IS NOT INTENDED TO SHOW EXACT DIMENSIONS PECULIAR TO A SPECIFIC MANUFACTURER. THE DRAWINGS ARE, IN PART, DIAGRAMMATIC AND SOME FEATURES OF THE ILLUSTRATED EQUIPMENT INSTALLATION MAY REQUIRE REVISION TO MEET ACTUAL EQUIPMENT INSTALLATION REQUIREMENTS, STRUCTURAL SUPPORTS, FOUNDATIONS, CONNECTED PIPING, VALVES, PIPE SUPPORTS AND ELECTRICAL CONDUIT SPECIFIED MAY HAVE TO BE ALTERED OR ADDITIONAL ITEMS REQUIRED TO ACCOMMODATE THE EQUIPMENT PROVIDED. NO ADDITIONAL PAYMENT WILL BE MADE FOR SUCH REVISIONS, ALTERATIONS AND / OR ADDITIONS.
- PIPING THROUGH FIRE RATED WALLS SHALL BE PER U.L. FIRE RESISTANCE SYSTEM NO. W1001. SEE ARCHITECTURAL PLANS FOR ALL WALL LOCATIONS.
- ALL VALVES, TRAP PRIMERS, WATER HAMMER ARRESTORS OR OTHER EQUIPMENT SHOWN IN WALLS OR ABOVE NON-ACCESSIBLE CEILINGS SHALL BE INSTALLED BEHIND AN ACCESS PANEL.
- ALL CONNECTIONS TO EXISTING SERVICES SHALL BE MADE SUCH THAT INTERRUPTION TIME WILL BE AS SHORT AS POSSIBLE. THE CONTRACTOR SHALL GIVE THE OWNERS REPRESENTATIVE SUFFICIENT NOTICE OF SUCH INTERRUPTION AND THE ACTUAL SHUT-DOWN TIME SHALL BE AT A TIME DESIGNATED BY THE OWNERS REPRESENTATIVE.
- ALL VALVES, UNIONS, ETC. TO BE SAME SIZE AS LINE SIZE UNLESS OTHERWISE INDICATED ON DRAWINGS.
- UNIONS SHALL BE PROVIDED AND INSTALLED AFTER EACH SCREW-TYPE VALVE AND PRIOR TO EQUIPMENT CONNECTIONS.
- ALL SOIL, WASTE, STORM DRAIN, ACID WASTE, GREASE WASTE AND VENT PIPING SHALL SLOPE AT 2% UNLESS OTHERWISE INDICATED.
- BEFORE FABRICATION OR INSTALLATION, THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS OF ALL EQUIPMENT AND FIXTURES. EXACT ROUGH-IN LOCATIONS AND REQUIREMENTS SHALL BE COORDINATED IN FIELD.
- VERIFY WITH ARCHITECTURAL DRAWINGS FOR EXACT LOCATIONS OF ALL FLOOR DRAINS, ROOF, OVERFLOW DRAINS AND FLOOR SINKS.
- PROVIDE AND INSTALL WATER HAMMER ARRESTORS IN THE FOLLOWING LOCATIONS (ONLY NON-FERROUS ARRESTORS MAY BE INSTALLED IN ANY WATER SYSTEM):
 - WATER LINES TO LAVATORY HEADERS, WATER CLOSET AND URINAL HEADERS, SERVICE SINKS, KITCHEN SINKS, WASH FOUNTAINS, DRINKING FOUNTAINS, LABORATORIES WITH MEDICAL TYPE FALCETS AND ON WASH SINKS HAVING 3 OR MORE STATIONS AND ALL OTHER QUICK-CLOSING FIXTURE SUCH AS CLOTHES WASHERS, AS CLOSE TO FIXTURE AS POSSIBLE. BETWEEN LAST 2 FIXTURES WHEN 3 OR MORE FIXTURES, OTHER THAN THOSE LISTED IN "A" ABOVE, ARE SERVED BY A COMMON HEADER.
 - WHEN ARRESTOR SHALL BE INSTALLED IN WALL OR FURRING, FURNISH WITH AN ACCESS PLATE LARGE ENOUGH TO PERMIT REMOVAL OF ARRESTOR. ACCESS PLATE SHALL BE A MINIMUM OF 2 INCHES LARGER IN EACH DIRECTION THAN ARRESTOR AND MINIMUM 12" X 12".
- CLEANOUTS SHALL BE PROVIDED PER 2019 CPC SECTION 707.0 & 719.0 AND TO THE FOLLOWING LOCATIONS:
 - AT EACH BASE OF ROOF DRAIN DOWNSPOUTS.
 - AT EACH BASE OF WASTE STACK.
 - AT EVERY 100 FT OF STRAIGHT RUN OF HORIZONTAL PIPING.
 - AT EACH AGGREGATE HORIZONTAL CHANGE IN DIRECTION EXCEEDING ONE HUNDRED THIRTY-FIVE (135) DEGREES.
 - AT EACH HORIZONTAL DRAINAGE PIPE UPPER TERMINAL.
 - ABOVE EACH URINAL.
 - BELOW EACH SINK.
- ALL PLUMBING FIXTURES AND FITTINGS SHALL MEET CALGREEN MANDATORY REQUIREMENT OF 20% REDUCED FLOW RATE SPECIFIED IN TABLE 5.303.2.3.
- UNLESS SPECIFIED ON STRUCTURAL DRAWINGS, ANY ALTERATION OR MODIFICATIONS TO STRUCTURAL ELEMENTS BY CUTTING, DRILLING, BORING, BRACING, WELDING ETC. SHALL HAVE WRITTEN APPROVAL BY THE STRUCTURAL ENGINEER PRIOR TO START WORK.

SHEET INDEX

SHEET	DESCRIPTION
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GENERAL NOTES,
 LEGEND,
 ABBREVIATIONS
 AND SHEET
 INDEX

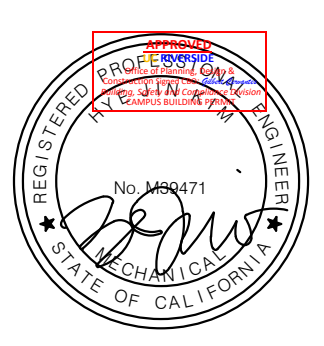
P0.01

PLUMBING FIXTURES

MARK	MANUFACTURER & MODEL	FIXTURE TYPE	PIPING REQUIREMENTS				REMARKS
			COLD WATER	HOT WATER	SOIL/WASTE	VENT	
HB-1	ACORN ENGINEERING 8121-LF	HOSE BIBB	3/4"	-	-	-	HOSE BIBB WITH ROUGH BRASS BODY. LOCKSHIELD BONNET. REMOVABLE LOOSE KEY WHEEL HANDLE AND ATMOSPHERIC VACUUM BREAKER.

PIPING MATERIALS

	SERVICE	MATERIALS
1.	DOMESTIC WATER PIPING ABOVE GRADE:	TYPE "L" COPPER TUBING, HARD DRAWN CONFORMING TO ASTM B 88, WITH WROUGHT COPPER SOLDER SWEAT FITTINGS AND LEAD FREE-SOLDER JOINTS.
2.	INDIRECT WASTE:	TYPE "L" COPPER TUBING, HARD DRAWN CONFORMING TO ASTM B 88, WITH WROUGHT COPPER SOLDER SWEAT FITTINGS AND LEAD FREE-SOLDER JOINTS.
3.	RO SYSTEM WASTE	CPVC DRAIN PIPE AND FITTINGS WITH ASTM F2618 PIPE AND DRAINAGE-PATTERN FITTINGS.
4.	PIPE PROTECTION: PROVIDE NON-CONDUCTING DIELECTRIC CONNECTIONS JOINING DISSIMILAR METALS. LEAD FREE BRASS UNIONS WITH 6-INCH LEAD FREE BRASS NIPPLE.	
5.	QUALITY ASSURANCE: THE PIPING SYSTEMS SHALL BE CONSTRUCTED FROM MATERIALS EXTRUDED AND MOLDED USING THE SAME COMPOUND MANUFACTURER.	
6.	QUALITY ASSURANCE: BOTH THE PIPE AND FITTINGS SHALL BE MANUFACTURED IN NORTH AMERICA AND MEET OR EXCEED THE REQUIREMENTS SET FORTH BY THE AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM) AND ANS/ANSI STANDARDS 14 AND 61.	



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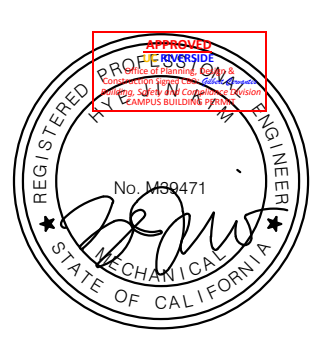
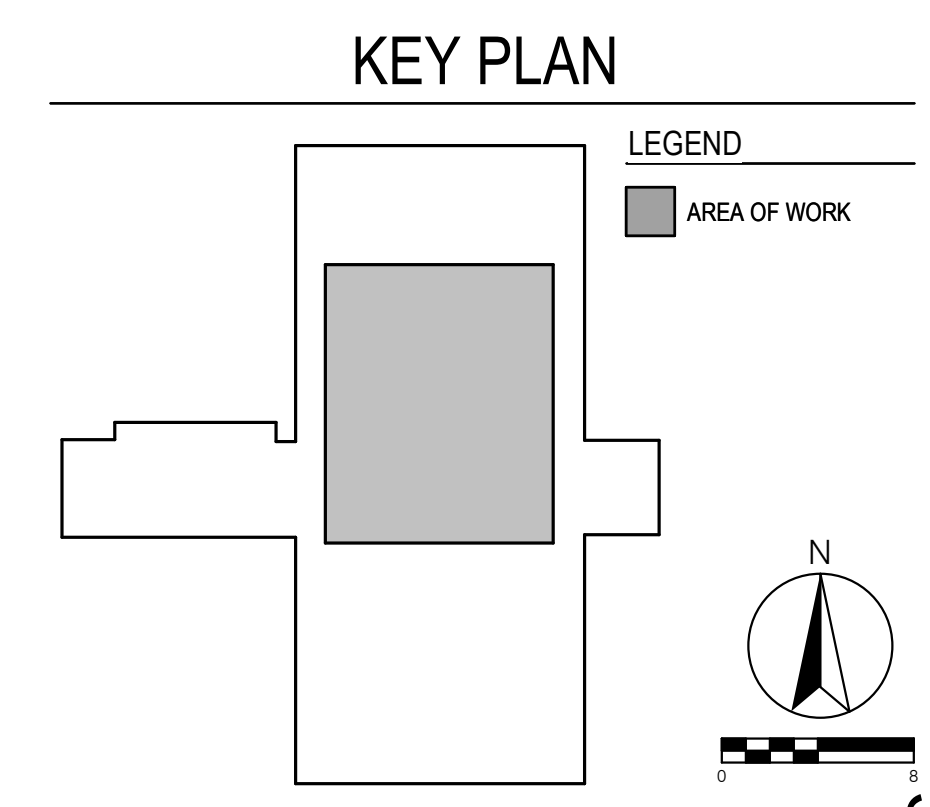
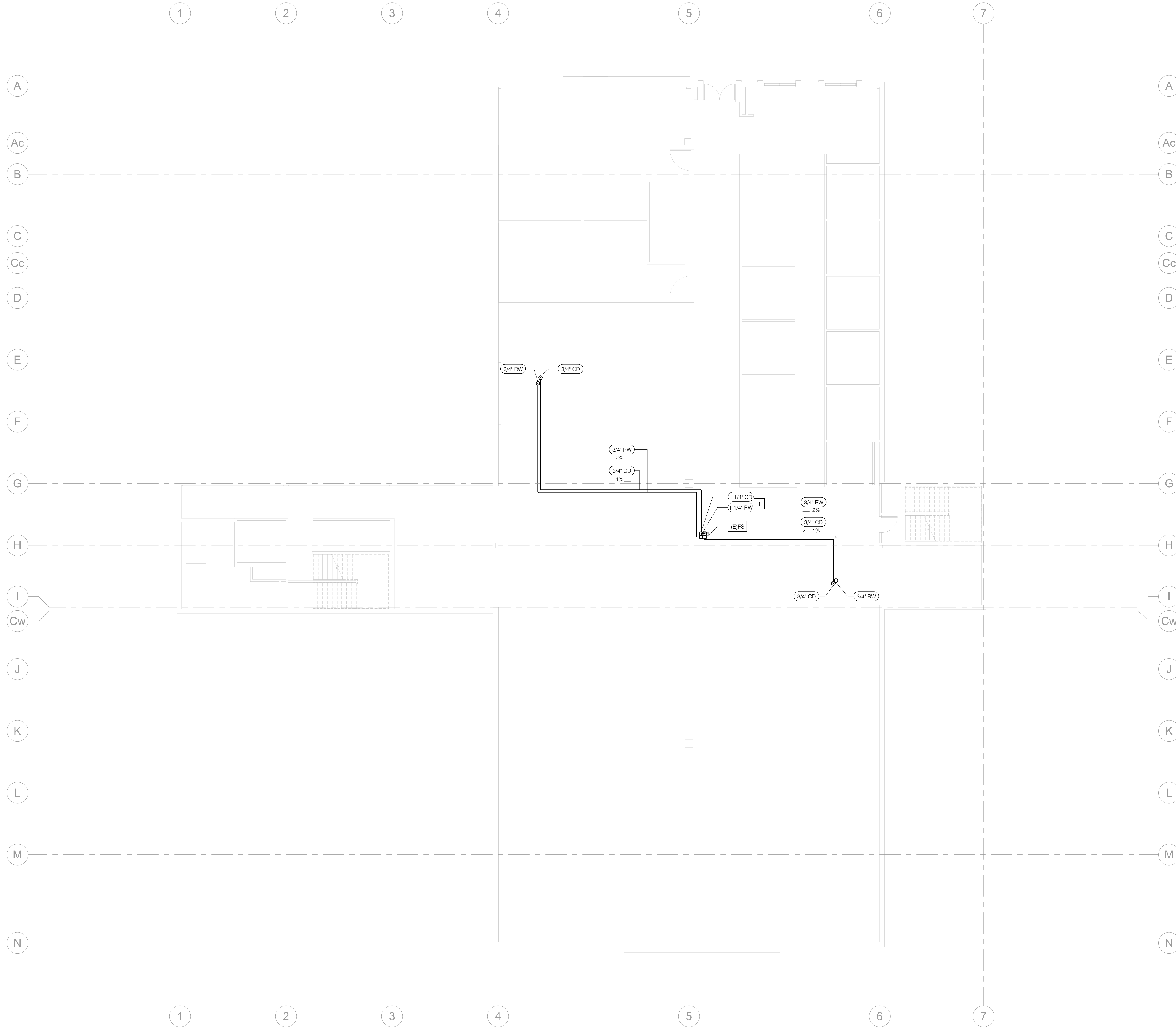
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SCHEDULES

P0.02

NOTES
1 1-1/4" CD AND 1-1/4" RW TO DISCHARGE TO (E) FS WITH 1" MINIMUM AIR GAP.



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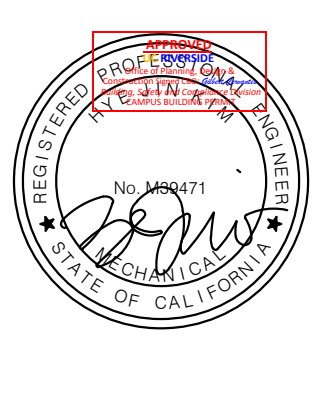
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BASEMENT FLOOR PLAN

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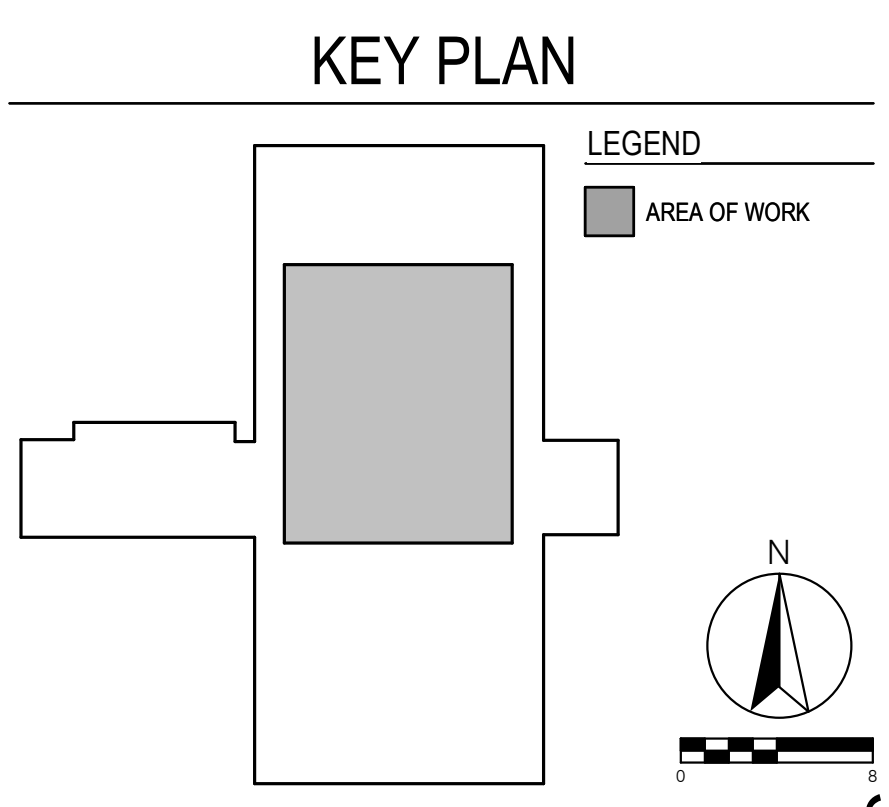
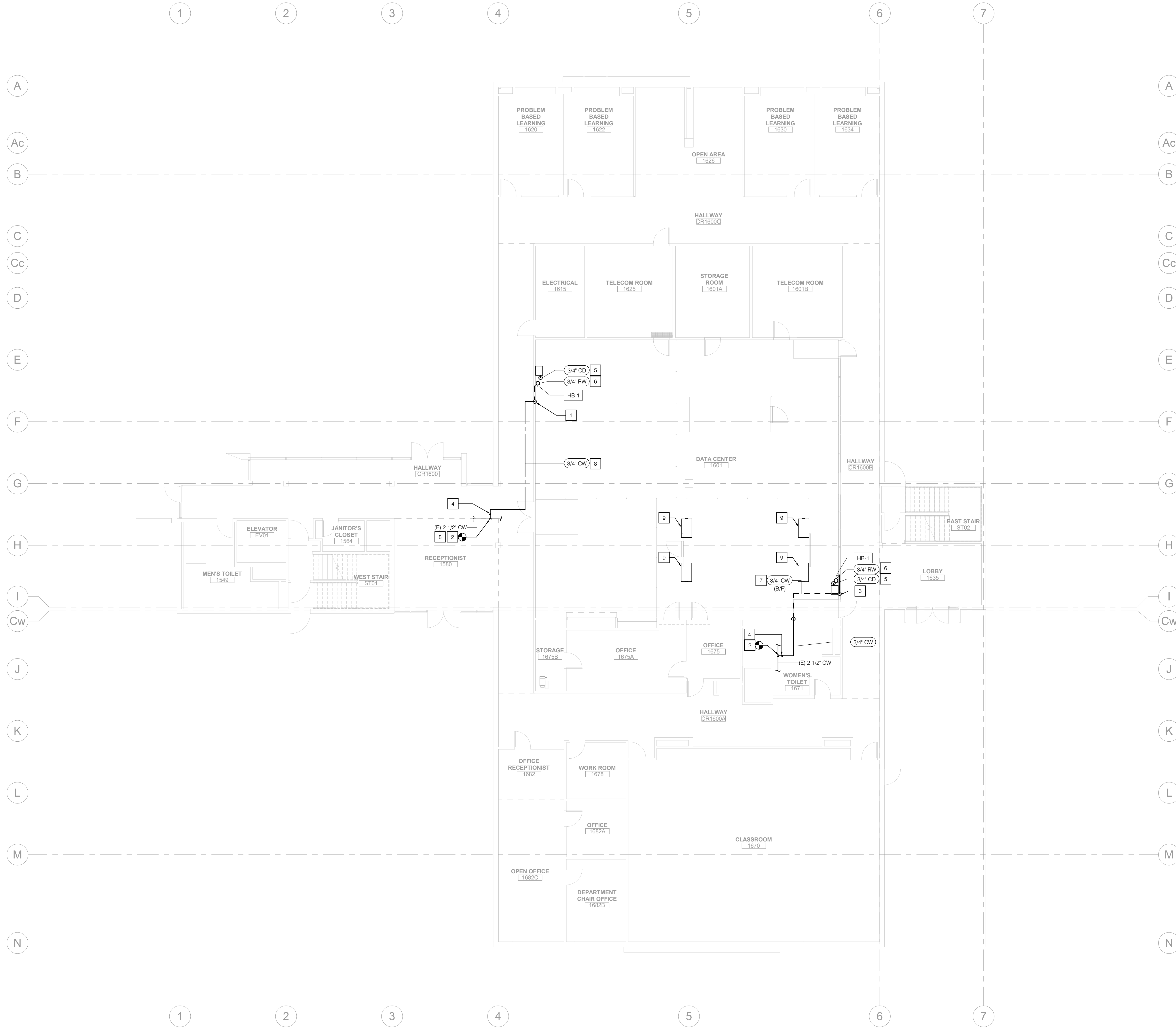
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FIRST FLOOR PLAN

P2.11

- NOTES**
- 3/4" CW DOWN IN WALL TO SERVE HB-1.
 - POC. CONNECT 3/4" CW TO (E) 2-1/2" CW.
 - 3/4" CW UP IN WALL TO SERVE HB-1.
 - 3/4" SHUT-OFF VALVE.
 - 3/4" CD FROM HUMIDIFIER DOWN THRU FLOOR.
 - 3/4" RW TO CONNECT TO RO SYSTEM DISCHARGE HOSE
3/4" RW DOWN THRU FLOOR.
 - BEL. RAISED FLOOR.
 - FIELD VERIFY POC AND ROUTING OF NEW WATER LINE IN CORRIDOR.
 - ALTERNATE #4 - CONNECT CONDENSATE TO EXISTING CONDENSATE DRAIN.



GENERAL NOTES

- ALL WORK SHALL COMPLY WITH THE 2019 EDITION OF THE CALIFORNIA ELECTRICAL CODE AND ALL OTHER APPLICABLE FEDERAL AND STATE. WHERE THE CONSTRUCTION DOCUMENTS INDICATE MORE RESTRICTIVE REQUIREMENTS, THE CONSTRUCTION DOCUMENTS SHALL GOVERN BUT THE CONSTRUCTION DOCUMENTS SHALL NOT BE INTERPRETED AS AUTHORITY TO VIOLATE ANY CODE OR REGULATION.
- ALL MATERIALS AND EQUIPMENT SHALL BE NEW AND SHALL BEAR THE UNDERWRITERS LABEL (UL) AND SHALL BE INSTALLED IN THE MANNER FOR WHICH THEY ARE DESIGNED AND APPROVED.
- THE CONTRACTOR SHALL NOT BORE, NOTCH OR IN ANY WAY CUT INTO ANY STRUCTURAL MEMBER WITHOUT WRITING APPROVAL FROM THE ARCHITECT OR STRUCTURAL ENGINEER.
- MEP COMPONENT ANCHORAGE NOTE:

ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA-APPROVED CONSTRUCTION DOCUMENTS. THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2019 CBC SECTIONS 1617A.1.18 THROUGH 1617A.1.26 AND ASCE 7-16 CHAPTERS 13, 26, AND 30:

- ALL PERMANENT EQUIPMENT AND COMPONENTS.
- TEMPORARY, MOVABLE OR MOBILE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS OR WATER. "PERMANENTLY ATTACHED" SHALL INCLUDE ALL ELECTRICAL CONNECTIONS EXCEPT PLUGS FOR 110/220 VOLT RECEPTACLES HAVING A FLEXIBLE CABLE.
- TEMPORARY, MOVABLE OR MOBILE EQUIPMENT WHICH IS HEAVIER THAN 400 POUNDS OR HAS A CENTER OF MASS LOCATED 4 FEET OR MORE ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT IS REQUIRED TO BE RESTRAINED IN A MANNER APPROVED BY DSA.

THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE BUT NEED NOT DEMONSTRATE DESIGN COMPLIANCE WITH THE REFERENCES NOTED ABOVE. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING, AND CONDUIT. FLEXIBLE CONNECTIONS MUST ALLOW MOVEMENT IN BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS.

- COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVING A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.
- COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS, LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL. THE ANCHORAGE OF ALL MECHANICAL, ELECTRICAL AND PLUMBING COMPONENTS SHALL BE SUBJECT TO THE APPROVAL OF THE DESIGN PROFESSIONAL IN GENERAL RESPONSIBLE CHARGE OR STRUCTURAL ENGINEER DELEGATED RESPONSIBILITY AND ACCEPTANCE BY DSA. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH THE ABOVE REQUIREMENTS.

- ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE:
ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN LATEST SECTIONS OF CBC AND ASCE.

THE BRACING AND ATTACHMENTS TO THE STRUCTURE SHALL BE DETAILED ON THE APPROVED DRAWINGS OR THEY SHALL COMPLY WITH ONE OF THE OSHDP PRE-APPROVALS (OFA #0052-13) AS MODIFIED TO SATISFY ANCHORAGE REQUIREMENTS OF ACI 318, APPENDIX D.

COPIES OF THE MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF HANGING AND BRACING OF ELECTRICAL DISTRIBUTION SYSTEMS.

ABBREVIATIONS

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
&	AND	LF	LINEAR FEET
1/C	SINGLE CONDUCTOR	LFMC	LIQUIDTIGHT FLEXIBLE METAL CONDUIT
A OR AMP	AMPERES	LGST	LARGEST
A.C.	ASPHALT CONCRETE	LI	LOAD INTERRUPTER SWITCH
ABV	ABOVE	LOC.	LOCATION
AF	AMPERE FUSE RATING	LOTO	LOCK-OUT & TAG-OUT
AFC	AVAILABLE FAULT CURRENT	LSI	LONG TERM, SHORT TERM, INSTANTANEOUS LIGHTING
AFB	ABOVE FINISHED FLOOR	LTG	LIGHTING
AFG	ABOVE FINISH GRADE	LV	LOW VOLTAGE
AIC	AMPERE INTERRUPTING CAPACITY	M	METER
AL	ALUMINUM	MAX	MAXIMUM
APPROX.	APPROXIMATE	MCA	MINIMUM CIRCUIT AMPS
ARCH.	ARCHITECT; ARCHITECTURAL	MCC	MOTOR CONTROL CENTER
AS	AMPERE SWITCH RATING	MCP	MOTOR CIRCUIT PROTECTOR
ASCC	AVAILABLE SHORT CIRCUIT CURRENT	MFR	MANUFACTURER
ATC	AIR TERMINAL CHAMBER	MH	MANHOLE
ATO	AUTOMATIC THROW-OVER (SWITCH)	MI	MECHANICAL INTERLOCK
ATS	AUTOMATIC TRANSFER SWITCH	MIN	MINIMUM
AUTO	AUTOMATIC	MOCIP	MAXIMUM OVERCURRENT PROTECTION
AUX	AUXILIARY	MRCT	MULTI-RATIO CURRENT TRANSFORMER
AWG	AMERICAN WIRE GAUGE	MTD	MOUNTED
B.S.	BARE STRANDED	MTG	MOUNTING
BAT	BATTERY	MTR	MOTOR
BEL	BELOW	MTTB	MAIN TELEPHONE TERMINAL BOARD
BKBD	BACKBOARD	MV	MEDIUM VOLTAGE
BKR	BREAKER	N	NORTH
BLDG	BUILDING	NAC	NOTIFICATION APPLIANCE CIRCUIT
C	CONDUIT	NC	NORMALLY CLOSED
C.O.	CONDUIT ONLY WITH PULL WIRE	NEC	NATIONAL ELECTRICAL CODE
CB	CIRCUIT BREAKER	NEF	NON-FUSED
CC	CONSTANT CURRENT	NIC	NOT IN CONTRACT
CKT	CIRCUIT	NL	NIGHT LIGHT- 24HRS ON NUMBER
CL	CENTER LINE	NO.	NUMBER
CLG	CEILING	OC	ON CENTER
CMU	CONCRETE MASONRY UNIT	OCPD	OVERCURRENT PROTECTIVE DEVICE
COL	COLUMN	OD	OUTSIDE DIAMETER
CP	COMMUNICATION PROCESSOR	OE	OVERHEAD ELECTRICAL
CPT	CONTROL POWER TRANSFORMER	OF	OIL-FUSED CUTOUT
CR	CONTROL RELAY	OHC	OIL HUSED
CSFD	COMBINATION SMOKE FIRE DAMPER	OLS	OIL LEVER SWITCH
CT	CURRENT TRANSFORMER	P	POLE
CU	COPPER	PAC	PROGRAMMABLE AUTOMATION CONTROLLER
CW	COLD WATER	PB	PULL BOX
DIAG	DIAGRAM	PC	PHOTOCELL
DIS	DISCONNECT	PCB	POLYCHLORINATED BIPHENYL
DIST.	DISTANCE	PDS	PRESSURE DIFFERENTIAL SWITCH
DL	DAMP LOCATION LISTING	PF	POWER FACTOR
DM	DIGITAL METER	PH	PHASE
DMM	DIGITAL METER MODULE	PI	PISTON INDICATING VALVE
DP	DISTRIBUTION PANEL	PL	PLATE
DWG	DRAWING	PLC	PROGRAMMABLE LOGIC CONTROLLER
DWP	DEPARTMENT OF WATER & POWER	PNL	PANEL
EA	EACH	PNC	POINT OF CONNECTION
ECM	ELECTRIC CIRCUIT MONITOR	PREF.	PREFERRED
ELEC.	ELECTRICAL	PRM	PRIMARY
EM	EMERGENCY	PVC	POLY-VINYL CHLORIDE
EMH	ELECTRICAL MANHOLE	PWR	POWER
EML	ELECTRICAL METALLIC TUBING	REC/RECEPT	RECEPTACLE
EPO	EMERGENCY POWER OFF	REQD	REQUIRED
EPR	ETHYLENE PROPYLENE RUBBER	RGS	RIGID GALVANIZED STEEL
EQUIP	EQUIPMENT	RM	ROOM
EXISTING	EXISTING TO BE RELOCATED AND RECONNECTED	RMC	RIGID METAL CONDUIT
EXIST(E)	EXISTING	RPBP	REDUCED PRESSURE BACK FLOW PREVENTER
EXP	EXPLOSION PROOF	RTAC	REAL TIME
FA	FIRE ALARM	SCOR	SHORT CIRCUIT CURRENT RATING
FACP	FIRE ALARM CONTROL PANEL	SCE	SOUTHERN CALIFORNIA EDISON
FATC	FIRE ALARM TERMINAL CABINET	SF	SQUARE FEET
FFE	FINISHED FLOOR ELEVATION	SHT	SHEET
FIN.	FINISH	SIG.	SIGNAL
FIP.	FIELD INTERFACE PANEL	SP	SPARE
FKT	FIXTURE	SPECS	SPECIFICATIONS
FLA	FULL LOAD AMPS	ST	STREET
FLR	FLOOR	STD	STANDARD
FLUOR	FLUORESCENT	STP	SHIELDED TWISTED PAIR
FMC	FLEXIBLE METAL CONDUIT	SW	SWITCH
FO	FIBER OPTIC	SWBD	SWITCHBOARD
FT	FEET	SWGR	SWITCHGEAR
FTG	FOOTING	SWST	SWITCHING STATION
GEN	GENERATOR	T.O.D.	TOP OF DUCTBANK
GF1	GROUND FAULT INTERRUPTER	T.O.M.	TOP OF MANHOLE
GFR	GROUND FAULT RELAY	TB	TERMINAL BLOCK
GG	GREEN GROUND	TEL./TELE	TELEPHONE
GND	GROUND	TMH	TELEPHONE MANHOLE
HOA	HAND-OFF-AUTOMATIC	TPS	TWISTED SHIELDED PAIR
HP	HORSEPOWER	TRANSF./XFMR	TRANSFORMER
HT	HEIGHT	TS	TAMPER SWITCH
HTR	HEATER	TYP	TYPICAL
HV	HIGH VOLTAGE	UG	UNDERGROUND
HZ	HERTZ	UJON	UNLESS OTHERWISE NOTED
ICON	INTEGRATED COMMUNICATIONS OPTICAL NETWORK	V	VOLTS
IE	INVERT ELEVATION	VA	VOLT-AMPERES
IED	INTELLIGENT ELECTRONIC DEVICE	VB	VIBRATION SWITCH
IMC	INTERMEDIATE METAL CONDUIT	VFD	VARIABLE FREQUENCY DRIVE
INCAND	INCANDESCENT	W	WATTS
ISC	SHORT CIRCUIT CURRENT	W/O	WITHOUT
J, JB, J-BOX	JUNCTION BOX	WP	WEATHERPROOF
KDML	THOUSAND CIRCULAR MILS	Z	IMPEDANCE
KV	KILOVOLT		
KVA	KILOVOLT-AMPERES		
KW	KILOWATT		

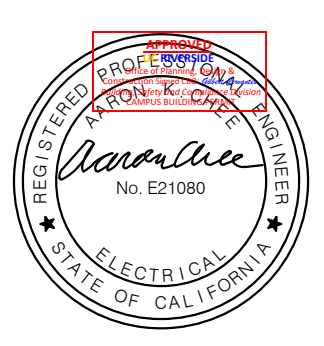
IN THE EVENT ABBREVIATIONS NOT MENTIONED HEREIN ARE USED, REFERENCE WILL BE MADE TO ANSI Y1.1, MILITARY STANDARD ABBREVIATIONS AND OTHER STANDARD INDUSTRY CONVENTIONS.

LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	NOTE CALLOUT		JUNCTION BOX
	DETAIL CALLOUT - NUMBER ON TOP DENOTES DETAIL NUMBER - NUMBER ON BOTTOM DENOTES SHEET DETAIL IS SHOWN		RELAY
	MECHANICAL EQUIPMENT CALLOUT. SEE MECHANICAL PLANS FOR EXACT LOCATION AND REQUIREMENTS		EMERGENCY RELAY UL 924 COMPLIANT
	SECTION CALLOUT		MOTION SENSOR - CEILING MOUNTED
	FEEDER CALLOUT		MOTION SENSOR - CORNER OR WALL MOUNTED
	EXISTING FEEDER CALLOUT		MOTION SENSOR WITH ASLE/CORRIDOR LENS - CEILING MOUNTED
	NEW LINEWORK		LIGHTING CONTROL NETWORK DEVICE
	EXISTING LINEWORK		DIGITAL TIMER SWITCH
	CONDUIT CONCEALED IN WALL OR ABOVE CEILING		MOTION SENSOR SWITCH
	CONDUIT EXPOSED		LOW VOLTAGE SWITCH
	CONDUIT CONCEALED UNDERGROUND OR BELOW FLOOR		DIGITAL DIMMING SWITCH
	CONDUIT EMERGENCY		PANELBOARD - RECESSED MOUNTED
	MULTI-CHANNEL RACEWAY		PANELBOARD - SURFACE MOUNTED
	CONDUIT TURNED UP		DISTRIBUTION PANEL/ BOARD
	CONDUIT CAPPED		SINGLE POLE SWITCH. DEVICE SHALL BE MOUNTED +48" MAX AND +36" MIN FROM THE CENTER OF DEVICE.
	BRANCH CIRCUIT HOMERUN TO PANELBOARD AND CIRCUITS AS INDICATED		SWITCH 3-WAY (48" AFF MAXIMUM)
	3/4" CONDUIT. TICK MARKS INDICATE QUANTITY OF #12 AWG WIRES (UNLESS NOTED OTHERWISE, NO MARKS INDICATES 2#12 & 1#12 GND WIRES)		RECESSED ON WALL SURFACE FLOOR OR CEILING G=GFCI, WP=WEATHER PROOF G=GFCI, WP=WEATHER PROOF C=CEILING
	- SMALL MARK DENOTES HOT WIRE - LARGE MARK DENOTES NEUTRAL WIRE - DIAGONAL DENOTES GROUND WIRE		20A, 125V DUPLEX RECEPTACLE MOUNTED +15" AFF, UNLESS OTHERWISE NOTED
	GENERATOR		20A, 125V QUAD RECEPTACLE MOUNTED +15" AFF, UNLESS OTHERWISE NOTED
	SWITCH		20A, 125V DUPLEX RECEPTACLE RECEPTACLE ON DEDICATED CIRCUIT
	CIRCUIT BREAKER		20A, 125V CONTROLLED DUPLEX RECEPTACLE
	2-WAY SWITCH, TRANSFER SWITCH		20A, 125V QUAD RECEPTACLE (HALF) CONTROLLED RECEPTACLE
	FUSE		SPECIAL RECEPTACLE REFER TO DRAWINGS FOR NEMA CONFIGURATION
	TRANSFORMER		JUNCTION BOX
	GROUND CONNECTION		
	MOTOR - SINGLE PHASE FRACTIONAL OR INTEGRAL HORSEPOWER		
	METER		
	ELECTRONIC CIRCUIT MONITOR		
	480V DRAWOUT BREAKER		
	VARIABLE FREQUENCY DRIVE		
	PANEL		
	FUSED DISCONNECT SWITCH		
	NON-FUSED DISCONNECT SWITCH		
	COMBINATION STARTER/DISCONNECT SWITCH		
	SWITCH MOTOR RATED		
	SPLICE		
	EXISTING TERMINATION		
	MEDIUM VOLTAGE - AIR CIRCUIT BREAKER DRAWOUT BREAKER		
	MEDIUM VOLTAGE FUSED DISCONNECT SWITCH		
	MEDIUM VOLTAGE EXISTING MODULAR SPLICE		
	2x4 LIGHT FIXTURE - UPPER CASE LETTER INDICATES LIGHT FIXTURE CALLOUT. LOWER CASE LETTER INDICATES LIGHTING CONTROL ZONE.		
	2x4 EMERGENCY LIGHT FIXTURE FED FROM GENERATOR/ INVERTER/ BATTERY BACKUP		
	2x2 LIGHT FIXTURE - UPPER CASE LETTER INDICATES LIGHT FIXTURE CALLOUT. LOWER CASE LETTER INDICATES LIGHTING CONTROL ZONE.		
	2x2 EMERGENCY LIGHT FIXTURE FED FROM GENERATOR/ INVERTER/ BATTERY BACKUP		
	LINEAR LIGHT FIXTURE. DIMENSIONS PER PLANS - UPPER CASE LETTER INDICATES LIGHT FIXTURE CALLOUT. LOWER CASE LETTER INDICATES LIGHTING CONTROL ZONE.		
	EMERGENCY LINEAR LIGHT FIXTURE. DIMENSIONS PER PLANS - LIGHT FIXTURE FED FROM GENERATOR/ INVERTER/ BATTERY BACKUP		
	LED STRIP LIGHT FIXTURE - UPPER CASE LETTER INDICATES LIGHT FIXTURE CALLOUT. LOWER CASE LETTER INDICATES LIGHTING CONTROL ZONE.		

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E0.04	SCHEDULES
E2.11	FIRST FLOOR POWER PLAN
E2.12	FIRST FLOOR DEMO LIGHTING PLAN
E2.31	ROOF POWER PLAN
E6.01	SINGLE LINE DIAGRAM



REVISIONS

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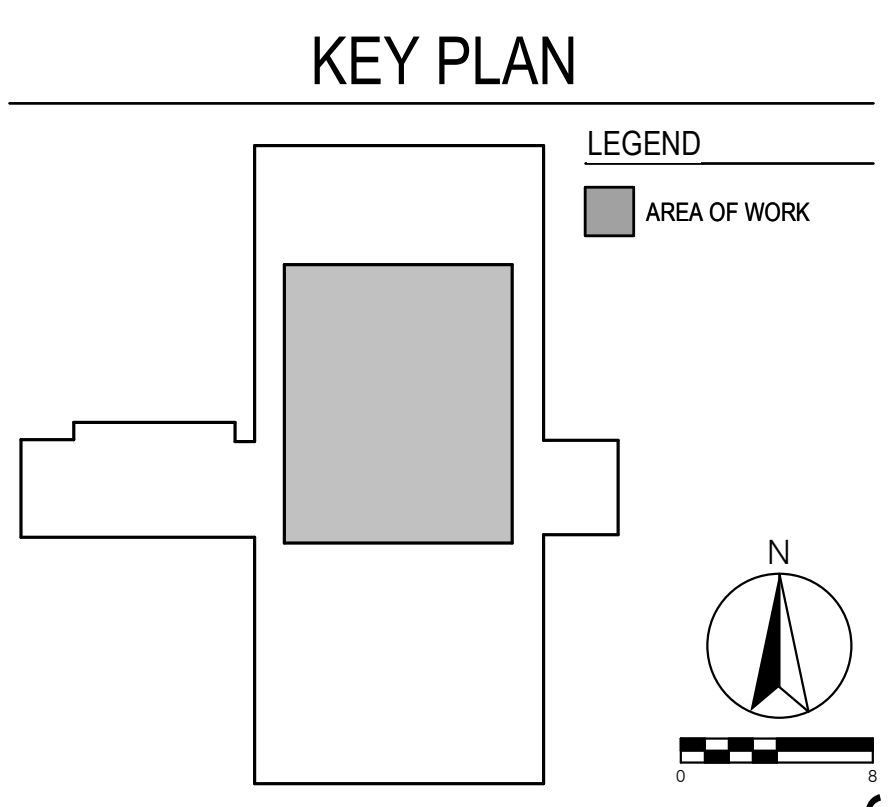
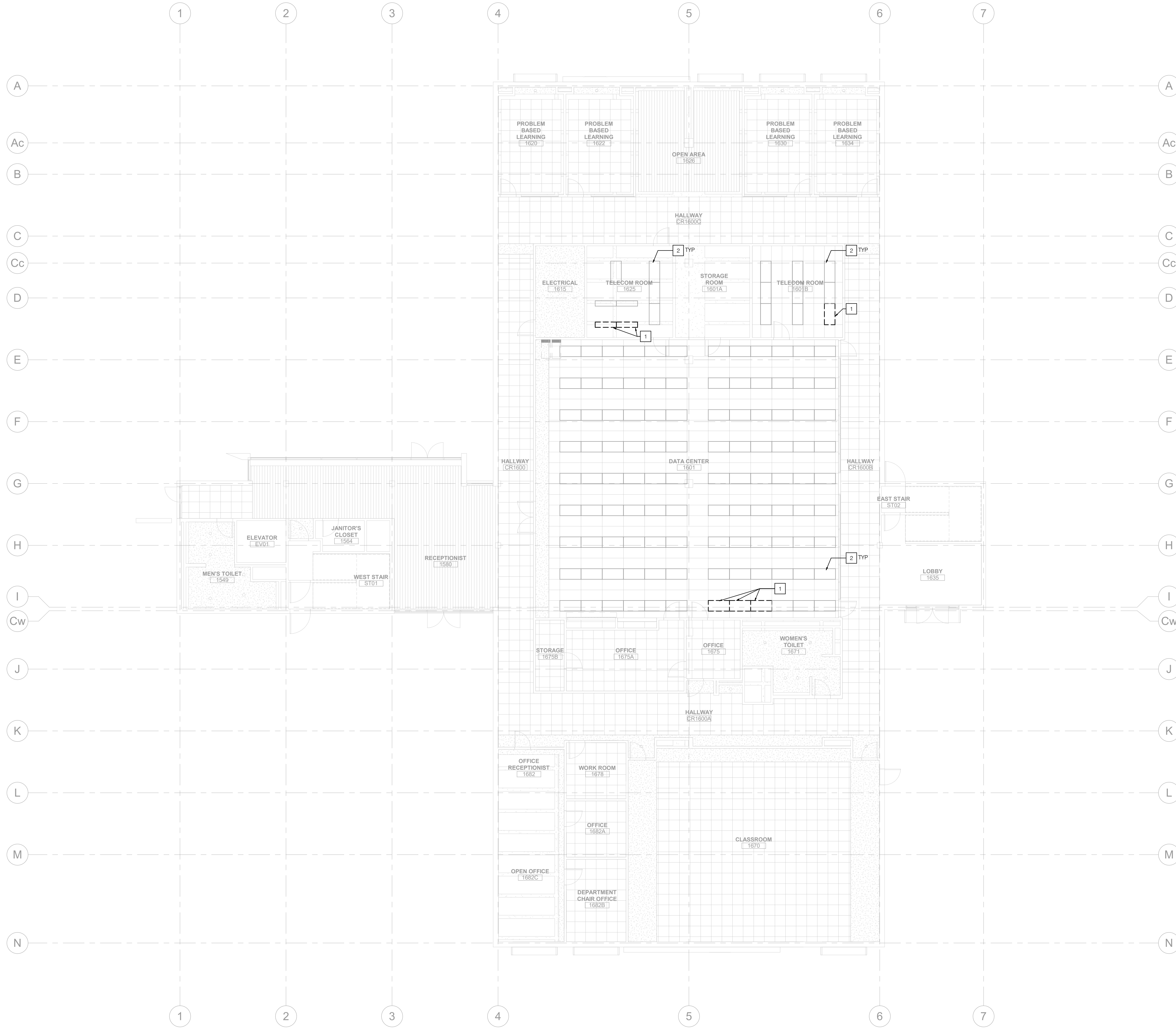
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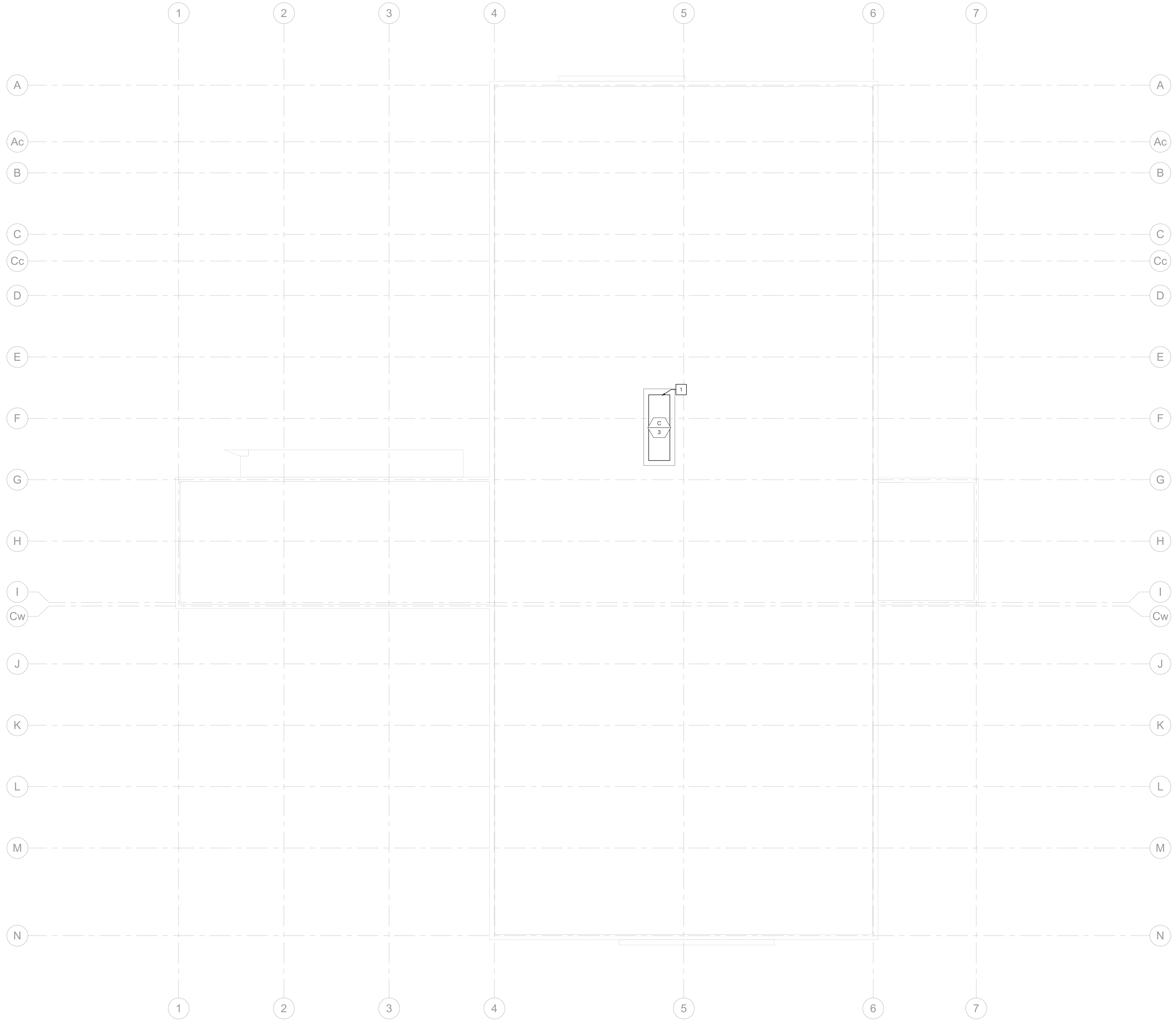
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FIRST FLOOR
DEMO LIGHTING
PLAN

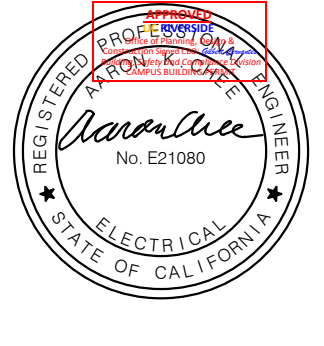
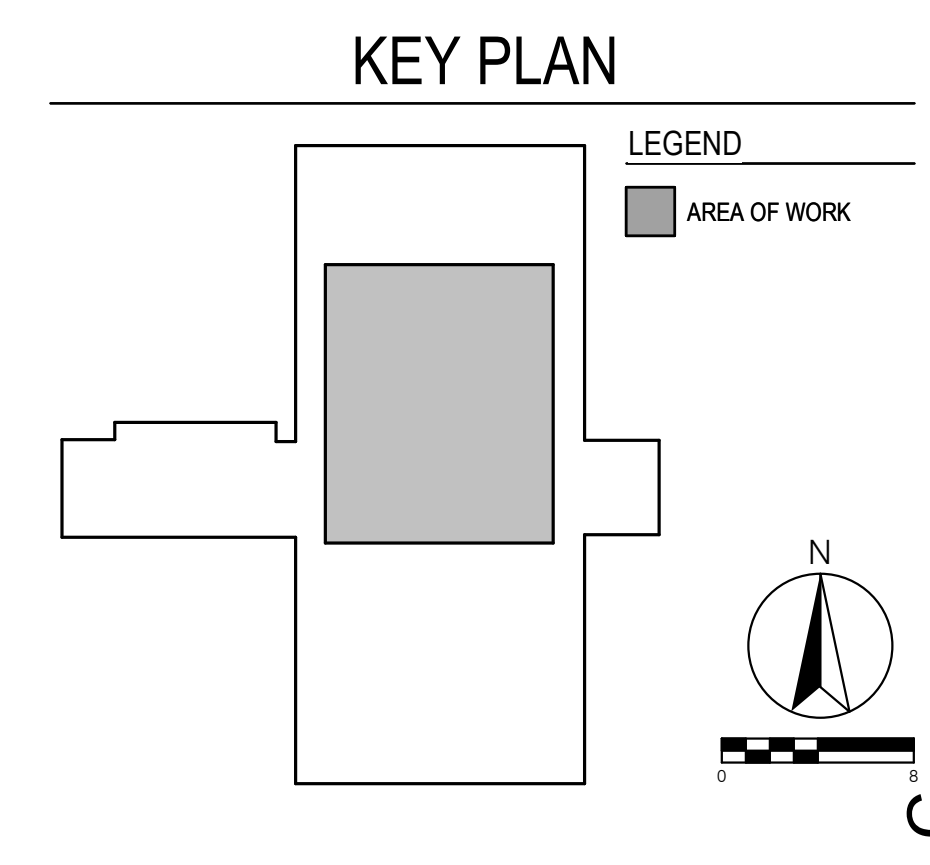
E2.12

- NOTES
- 1 (E)LIGHT FIXTURES TO BE DEMOLISHED.
 - 2 (E)LIGHT FIXTURES TO REMAIN.





NOTES
 1 REUSE (E)CONDUIT AND WIRE TO FEED CONDENSOR C-3.



REVISIONS

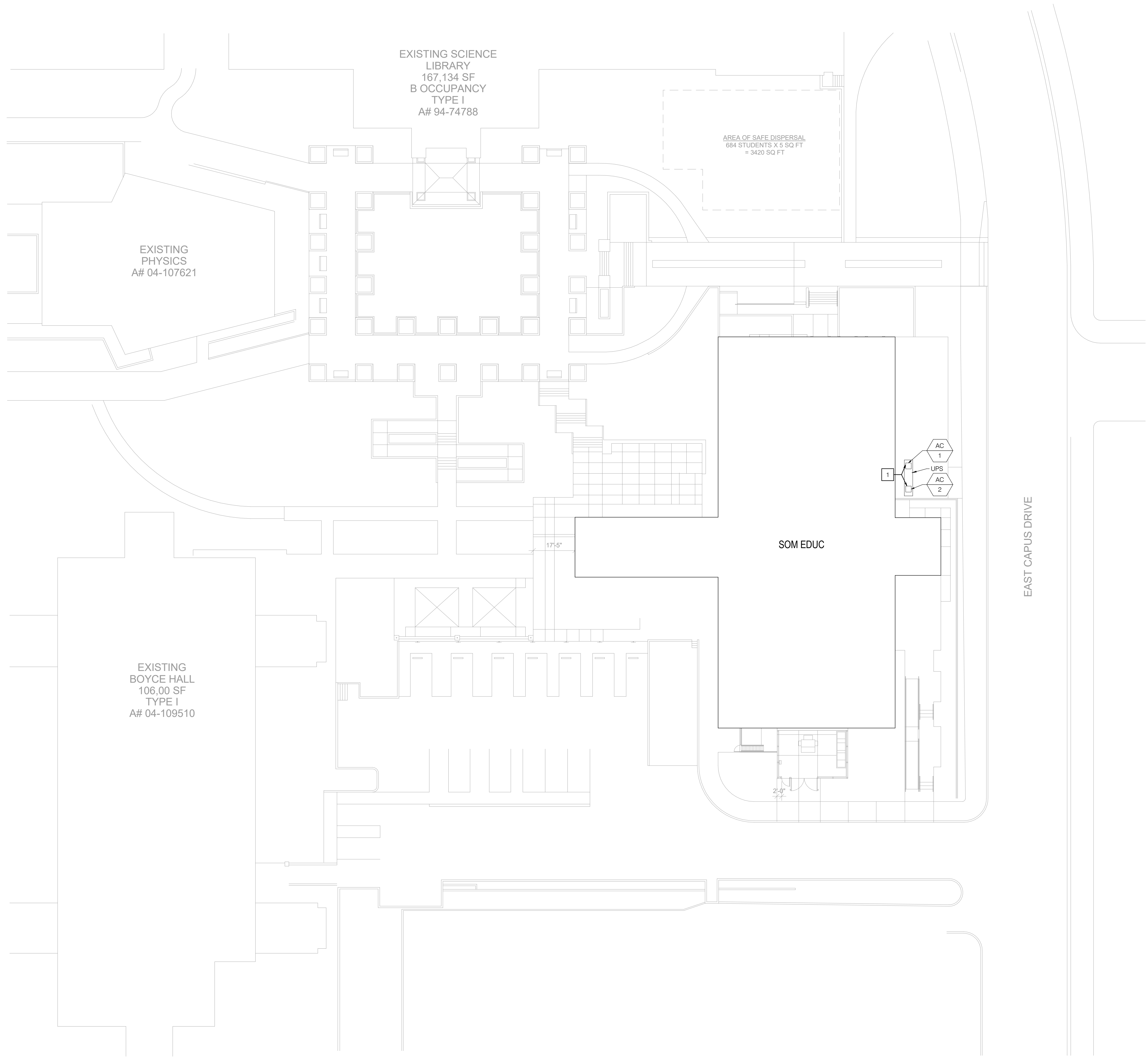
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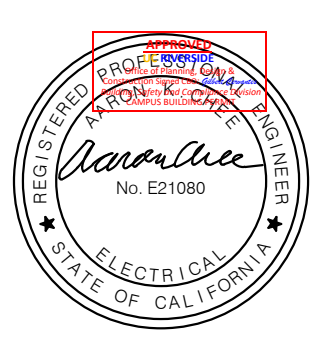
ROOF POWER PLAN

E2.31



NOTES

1 REUSE (E)CONDUIT AND WIRE TO FEED UPS AC-1 &2 UNITS.



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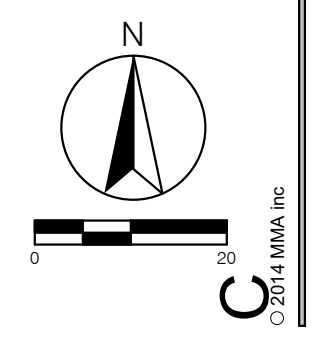
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SITE PLAN

xE1.01



GENERAL LEGEND

SYMBOL	DESCRIPTION
	NOTE CALLOUT
	DETAIL CALLOUT - NUMBER ON TOP DENOTES DETAIL NUMBER - NUMBER ON BOTTOM DENOTES SHEET DETAIL IS SHOWN
	BUILDING NUMBER

TELECOM LEGEND

SYMBOL	DESCRIPTION
	CABLE TRAY. REFER TO DRAWINGS FOR SIZING.
	TELECOMMUNICATIONS RACK/CABINET. REFER TO DRAWINGS FOR DETAILS

ABBREVIATIONS

ABBREVIATION	DESCRIPTION
#	NUMBER (IDENTIFICATION) OR COUNT
(I/F)	NUMBER IS QUANTITY
A OR AMP	AMPERES
A/E	ARCHITECT/ENGINEER
AFF	ABOVE FINISHED FLOOR
AH	AMPERE HOUR
AHJ	AUTHORITY HAVING JURISDICTION
ALS	ASSISTIVE LISTENING SYSTEM
AP	ACCESS POINT
ARCH	ARCHITECT, ARCHITECTURAL
ASP	ALUMINUM, STEEL, POLYETHYLENE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AVC	AUDIOVISUAL CONTRACTOR
AWG	AMERICAN WIRE GAUGE
BUR	BURIED
BDF	BUILDING DISTRIBUTION FRAME
BMS	BUILDING MANAGEMENT SYSTEM
BTU	BRITISH THERMAL UNIT
C.O.	CONDUIT ONLY - WITH PULL WIRE
CATV	COMMUNITY ANTENNA TELEVISION (CABLE TELEVISION)
CB	CONDUIT BANK
CCTV	CLOSED CIRCUIT TELEVISION
CKT	CIRCUIT
CLD	CEILING
CMP	COMMUNICATIONS PLENUM (CABLE JACKET RATING)
CMR	COMMUNICATIONS RISER (CABLE JACKET RATING)
CP	CONSOLIDATION POINT
CSC	CAPTURED SCREW CONNECTOR
CJ	COPPER
DAS	DISTRIBUTED ANTENNA SYSTEM
dB	DECIHEL
DC	DIRECT CURRENT
DIST	DISTRIBUTION
DMARC	POINT OF DEMARCATION BETWEEN UTILITIES OR BETWEEN UTILITIES AND OWNER PREMISE EQUIPMENT
DWG	DRAWING
E.C.	ELECTRICAL CONTRACTOR
EA	EACH
EF	ENTRANCE FACILITY
ELEC	ELECTRIC
EMI	ELECTROMAGNETIC INTERFERENCE
EMS	EMERGENCY MANAGEMENT SYSTEM
EMT	ELECTRICAL METALLIC TUBING
ENT	ELECTRICAL NONMETALLIC TUBING
EQUIP	EQUIPMENT
EXIST(E)	EXISTING
FB	FLOOR BOX
FDC	OPTICAL - FIBER DISTRIBUTION CENTER
FDR	FEEDER
FEXT	FAR END CROSSTALK
FIN	FINISH
FKT	FIXTURE
FLR	FLOOR
FOC	FIBER OPTIC CABLE
FPS	FRAMES PER SECOND
FT	FEET
G.C.	GENERAL CONTRACTOR
GA	GAUGE
GND	GROUND (MECHANICAL CONNECTION TO EARTH)
GRC	GALVANIZED RIGID CONDUIT
H, W, D, L	HEIGHT, WIDTH, DEPTH, LENGTH
IC	INTERCOM
ID	INSIDE DIAMETER OR INSIDE DIMENSION
IDF	INTERMEDIATE DISTRIBUTION FRAME
IN	INCHES, MEASUREMENT
IR	INFRARED
ISP	INTERNET SERVICE PROVIDER
JB	JUNCTION BOX
LTG	LIGHTING
M	METER
MAC	MEDIA ACCESS CONTROL
MDF	MAIN DISTRIBUTION FRAME
MH	MAINTENANCE HOLE (CSP CONFINED SPACE) - (A.K.A. MANHOLE)
MM	MULTI-MODE - REFERRING TO OPTICAL FIBER CORE/CLADDING PROPERTIES
MTO	MOUNTING
MTU	MULTI TENANT UNIT
N	NORTH
N.T.S.	NOT TO SCALE
ND	NETWORK DEVICE
NE	NETWORK ENCLOSURE
NEXT	NEAR END CROSSTALK
NIC	NOT IN CONTRACT
NO, OR #	NUMBER
O.F.C.I.	OWNER FURNISHED CONTRACTOR INSTALLED

ABBREVIATION	DESCRIPTION
O.F.O.I.	OWNER FURNISHED OWNER INSTALLED
OD	OUTSIDE DIAMETER
OF	OPTICAL FIBER
OSP	OUTSIDE PLANT
OTDR	OPTICAL TIME DOMAIN REFLECTOMETER
PA	PUBLIC ADDRESS SYSTEM
PB	PULL BOX
PH	PHASE
PNL	PANEL
POE	POWER OVER ETHERNET
PPF	PIXELS PER FOOT
PR	PAIR
PSU	POWER SUPPLY UNIT
PTP	POINT-TO-POINT
PVC	POLYVINYL CHLORIDE
PWR	POWER
REC/RECEPT	RECEPTACLE
REQD	REQUIRED
RM	ROOM
RMC	RIGID METAL CONDUIT
RMS	RACK MOUNTED SPACE
RNC	RIGID NONMETALLIC CONDUIT
RJ	RACK UNIT
S	SOUTH
SAC	SECURITY AND ACCESS CONTROL
SCH	SCHEDULE
SCS	STRUCTURED CABLING SOLUTION
ScTP	SCREENED TWISTED PAIR
SF	SQUARE FEET
SM	SINGLE-MODE REFERRING TO OPTICAL FIBER CORE/CLADDING PROPERTIES
SNR	SIGNAL TO NOISE RATIO
SPD	SURGE PROTECTION DEVICE
SQ	SQUARE
STP	SHIELDED TWISTED-PAIR
SW	SWITCH
SYS	SYSTEM
TB	TERMINAL BLOCK
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TCPIP	TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL
TE	TELECOMMUNICATIONS ENCLOSURE
TEL	TELEPHONE
TELECO	TELEPHONE UTILITY
TGB	TELECOMMUNICATIONS GROUNDING BUSBAR
TMB	TELECOMMUNICATIONS MAIN GROUNDING BUSBAR
TP	TRANSITION POINT
TR	TELECOMMUNICATIONS ROOM OR SPACE
TV	TELEVISION
TP	TYPICAL
UG	UNDERGROUND DUCT
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES INC.
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTP	UNSHIELDED TWISTED PAIR
V	VOLTS OR VOLTAGE
V-A	VOLT-AMPERES
W	WATTS
W	WITH
W/O	WITHOUT
WAO	WORK AREA OUTLET / WORK STATION OUTLET
WBS	WORK BREAKDOWN STRUCTURE
WFI	WIRELESS FIDELITY (LOCALIZED WIRELESS USER ACCESS INTERNET NETWORK)
WP	WATERPROOF OUTLET BOX
WS	WORK STATION

IN THE EVENT ABBREVIATIONS NOT MENTIONED HEREIN ARE USED, REFERENCE WILL BE MADE TO ANSI Y1.1, MILITARY STANDARD ABBREVIATIONS, AND OTHER STANDARD INDUSTRY CONVENTIONS.

GENERAL NOTES

- ALL TELECOMMUNICATIONS WORK SHALL COMPLY WITH THE LATEST EDITION OF THE UNIVERSITY TELECOMMUNICATIONS INFRASTRUCTURE STANDARDS AND CURRENT MANUFACTURER AND BICSI INSTALLATION PRACTICES. THESE STANDARDS HAVE BEEN ESTABLISHED TO EXCEED ALL CURRENT CODE AND BICSI INSTALLATION PRACTICE. ANY ITEMS THAT RAISE QUESTION SHALL BE BROUGHT TO THE ATTENTION OF THE CONSTRUCTION MANAGER AND UNCLEVIA REPRESENTATIVE IN WRITING. IT IS ALWAYS A BEST PRACTICE TO PROVIDE THE AHJ WITH DETAIL ON ANY AND ALL CONSTRUCTION ITEMS THAT COULD BE QUESTIONED BY THE AHJ. THE PROJECT DOCUMENTATION AND ASSOCIATED UNIVERSITY STANDARDS ARE INTERPRETED NOR CONSIDERED AS AUTHORIZATION TO DEVIATE FROM ANY CODE OR REGULATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VALIDATE THAT THESE REQUIREMENTS WILL MEET THE EQUIPMENT MANUFACTURERS REQUIREMENT TO PROVIDE THE UNIVERSITY WITH A MINIMUM 25-YEAR SC5 EXTENDED MATERIALS WARRANTIES.
- IN THE EVENT OF A CONFLICT OR INCONSISTENCY BETWEEN ITEMS INDICATED ON THE PLANS AND/OR SPECIFICATIONS, THE DOCUMENT WHICH PRESCRIBES AND ESTABLISHES THE COMPLETE JOB AS PER MANUFACTURER OR THE HIGHER STANDARD SHALL PREVAIL. ALL SUCH DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE CONSTRUCTION MANAGER AND THE UNIVERSITY REPRESENTATIVE IN WRITING IMMEDIATELY UPON DISCOVERY.
- OMISSIONS FROM THE DRAWINGS OR FROM THE SPECIFICATIONS OR THE MISDESCRIPTION OF DETAILS OF WORK WHICH ARE CLEAR AND NECESSARY TO CARRY OUT THE INTENT FOR THE DRAWINGS AND SPECIFICATIONS, OR WHICH ARE CUSTOMARILY PERFORMED SHALL NOT RELIEVE THE CONTRACTOR FROM PERFORMING SUCH OMITTED OR MISDESCRIBED DETAILS OF THE WORK. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER AND UNIVERSITY REPRESENTATIVE UPON IDENTIFICATION OF SUCH OMISSIONS, MISDESCRIPTION, AND UNCLEAR DIRECTIONS IMMEDIATELY. THE CONTRACTOR SHALL PERFORM ALL PROJECT TASKS AND ASSEMBLY BUILDS AS PER BICSI STANDARDS AND MANUFACTURERS REQUIREMENTS ALONG WITH COORDINATING AND WORKING WITH THE UNIVERSITY TO CORRECT SUCH DOCUMENTATION ERRORS.
- THE CONTRACTOR SHALL CHECK ALL DRAWINGS FURNISHED IMMEDIATELY UPON THEIR RECEIPT AND PROMPTLY NOTIFY THE UNIVERSITY OF ANY DISCREPANCIES. THIS INCLUDES BUT NOT LIMITED TO, DISCREPANCIES BETWEEN DRAWINGS AND SPECIFICATIONS, OR DRAWINGS AND MANUFACTURER INSTALLATION INSTRUCTIONS THAT WILL CAUSE EXTENDED WARRANTY ISSUES, OR DRAWINGS AND GOVERNING CODES AND BEST PRACTICES. THE CONTRACTOR SHALL BRING TO THE ATTENTION OF THE CONSTRUCTION MANAGER AND UNIVERSITY REPRESENTATIVE ANY DISCREPANCIES BETWEEN DRAWINGS AND HOW THE CONTRACTOR NORMALLY DELIVERS THE SERVICES DESCRIBED IN THE DRAWINGS OR SPECIFICATIONS.
- ALL MATERIALS AND EQUIPMENT FURNISHED AND INSTALLED SHALL BE NEW AND FREE FROM ANY KNOWN DEFECT. ALL EQUIPMENT SHALL BEAR THE UNDERWRITERS LABORATORIES LABEL (UL) LISTING, CLASSIFIED, AND/OR PERFORMANCE VERIFIED MARK OR FROM A UNIVERSITY APPROVED ALTERNATIVE TESTING ORGANIZATION. ALL MATERIALS SHALL BE INSTALLED AND USED IN THE MANNER FOR WHICH THE MANUFACTURER INTEND THEM FOR. THIS APPLIES FOR BOTH PIECE PARTS AND COMPLETE FUNCTIONING ASSEMBLIES.
- CONTRACTOR IS REQUIRED TO RECEIVE WRITTEN APPROVAL FOR ALL RECOMMENDED AND REQUIRED WORK DEVIATIONS AND CLARIFICATIONS TO THE PLANS AND SPECIFICATIONS OF THIS PROJECT BY THE UNIVERSITY AND ITS REPRESENTATIVES PRIOR TO ANY FIELD ACTIVITY.
- ALL WORK MUST BE COMPLETED IN AS PER MANUFACTURER INSTALLATION REQUIREMENTS AND BICSI INSTALLATION PRACTICES. THE UNIVERSITY DEMANDS THE UTMOST PROFESSIONALISM WHEN WORK IS BEING PERFORMED AT EITHER UNIVERSITY CAMPUS AND HOLDS ALL CONTRACTORS TO THAT LEVEL OF PROFESSIONALISM. THE WORK SITE SHALL BE KEPT CLEAN AND FREE FROM DEBRIS. IT IS EVERY CONTRACTOR AND ALL THEIR REPRESENTATIVES RESPONSIBILITY TO GUARD AGAINST ANY DAMAGE TO UNIVERSITY PROPERTY AND THE IMMEDIATE REPAIR IF ANY DAMAGE IS CAUSED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONDUCTING A FINAL CLEANUP OF THE WORK SITE PRIOR TO FINAL SYSTEM ACCEPTANCE AS PART OF THE PUNCH-LIST PROCESS.
- THE CONTRACTOR SHALL NOT BORE, NOTCH, OR IN ANY WAY CUT INTO ANY STRUCTURAL MEMBER WITHOUT WRITTEN APPROVAL FROM THE UNIVERSITY, ARCHITECT, AND STRUCTURAL ENGINEER. WITH PERMISSION FROM THE ABOVE AND PRIOR TO ALL CUTTING, DRILLING, NOTCHING, CORING, ETC. OF CONCRETE STRUCTURE AND FACADE THESE SURFACES SHALL BE X-RAYED OR GROUND PENETRATING RADAR USED TO ACCURATELY LOCATE REBAR, POST-TENSION CABLES & RODS, CONDUITS, AND ANY OTHER EMBEDDED POTENTIAL OBSTRUCTIONS TO ENSURE THAT NO DAMAGE IS CAUSED TO ANY STRUCTURAL REINFORCEMENTS.
- FOR THE PURPOSE OF CLEARNESS AND LEGIBILITY THE TELECOM DRAWINGS ARE ESSENTIALLY DIAGRAMMATIC. THE SIZE AND LOCATION OF EQUIPMENT IS SHOWN TO SCALE WHEREVER POSSIBLE. THE CONTRACTOR SHALL VERIFY ALL FIELD CONDITIONS WITH INFORMATION INDICATED ON THE DRAWINGS AND DESCRIBED IN THE SPECIFICATION SECTIONS WHERE TELECOM WORK INTERFACES WITH OTHER TRADES.
- THE CONTRACTOR SHALL TAKE SPECIAL PRECAUTIONS WHEN WORKING IN AREAS WITH EXISTING CEILINGS AND SHALL BE RESPONSIBLE FOR REMOVAL AND REPLACEMENT OF CEILING TILES WITHOUT DAMAGING OR SOLING THE CEILING TILES. CHIPPED, DAMAGED, CRACKED, OR BROKEN TILES ARE THE CONTRACTOR'S RESPONSIBILITY TO REPLACE WITH LIKE TILES.
- ALL FOOTAGES IDENTIFIED ON DRAWINGS OR SCALED OFF OF DRAWINGS ARE TO BE CONSIDERED ESTIMATES AND ARE REQUIRED TO BE FIELD VERIFIED BY CONTRACTOR PRIOR TO ORDERING OF MATERIAL.
- ALL CABLE TRAYS, LADDER (TYPE) RACKING, "BASKET" TYPE TRAY, CONDUIT & SLEEVES, EQUIPMENT RACKS, PROTECTION PANELS, AND CABLE SHEATHS SHALL BE BONDED TO AN APPROVED TELECOMMUNICATIONS BONDING ASSEMBLY.
- ACCORDING TO TIA STANDARDS AND BICSI METHODOLOGIES PULL-BOXES LOCATED WITHIN A STRUCTURE ARE TO BE PLACED AT 100' INCREMENTS AND PROPERLY SPACED WITHIN RUNS OF MORE THAN 150'. PULL-BOXES ARE TO BE PLACED IN CONDUIT RUNS THAT EXCEED A MAXIMUM OF 180 DEGREES IN CHANGES OF DIRECTION. TELECOMMUNICATIONS PULL-BOXES ARE TO BE SIZED AT A MINIMUM OF TWELVE (12) TIMES THE DIAMETER OF THE LARGEST CONDUIT. PULL-BOXES SHOULD NOT BE USED FOR CHANGES OF DIRECTION. THESE STANDARDS ARE TO BE ADHERED TO WHERE EVER PRACTICAL AND ANY DEVIATION TO THESE STANDARDS REQUIRES A SHOP-DRAWING, IF DISCOVERED DURING THE SUBMITTAL PHASE, TO REMEDIATE THE ISSUE OR BY AN RFI DURING THE CONSTRUCTION INSTALLATION PHASE. THE UNIVERSITY MAY ELECT TO INCREASE THE CONDUIT SIZE OR QUANTITY OF CONDUITS TO MITIGATE THE ISSUE FOR THE EXCESS LENGTH, ADDITIONAL QUANTITY OF CHANGES OF DIRECTION, AND/OR THE REDUCED SIZE OF PULL-BOXES WITHIN THE GIVEN PATHWAY. THE CONTRACTOR IS REQUIRED TO HAVE APPROVAL IN WRITING PRIOR TO ANY ROUGH-IN WORK OR MATERIAL PROCUREMENT.
- AS A STANDARD, ALL INTRA-BUILDING PATHWAYS SHALL HAVE A MINIMUM OF 25% AVAILABLE CAPACITY AT THE SCHEDULED END OF THE PROJECT. SHOULD THIS PERCENTAGE NOT BE ACHIEVABLE, THIS ISSUE MUST BE BROUGHT TO THE ATTENTION OF THE CONSTRUCTION MANAGER AND THE UNIVERSITY REPRESENTATIVE.
- "J" HOOKS FOR STATION CABLE DISTRIBUTION IN OPEN CEILING ENVIRONMENTS IS ACCEPTABLE TO THE UNIVERSITY AS LONG AS THE FOLLOWING PARAMETERS ARE MET: DO NOT USE CEILING SUPPORT WIRE OR CEILING HANGERS. DO NOT USE SUPPORTS FOR ANY OTHER BUILDING SERVICES UNLESS PRIOR WRITTEN APPROVAL FOR THEIR USE IS GIVEN AND VERIFIED WITH PROJECT STRUCTURAL ENGINEER. NEVER IS IT ACCEPTABLE FOR CABLING TO IMPEDE OR HINDER THE ACCESSING OF THE ABOVE CEILING SPACE OR ANY ABOVE CEILING MOUNTED EQUIPMENT. CABLES ARE NOT TO BE WRAPPED AROUND ANY BUILDING STRUCTURAL SUPPORTS OR BUILDING SERVICES. ALL APPROPRIATE UNIVERSITY AND BICSI INSTALLATION PRACTICE CLEARANCES FROM FIXTURES, CONTROLS, AND ACCESS DEVICES OF ANY KIND ARE TO BE ADHERED TO. CABLING IS NEVER TO RUN THROUGH OR IMPEDE THE OPERATION OF ANY AIR-HANDLING DUCTS OR DAMPERS.
- WHERE PATHWAY CONSISTS OF MULTIPLE CONDUITS OR SLEEVES, A PATHWAY MUST BE FILLED TO CURRENT TIA AND BICSI INSTALLATION RECOGNIZED MAXIMUM FILL BEFORE UTILIZING THE NEXT VACANT OR PARTIALLY FILLED PATHWAY.
- OVERHEAD AND WALL MOUNTED LADDER (TYPE) RACKING INSTALLATION SHALL MATCH THE DRAWINGS AS CLOSELY AS POSSIBLE AND REQUIRES A SHOP DRAWING FOR EACH ROOM LOCATION. THE PACKAGE IS TO INCLUDE A BILL OF MATERIALS WITH PART NUMBERS FROM RACKING MANUFACTURER FOR MOUNTING AND CONNECTION PIECE PARTS. PRIOR TO ANY ROUGH-IN WORK BEING PERFORMED THESE SUBMITTALS MUST BE APPROVED BY THE UNIVERSITY REPRESENTATIVE.
- ALL CABLING AND THEIR PATHWAYS PASSING THROUGH A RATED FIRE OR SMOKE BARRIER MUST BE PROPERLY SLEEVED AND FIRE STOPPED USING APPROVED (UL CLASSIFIED) FIRE STOP ASSEMBLIES. FIRESTOP ASSEMBLIES ARE TO BE INSTALLED PER THE MANUFACTURERS INSTRUCTIONS FOR THE TYPE OF BARRIER, PATHWAY SIZE, AND QUANTITY OF CABLES THE FIRESTOP ASSEMBLY IS BEING INSTALLED FOR. CONTRACTOR IS REQUIRED TO MAINTAIN TRAINING RECORDS FOR ALL STAFF PERFORMING FIRESTOP ASSEMBLY INSTALLATION WORK.
- CABLE PULLING - LINER/ROPE/TAPE SHALL BE PLACED IN ALL NEW CONDUITS. ALL UNUSED CONDUITS SHALL ALSO BE CAPPED AND/OR PROPERLY FIRE STOPPED IN A MANNER APPROVED BY THE UNIVERSITY AND/OR THE AHJ.
- CONTRACTOR TO COORDINATE WAO AND SUPPORTING CONDUIT WITH THE ELECTRICAL CONTRACTOR WHERE THE ELECTRICAL CONTRACTOR IS A DIFFERENT ORGANIZATION THAN LOW-VOLTAGE CABLING/CONDUIT CONTRACTOR FOR PROPER PLACEMENT.
- ALL STATION CABLES SHALL BE NEATLY DRESSED AND SECURED FEET AT A MINIMUM EVERY FIVE FEET.
- ALL STATION CABLES SHALL BE TERMINATED ON THE SAME FLOOR AS THE FLOOR SERVING BDF/IDF UNLESS OTHERWISE NOTED IN THESE DRAWINGS.
- ALL STATION CABLING IS TO BE MECHANICALLY PROTECTED IN PLACE UNLESS OTHERWISE IDENTIFIED IN THESE DRAWINGS, BY A CONTRACT CHANGE RECORD, OR BY A RFI RESPONSE FROM THE UNIVERSITY REPRESENTATIVE IN WRITING DIRECTING SURFACE-MOUNT EXPOSED AS THE CABLE INSTALLATION MEANS.
- ALL NEW AND REUSED STATION CABLES SHALL BE TESTED AND DOCUMENTED USING RECOGNIZED MANUFACTURER INSTALLATION REQUIREMENTS AND BICSI INSTALLATION PRACTICES. UTP (CATEGORY) CABLE TESTING RESULTS SHALL BE ONE TEST RECORD FOR EACH CABLE AND THE RECORD MUST INCLUDE THE UNIVERSITY'S APPROVED CABLE IDENTIFICATION STANDARD NAMING/NUMBERING SCHEME. OPTICAL FIBER TESTING SHALL FOLLOW ALL UNIVERSITY AND MANUFACTURER INSTALLATION PRACTICES. COAX TESTING SHALL FOLLOW BOTH UNIVERSITY AND THE ANSIS/SCTE CABLE TESTING STANDARDS & BEST PRACTICES, INCLUDING BUT NOT LIMITED TO: ANSIS/SCTE - 10-2014, 40-2011, 44-2010, 47-2007, 48-3-2011.
- THE UNIVERSITY REQUIRES A ONE (1) METER SLACK LOOP FOR ALL WAO SUPPORTED BY OPEN CEILING CABLE DISTRIBUTION. THE SLACK LOOP MUST BE SUPPORTED ABOVE THE WAO IN NEAT AND REPEATABLE FASHION THAT MEETS BOTH BICSI INSTALLATION AND MANUFACTURER PRACTICES.

SHEET INDEX

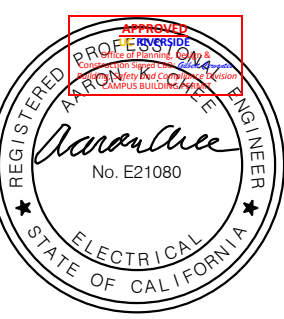
SHEET	DESCRIPTION
T0.01	TECHNOLOGY GENERAL NOTES, LEGEND, ABBREVIATIONS AND SHEET INDEX
T2.11	FIRST FLOOR PLAN
T4.01	ENLARGED EQUIPMENT PLAN
T4.02	ENLARGED LADDER RACK PLAN
T5.01	DETAILS



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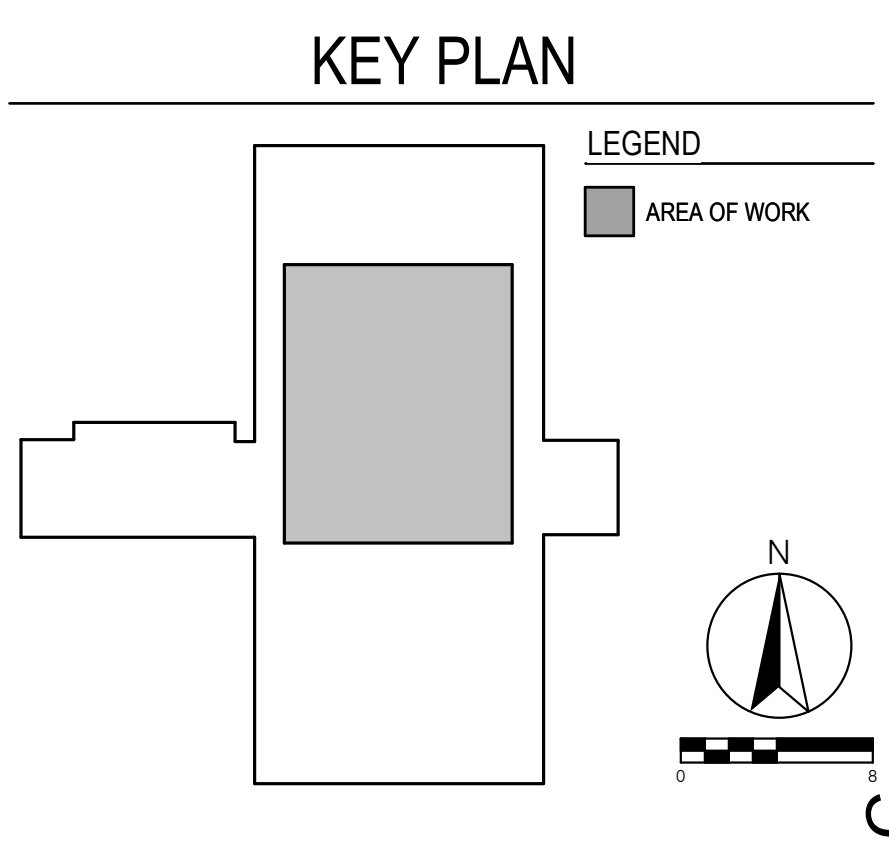
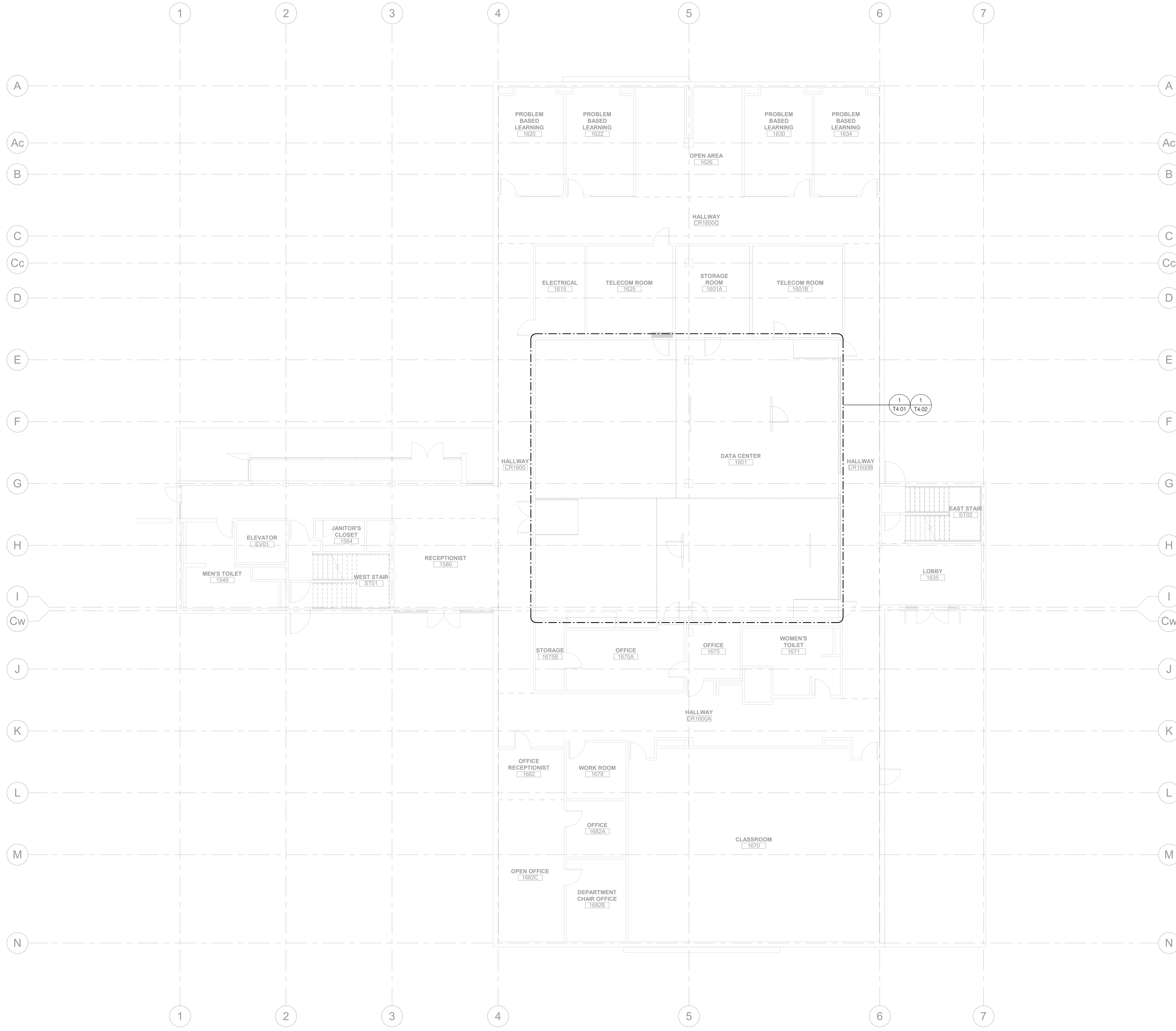
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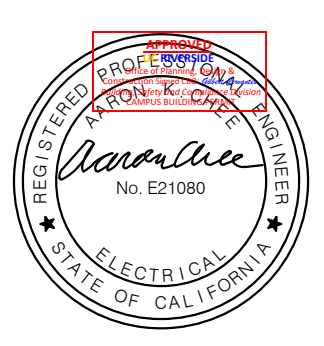
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CHECKED	B. PUROHIT

TECHNOLOGY
GENERAL NOTES,
LEGEND,
ABBREVIATIONS
AND SHEET
INDEX

T0.01

- GENERAL NOTES**
1. ALL CONDUITS SHALL BE FITTED WITH BONDING RING AND NON-SNAG BUSHINGS CFCI.
 2. ALL CONDUITS SHALL HAVE MULE TAPE INSTALLED CFCI.
 3. ALL CONDUITS WITHIN BUILDINGS SHALL BE FIRE STOPPED WITH FIRE STOP ASSEMBLY CFCI.
 4. ALL CONDUITS ENTERING A BUILDING SHALL HAVE PROPERLY SIZED AND CONFIGURED CFCI DUCT RUGS INSTALLED.
 5. CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE AND INSTALL ALL PARTS REQUIRED TO COMPLETE THE INSTALLATION OF THIS PROJECT, INCLUDING DRILLING INTO WALLS, CABLE SUPPORT STRAPS IN CEILINGS, AND ALL OTHER COMPONENTS NOT LISTED.
 6. COORDINATE INSTALLATION IN THIS ROOM WITH MECHANICAL, ELECTRICAL, CABLING, AND AUDIOVISUAL TRADES PRIOR TO INSTALLATION.
 7. ALL PENETRATIONS SHALL BE SEALED AND APPROPRIATE FIRE STOP ASSEMBLIES SHALL BE PROVIDED AND IMPLEMENTED.





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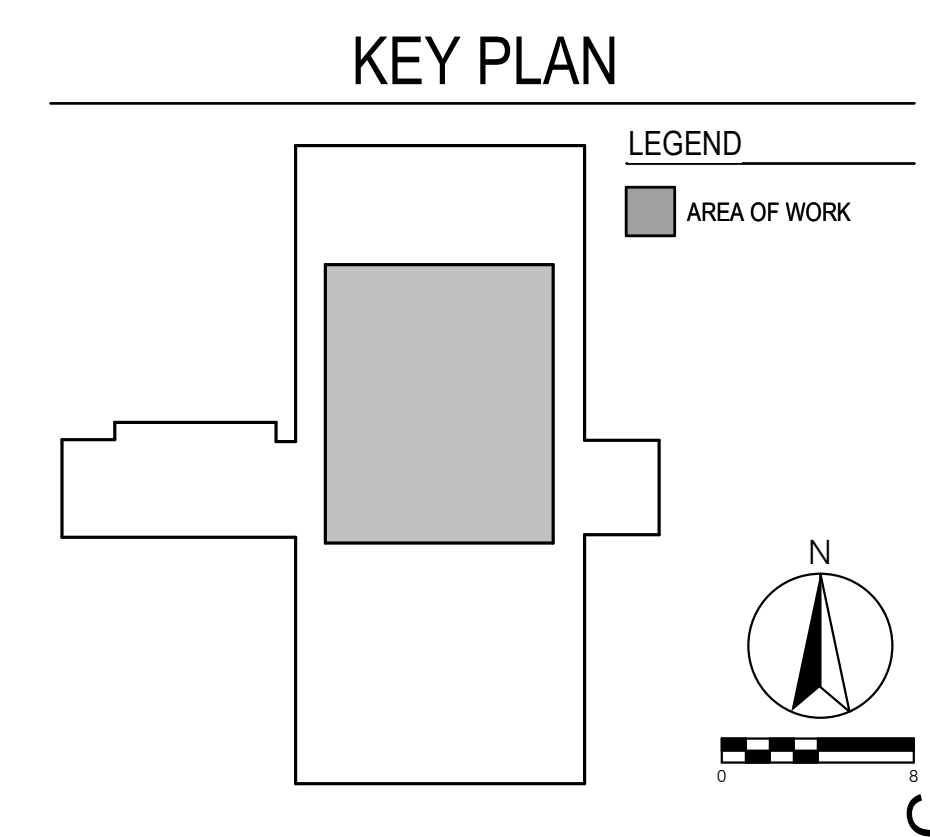
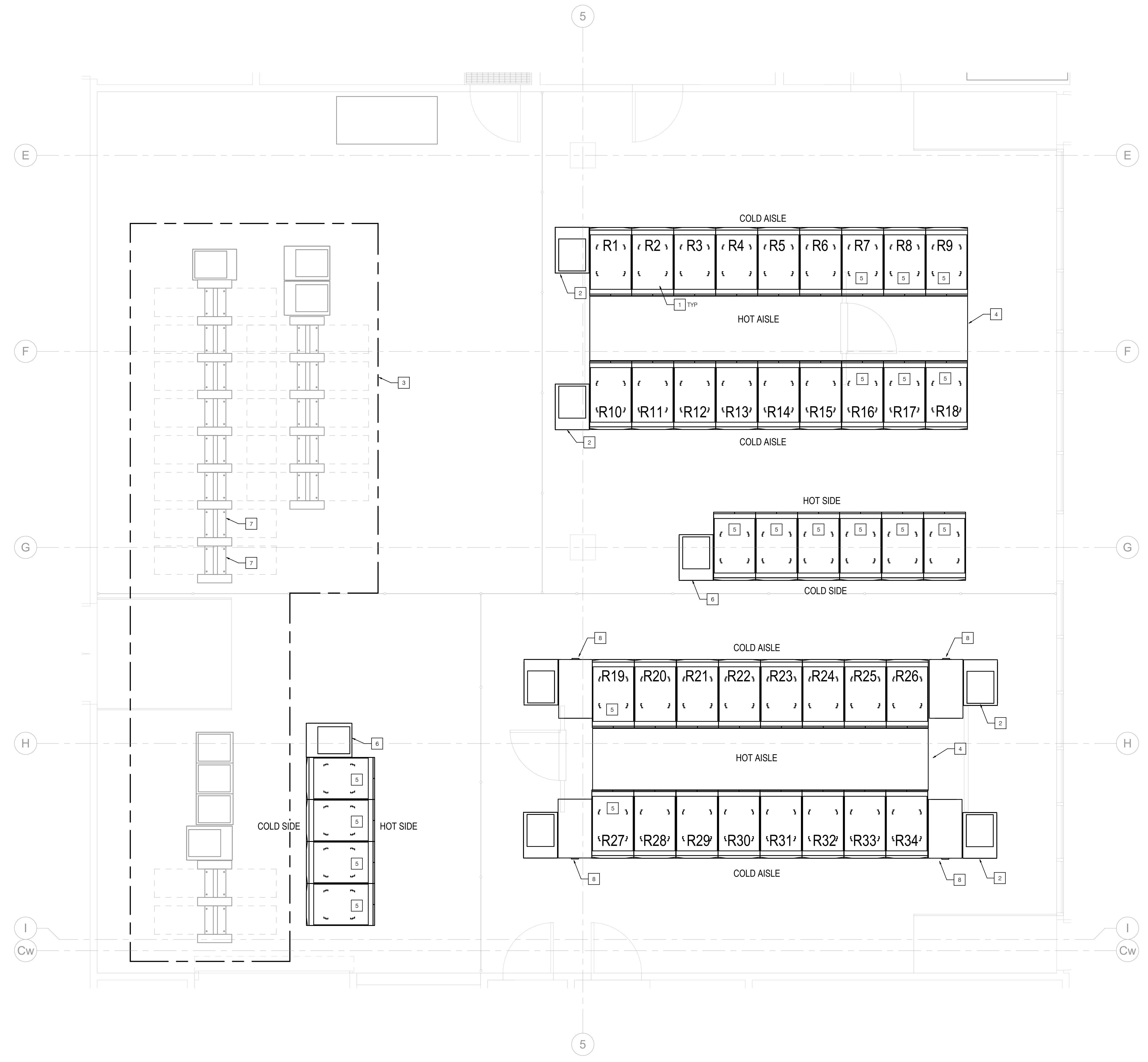
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ENLARGED
EQUIPMENT
PLAN

T4.01

- NOTES**
- 1 NEW SERVER CABINET. COORDINATE EXACT LOCATION IN FIELD. PROVIDE AND INSTALL 12 STRANDS OCS FIBER OPTIC CABLE FROM THE INCOMING FIBER TERMINATION RACK AND TERMINATE IN THE RACK MOUNTED FIBER TERMINATION UNIT. COORDINATE EXACT LOCATION THE UCR PRIOR TO INSTALL. REFER TO DETAIL 4/AS 01 FOR ATTACHMENT INFORMATION.
 - 2 REUSE EXISTING PDU. COORDINATE EXACT LOCATION IN FIELD. REFER TO ELECTRICAL DRAWINGS FOR DETAILS.
 - 3 EXISTING RACK AND CABINET ASSEMBLY SHALL REMAIN AS IT IS AND BE PROTECTED IN PLACE.
 - 4 NEW HOT AISLE CONTAINMENT SYSTEM. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR DETAILS.
 - 5 FUTURE CABINET TO BE COORDINATED WITH UCR.
 - 6 FUTURE PDU TO BE COORDINATED WITH UCR.
 - 7 EXISTING INCOMING BACKBONE FIBER FROM THE UTILITY TUNNEL TERMINATED IN THE RACK.
 - 8 FUTURE IN-ROW COOLING UNITS. REFER TO MECHANICAL PLANS FOR MORE INFORMATION.

- GENERAL NOTES**
1. ALL EQUIPMENT IS TO BE INSTALLED BY MANUFACTURER INSTALLATION REQUIREMENTS AND INDUSTRY BEST PRACTICES.
 2. ALL CONDUITS LONGER THAN 48" REQUIRE BONDING CONNECTIONS ON BOTH ENDS. BONDING CONNECTED SHALL BE MADE WITH A MINIMUM #6 BONDING CONDUCTOR TO THE TMBG / TBB FOR THE TELECOMMUNICATIONS ROOM THE BONDING CONNECTION IS LOCATED IN. ALL CONDUIT ENDS REQUIRE A NON-SNAG BUSHING ON EACH END.
 3. ALL CONDUIT SLEEVES REQUIRE NON-SNAG BUSHINGS ON BOTH ENDS.
 4. STANDARD 2-POST EQUIPMENT RACK SHALL HAVE A MAX CAPACITY LOAD OF 1,000 LBS.
 5. CONTRACTOR SHALL VERIFY EXACT QUANTITY OF PATCH PANELS PRIOR TO INSTALLATION.
 6. COORDINATE INSTALLATION IN THIS ROOM WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, CABLING, AND AUDIOVISUAL TRADES PRIOR TO INSTALLATION.
 7. ALL PENETRATIONS SHALL BE SEALED AND APPROPRIATE FIRE STOP ASSEMBLIES SHALL BE PROVIDED AND IMPLEMENTED.



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ENLARGED
LADDER RACK
PLAN

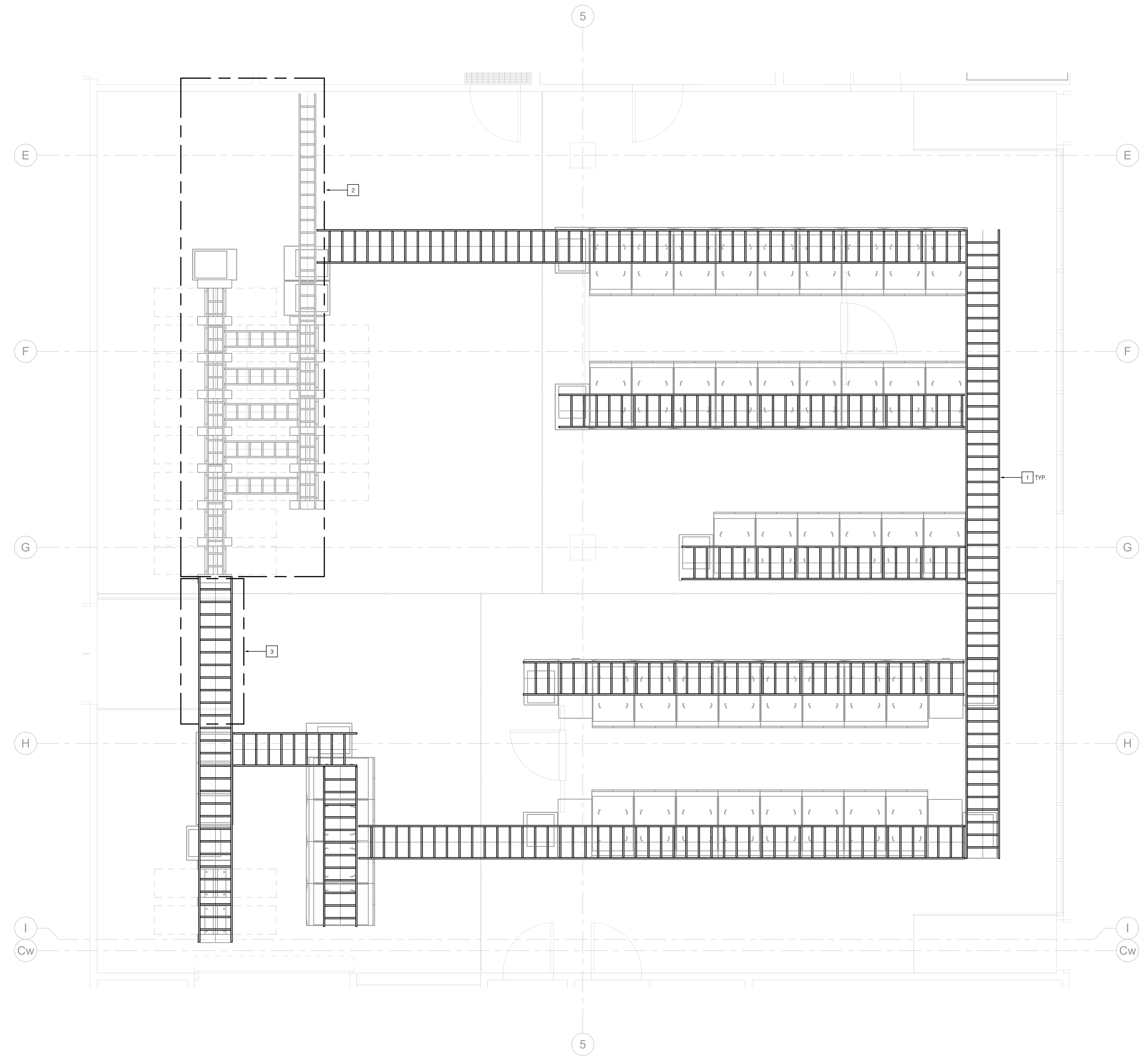
T4.02

NOTES

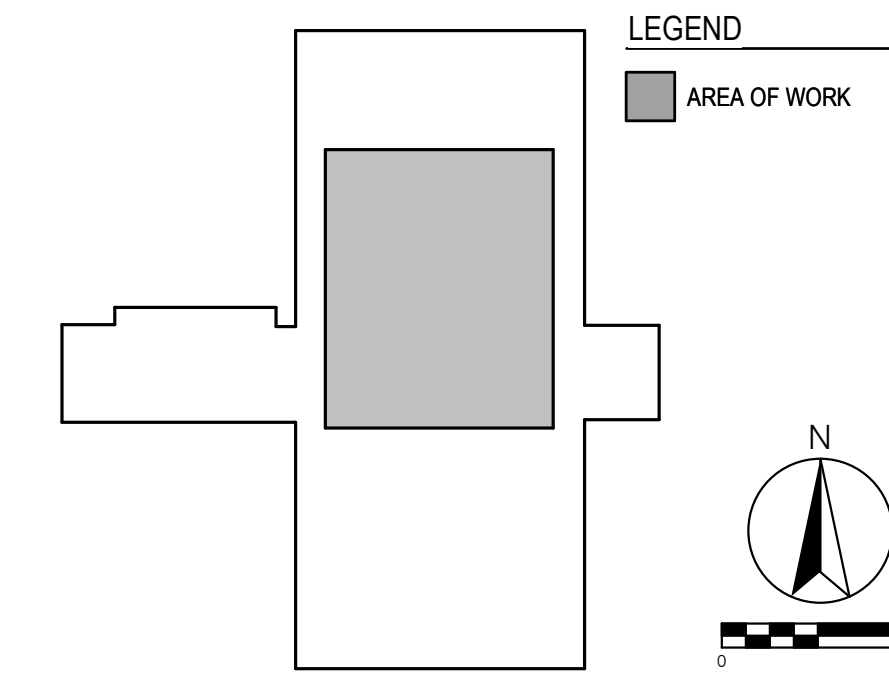
- 1 NEW 24"W X 4"D WIRE BASKET TRAY AT 8'-0". ATTACH TO THE STRUCTURE ABOVE. REFER TO DETAIL 2/A3.01 FOR ATTACHMENT INFORMATION. FIELD VERIFY EXACT LOCATION AND COORDINATE WITH ELECTRICAL, MECHANICAL AND LIGHTING DISCIPLINES.
- 2 EXISTING LADDER RACK SHALL REMAIN AS IT IS AND BE PROTECTED IN PLACE.
- 3 PROVIDE WIRE BASKET TRAY AT 10'-0" IN THIS LOCATION. PROVIDE WATERFALL WIRE BASKET TRAY TO TRANSITION TO 8'-0" AT THE BEGINNING OF THE RACKS/CABINETS ROW ASSEMBLY.

GENERAL NOTES

- 1. ALL EQUIPMENT IS TO BE INSTALLED BY MANUFACTURER INSTALLATION REQUIREMENTS AND INDUSTRY BEST PRACTICES.
- 2. ALL CONDUITS LONGER THAN 48" REQUIRE BONDING CONNECTIONS ON BOTH ENDS. BONDING CONNECTED SHALL BE MADE WITH A MINIMUM #6 BONDING CONDUCTOR TO THE TMSB / TBS FOR THE TELECOMMUNICATIONS ROOM THE BONDING CONNECTION IS LOCATED IN. ALL CONDUIT ENDS REQUIRE A NON-SNAG BUSHING ON EACH END.
- 3. ALL CONDUIT SLEEVES REQUIRE NON-SNAG BUSHINGS ON BOTH ENDS.
- 4. STANDARD 2-POST EQUIPMENT RACK SHALL HAVE A MAX CAPACITY LOAD OF 1,000 LBS.
- 5. CONTRACTOR SHALL VERIFY EXACT QUANTITY OF PATCH PANELS PRIOR TO INSTALLATION.
- 6. COORDINATE INSTALLATION IN THIS ROOM WITH MECHANICAL, ELECTRICAL, CABLING, AND AUDIOVISUAL TRADES PRIOR TO INSTALLATION.
- 7. ALL PENETRATIONS SHALL BE SEALED AND APPROPRIATE FIRE STOP ASSEMBLIES SHALL BE PROVIDED AND IMPLEMENTED.



KEY PLAN



ABBREVIATIONS:

Table with 2 columns: Abbreviation and Full Name. Includes codes for American Concrete Institute, American Iron and Steel Institute, etc.

Table with 3 columns: Symbol, POUND, NUMBER, QUANTITY, and Unit (LBS, POUNDS). Includes symbols like #, @, <, >, +, -, °, Ø.

Table with 2 columns: Abbreviations and Full Name. Includes AB (Anchor Bolt), ADL (Additional), ALT (Alternate), etc.

Table with 2 columns: Abbreviations and Full Name. Includes BEL (Building), BLKG (Blocking/Block), BM (Beam), etc.

Table with 2 columns: Abbreviations and Full Name. Includes CALCS (Calculations), CFRP (Carbon Fiber Reinforced Polymer), etc.

Table with 2 columns: Abbreviations and Full Name. Includes db (Bar Diameter (Rebar)), DBL (Double), DET (Detail), etc.

Table with 2 columns: Abbreviations and Full Name. Includes (E) (Existing), EA (Each), EF (Each Face), etc.

Table with 2 columns: Abbreviations and Full Name. Includes FDN (Foundation), FIN (Finish), FIO (Face of), etc.

Table with 2 columns: Abbreviations and Full Name. Includes GA (Gauge), GALV (Galvanized), GC (General Contractor), etc.

Table with 2 columns: Abbreviations and Full Name. Includes HEX (Hexagonal), HGR (Hanger), HT (Height), etc.

Table with 2 columns: Abbreviations and Full Name. Includes IF (Inside Face), ID (Inside Diameter), INFO (Information), etc.

Table with 2 columns: Abbreviations and Full Name. Includes K (KIPS), KB3 (HLTI KWIK BOLT 3 (ANCHOR)), etc.

GENERAL STRUCTURAL NOTES:

DESIGN CRITERIA: CODE OF RECORD: 2019 EDITION, CALIFORNIA BUILDING CODE. DESIGN LOADS: BASIC WIND SPEED: 95 MPH (3-SECOND GUST).

DESIGN CATEGORY: WIND EXPOSURE CATEGORY: ANALYSIS PROCEDURE: SEISMIC DESIGN FOR NONSTRUCTURAL COMPONENTS. RISK CATEGORY: SEISMIC SITE CLASS: D.

CONDENSING UNITS: COMPONENT AMPLIFICATION FACTOR: COMPONENT RESPONSE MODIFICATION FACTOR: OVERSTRENGTH FACTOR.

GOVERNING CODE AUTHORITY FOR THIS PROJECT: UNIVERSITY OF CALIFORNIA AND IS REFERRED TO AS 'THE GOVERNING AGENCY' IN THESE AND OTHER STRUCTURAL NOTES SECTIONS.

GENERAL NOTES AND TYPICAL DETAILS SHALL APPLY TO ALL PARTS OF THE JOB, EXCEPT WHERE THEY MAY DIFFER WITH DETAILS AND NOTES ON OTHER SHEETS.

DO NOT INSERT MECHANICAL, ELECTRICAL OR PLUMBING (MEP) SLEEVES, PIPES OR CONDUIT IN CONCRETE WITHOUT PRIOR APPROVAL OF THE SEOR.

ALL INFORMATION SHOWN ON THE DRAWINGS RELATIVE TO EXISTING CONDITIONS IS GIVEN AS THE BEST CURRENT KNOWLEDGE, BUT WITHOUT GUARANTEE OF ACCURACY.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THE WORK OF ALL TRADES AND SHALL CHECK ALL DIMENSIONS. ALL DISCREPANCIES SHALL BE CALLED TO THE ATTENTION OF THE ARCHITECT AND THE SEOR AND SHALL BE RESOLVED PRIOR TO PROCEEDING WITH THE WORK.

OBSERVATION VISITS TO THE SITE BY FIELD REPRESENTATIVES OF THE ARCHITECT/SEOR SHALL NOT INCLUDE INSPECTIONS OF THE PROTECTIVE MEASURES OF THE CONSTRUCTION PROCEDURES.

WHEN THE ALLOWANCE FOR SUBSTITUTION OF A SPECIFIED MATERIAL OR PRODUCT DESIGNATION IS IMPLIED ON THE DESIGN DRAWINGS BY THE USE OF THE WORDS 'OR APPROVED EQUAL', APPROVAL SHALL BE OBTAINED FROM THE SEOR AND THE GOVERNING AGENCY PRIOR TO FABRICATION OR INSTALLATION.

DIMENSIONS SHALL GOVERN OVER SCALES SHOWN ON DRAWINGS. THE OWNER SHALL EMPLOY ONE OR MORE SPECIAL INSPECTORS WHO SHALL PROVIDE SPECIAL INSPECTIONS DURING CONSTRUCTION.

SHOP DRAWINGS: SHOP DRAWINGS, INCLUDING CONCRETE MIX DESIGNS SHALL BE SUBMITTED TO THE SEOR FOR REVIEW PRIOR TO FABRICATION OR USE.

SHOP DRAWINGS AND CONCRETE MIX DESIGNS WILL NOT BE ACCEPTED BY THE SEOR DIRECTLY FROM THE PROJECT SUB-CONTRACTORS.

REINFORCING STEEL:

DETAILING, FABRICATION AND PLACING OF REINFORCING STEEL SHALL CONFORM TO STANDARDS AND RECOMMENDATIONS CONTAINED WITHIN THE CRS 'MANUAL OF STANDARD PRACTICE'.

REINFORCING BARS (REBAR), STEEL WELDED WIRE REINFORCING (WWR), AND THE WIRE USED TO SECURE REBAR AND WWR SHALL CONFORM TO THE FOLLOWING ASTM SPECIFICATIONS.

CONCRETE PROTECTION FOR REINFORCING BARS SHALL BE AT LEAST EQUAL TO THE DIAMETER OF THE BAR. MINIMUM COVER FOR CAST IN PLACE CONCRETE SHALL BE AS FOLLOWS.

MINIMUM CLEAR SPACING BETWEEN PARALLEL BARS IN A SINGLE LAYER SHALL NOT BE LESS THAN 1 1/2" TIMES LARGEST AGGREGATE.

DEVELOPMENT AND LAP SPICE LENGTHS FOR REINFORCING STEEL AND WELDED WIRE REINFORCING SHALL BE AS NOTED ON PLANS AND DETAILS CONTAINED THEREIN.

COMPLETE REINFORCING PLACEMENT DRAWINGS (SHOP DRAWINGS) SHALL BE PREPARED IN ACCORDANCE WITH ACI 315 AND SHALL BE SUBMITTED TO THE SEOR FOR REVIEW PRIOR TO FABRICATION.

THE CONTRACTOR SHALL SCHEDULE SPECIAL INSPECTIONS SO THAT BAR SIZE, SPACING, LAP SPICE AND EMBEDMENT LENGTH OF REINFORCING BARS, AND THE LOCATION OF CONDUIT, SLEEVES AND EMBEDDED ITEMS, MAY BE CORRECTED, IF NECESSARY, PRIOR TO PLACEMENT OF OVERLYING GRIDS OR REINFORCING STEEL.

OBSERVATION VISITS TO THE SITE BY FIELD REPRESENTATIVES OF THE ARCHITECT/SEOR SHALL NOT INCLUDE INSPECTIONS OF THE PROTECTIVE MEASURES OF THE CONSTRUCTION PROCEDURES.

WHEN THE ALLOWANCE FOR SUBSTITUTION OF A SPECIFIED MATERIAL OR PRODUCT DESIGNATION IS IMPLIED ON THE DESIGN DRAWINGS BY THE USE OF THE WORDS 'OR APPROVED EQUAL', APPROVAL SHALL BE OBTAINED FROM THE SEOR AND THE GOVERNING AGENCY PRIOR TO FABRICATION OR INSTALLATION.

DIMENSIONS SHALL GOVERN OVER SCALES SHOWN ON DRAWINGS. THE OWNER SHALL EMPLOY ONE OR MORE SPECIAL INSPECTORS WHO SHALL PROVIDE SPECIAL INSPECTIONS DURING CONSTRUCTION.

SHOP DRAWINGS: SHOP DRAWINGS, INCLUDING CONCRETE MIX DESIGNS SHALL BE SUBMITTED TO THE SEOR FOR REVIEW PRIOR TO FABRICATION OR USE.

SHOP DRAWINGS AND CONCRETE MIX DESIGNS WILL NOT BE ACCEPTED BY THE SEOR DIRECTLY FROM THE PROJECT SUB-CONTRACTORS.

CONCRETE:

ALL CONCRETE WORK SHALL CONFORM TO THE STANDARDS OF THE AMERICAN CONCRETE INSTITUTE (ACI), 'ACI MANUAL OF CONCRETE PRACTICE' CURRENT EDITION.

WHEN SPECIFIED FOR USE, NORMAL WEIGHT (NW) CONCRETE SHALL HAVE A DRY UNIT WEIGHT OF 150 ± 3 PCF. AGGREGATES FOR NORMAL WEIGHT CONCRETE SHALL CONFORM TO ASTM C33.

CONCRETE SHALL ATTAIN THE FOLLOWING MINIMUM COMPRESSIVE STRENGTH (F'c) AT 28 DAYS AND SHALL MEET THE OTHER REQUIREMENTS INDICATED BELOW.

CONCRETE MIX PROPORTIONING SHALL BE IN ACCORDANCE WITH ARTICLE 4.2.3 OF ACI 301, AND BASED ON FIELD EXPERIENCE AND/OR TRAIL MIXTURES.

CONCRETE MIX DESIGN SHALL BE PREPARED BY AN APPROVED TESTING LAB AND A REGISTERED CIVIL ENGINEER AND SUBMITTED TO THE STRUCTURAL ENGINEER OF RECORD (SEOR) FOR REVIEW.

ALL FURNISHED CONCRETE MIX DESIGNS SHALL REFLECT PROVEN CONCRETE SHRINKAGE CHARACTERISTICS OF 0.004 IN/IN (0.04%) FINAL SHRINKAGE STRAIN OR LESS AT ALL SLABS.

CONCRETE SHALL BE CONVEYED TO FINAL LOCATION BY METHODS THAT PREVENT SEGREGATION OR LOSS OF CONSTITUENTS AND ENSURE THE REQUIRED CONCRETE QUALITY.

CONSTRUCTION JOINTS SHALL BE ROUGHENED TO 1/4" AMPLITUDE, THOROUGHLY CLEANED AND ALL LANTANCE SHALL BE REMOVED. ALL JOINTS SHALL BE THOROUGHLY DAMPENED, BUT WITHOUT STANDING WATER.

CONCRETE SHALL BE PLACED DURING COLD WEATHER SHALL COMPLY WITH ACI 308R, 'GUIDE TO COLD WEATHER CONCRETING' AND ACI 306.1, 'STANDARD SPECIFICATION FOR COLD WEATHER CONCRETING'.

CONCRETE SHALL BE MAINTAINED IN A CONTINUOUSLY MOIST CONDITION ABOVE 50° FOR A MINIMUM OF SEVEN (7) DAYS AFTER PLACEMENT.

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STRUCTURAL AND MISCELLANEOUS STEEL:

ALL STRUCTURAL AND MISCELLANEOUS STEEL SHALL BE FABRICATED AND ERRECTED IN ACCORDANCE WITH AISC SPECIFICATIONS FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL.

WELDING PROCEDURE SPECIFICATIONS (WPS) SHALL BE SUBMITTED FOR REVIEW FOR EACH WELD TYPE, WELDING PROCESS, WELDING ELECTRODE CLASSIFICATION AND/OR BASE MATERIAL.

ALL STRUCTURAL AND MISCELLANEOUS STEEL SHALL CONFORM TO THE FOLLOWING SPECIFICATION (UNLESS NOTED OTHERWISE).

BOLTS, THREADED RODS, AND WASHERS SHALL CONFORM TO THE FOLLOWING UNO: A. MACHINE BOLTS: ASTM A-307

UNLESS NOTED OTHERWISE, BOLTS SHALL BE INSTALLED 'SNUG TIGHT'. THE SNUG TIGHT CONDITION IS DEFINED AS THE TIGHTNESS THAT EXISTS WHEN ALL PILES OF THE JOINT ARE IN FIRM CONTACT.

HOLES FOR BOLTED CONNECTIONS AND ANCHOR BOLTS SHALL BE AISC 'STANDARD' HOLES LIMITED TO 1/16-INCH LARGER IN DIAMETER THAN NOMINAL BOLT DIAMETER.

WHERE LENGTH OF WELD IS NOT INDICATED, WELD SHALL BE FULL LENGTH OF JOINT.

Table 2.4: MINIMUM SIZE OF FILLET WELDS. Columns: MATERIAL THICKNESS OF THINNER PART JOINED, MINIMUM SIZE OF FILLET WELD.

WHERE LENGTH OF WELD IS NOT INDICATED, WELD SHALL BE FULL LENGTH OF JOINT.

ALL COMPLETE- AND PARTIAL-JOINT PENETRATION GROOVE WELDS SHALL BE PERFORMED USING 'INNERSHIELD' AND 'NL-2' SEMI-AUTOMATIC EQUIPMENT.

SEE SPECIAL INSPECTION AND TESTING NOTES FOR INSPECTION AND TESTING REQUIREMENTS.

REVISIONS

Table with 2 columns: Revision Number and Description. Includes revision 1: 100% CD.

UNIVERSITY OF CALIFORNIA, RIVERSIDE 95090 SCHOOL OF MEDICINE EDUCATION 1 DATA CENTER RENOVATION

900 UNIVERSITY AVE, RIVERSIDE, CA 92521

100% CD

STRUCTURAL NOTES AND ABBREVIATIONS

S0.01



STRUCTURAL SHEET INDEX table with columns: SHEET NUMBER, SHEET NAME. Lists sheets S0.01 through S3.01.

Table with 2 columns: DATE and DRAWN. Includes date 8/18/21 and drafter GL.

STRUCTURAL NOTES AND ABBREVIATIONS

S0.01

POST-INSTALLED ANCHORS:

- 1. POST INSTALLED ANCHOR NOTES IN THIS SECTION SHALL APPLY TO ALL ANCHORS (INCLUDING THREADED ROD OR REINFORCING BARS) INSTALLED INTO HARDENED CONCRETE OR MASONRY EXCEPT FOR POWDER DRIVEN FASTENERS, AS APPLICABLE. SEE POWDER DRIVEN FASTENER GENERAL NOTES FOR MORE INFORMATION.
2. INSTALLATION SHALL CONFORM TO THE MANUFACTURER'S INSTRUCTIONS AND THE APPLICABLE EVALUATION REPORT AND SHALL BE INSTALLED BY PERSONNEL TRAINED TO INSTALL THE TYPE OF POST-INSTALLED ANCHOR BEING INSTALLED.
3. LOCATE EXISTING REINFORCING BY NON-DESTRUCTIVE METHODS PRIOR TO DRILLING. EXISTING REINFORCING SHALL NOT BE CUT OR DAMAGED.
4. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF FC = 2500 PSI, BE A MINIMUM OF 21 DAYS OLD AND HAVE A MINIMUM TEMPERATURE OF 50 DEGREES FAHRENHEIT WHEN DRILLING OCCURS.
5. HOLES FOR INSTALLATION OF THE POST-INSTALLED ANCHOR SHALL BE DRILLED USING A DRILL THAT HAS A CARBIDE-TIPPED BIT THAT COMPLIES WITH ANSI B212.15. A REBAR CUTTING DRILL BIT IS NOT ALLOWED.
6. CONTRACTOR SHALL USE APPROPRIATE EQUIPMENT AND METHODS AS REQUIRED TO PROVIDE DRILLED HOLES FOR POST-INSTALLED ANCHORS IN ACCORDANCE WITH APPLICABLE STANDARDS, MANUFACTURER'S RECOMMENDATIONS, AND QUALIFYING (IC) TEST REPORTS. CARE SHALL BE TAKEN TO PREVENT OVERSIZING, OVALING, AND/OR BLOW-OUT THROUGH THE BACK FACE OF THE DRILLED MEMBER, IF OVERSIZING, OVALING, AND/OR BLOW-OUT OCCURS, THE EMPLOYED EQUIPMENT AND METHODS SHALL BE DISCONTINUED. ADDITIONAL DRILLING SHALL NOT BE RESUMED UNTIL THE SECTOR HAS PROVIDED APPROVED REPAIR PROCEDURES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST OF ALL SUCH REPAIRS. WHEN RESUMING DRILLING, THE CONTRACTOR SHALL MODIFY THE PROCEDURES AS NECESSARY TO PREVENT FURTHER DAMAGE.
7. HOLES SHALL BE CLEANED OF DUST AND DEBRIS, USING A WIRE BRUSH AND COMPRESSED AIR OR MANUFACTURER'S BLOW-OUT BULB (AS PER MANUFACTURER'S RECOMMENDATIONS) AS REQUIRED TO REMOVE PARTICULATE DEBRIS AND TO ACHIEVE A RELATIVELY DUST-FREE SURFACE.
8. OIL, SCALE, AND RUST SHALL BE REMOVED FROM THE POST-INSTALLED ANCHOR AND HOLES SHALL BE DRY, PRIOR TO INSTALLATION.
9. POST-INSTALLED EMBEDMENT DEPTHS NOTED ON THE PLANS OR DETAILS ARE NOMINAL (I.E. MEASURED FROM FACE OF CONCRETE OR MASONRY TO EMBEDDED TIP OF ANCHOR/REBAR). FOR CORRESPONDING HOLE DEPTH, REFER TO APPLICABLE EVALUATION REPORT.
10. APPROVED ADHESIVE ANCHOR SYSTEMS (AND ANCHOR SPECIFICATION) AND EVALUATION REPORTS ARE AS FOLLOWS:
A. CONCRETE
* HILTI HIT-RE 500 V3 (ISO 888 CLASS 5.8) ESR-3814
* HILTI HIT-HY 200 (ISO 888 CLASS 5.8) ESR-3187
* DEWALT PURE 110V (A36) ESR-3288
* DEWALT AC208+ (A36) ESR-4027
WHERE NOTED ON SPECIFIC DETAILS, INSTALLATION OF ADHESIVE ANCHORS SHALL BE BY PERSONNEL CERTIFIED BY AN APPLICABLE CERTIFICATION PROGRAM PER ACI 318 SECTION 17.8.2.2. CERTIFICATION SHALL INCLUDE WRITTEN AND PERFORMANCE TESTS IN ACCORDANCE WITH ACI/CRSI ADHESIVE ANCHOR INSTALLER CERTIFICATION PROGRAM. CERTIFICATION DOCUMENTS SHALL BE SUBMITTED TO THE SEOR AND AHI FOR REVIEW AND ACCEPTANCE PRIOR TO INSTALLATION.
12. APPROVED EXPANSION ANCHORS AND EVALUATION REPORTS ARE AS FOLLOWS:
A. CONCRETE NOT EXPOSED TO WEATHER:
* HILTI KWIK BOLT-TZZ ANCHORS ESR-4266
* DEWALT POWER-STUD+ SD2 ESR-2502
* SIMPSON STRONG-TIE STRONG-BOLT 2 WEDGE ANCHOR ESR-3037
13. WHERE APPLICABLE, EXPANSION ANCHORS SHALL BE INSTALLED WITH THE MINIMUM TORQUE, USING A CALIBRATED TORQUE WRENCH. WEDGE OR SLEEVE TYPE ANCHORS MUST ATTAIN THE SPECIFIED TORQUE WITHIN ONE-HALF TURN OF THE NUT, EXCEPT 1/4" AND 3/8" DIAMETER WEDGE OR SLEEVE TYPE ANCHORS MUST ATTAIN SPECIFIED TORQUE WITHIN ONE QUARTER TURN OF THE NUT.
14. INSTALLATION TORQUES FOR EXPANSION ANCHORS SHALL BE AS NOTED BELOW:

EXPANSION ANCHOR MAXIMUM INSTALLATION TORQUE LOADS IN CONCRETE (FT-LB) table with columns: NOMINAL ANCHOR DIAMETER, HILTI KWIK BOLT-TZZ, DEWALT POWER-STUD+ SD2, OR SD4, OR SD6, SIMPSON STRONG BOLT 2

- 15. APPROVED SCREW ANCHORS AND EVALUATION REPORTS ARE AS FOLLOWS:
A. CONCRETE
* HILTI KH-EZ OR KH-EZ P ANCHORS ESR-3927
* DEWALT SCREW-BOLT+ ESR-3889
* DEWALT ULTRACON+ ESR-3066
* SIMPSON TITEN HD ESR-2713
* ITW RED HEAD TAPCON+ ESR-3699

SCREW ANCHOR MAXIMUM INSTALLATION TORQUE LOADS IN CONCRETE (FT-LB) table with columns: NOMINAL ANCHOR DIAMETER, HILTI KH-EZ OR KH-EZ P, DEWALT SCREW BOLT+, SIMPSON TITEN HD, ITW RED HEAD TAPCON+

17. SEE SPECIAL INSPECTION AND TESTING NOTES FOR INSPECTION REQUIREMENTS.

SPECIAL INSPECTIONS:

- 1. THE OWNER, OR THE OWNER'S AUTHORIZED AGENT (OTHER THAN THE CONTRACTOR AS APPLICABLE) SHALL EMPLOY ONE OR MORE SPECIAL INSPECTORS, INCLUDING AS APPLICABLE AN INSPECTOR OF RECORD (IOR), WHO SHALL PROVIDE SPECIAL INSPECTIONS FOR THE CONSTRUCTION FOR CERTAIN TYPES OF WORK WHEN SO SPECIFIED IN THE CONTRACT DOCUMENTS AND PROJECT SPECIFICATIONS. WHERE AN IOR IS REQUIRED BY THE GOVERNING AGENCY, THE IOR MAY PERFORM SPECIAL INSPECTIONS IF THAT PERSON IS QUALIFIED PER THE GOVERNING AGENCY'S STANDARDS FOR THE SPECIAL INSPECTIONS REQUIRED. WHERE AN IOR IS NOT REQUIRED, THESE SPECIAL INSPECTIONS SHALL BE IN ADDITION TO AND COMPLEMENTARY WITH THE INSPECTIONS PROVIDED BY THE GOVERNING AGENCY.
2. THE SPECIAL INSPECTOR SHALL BE A QUALIFIED PERSON FROM AN APPROVED AGENCY CONFORMING TO ASTM C1077 WHO SHALL DEMONSTRATE COMPETENCE. TO THE SATISFACTION OF THE ARCHITECT, STRUCTURAL ENGINEER OF RECORD AND THE GOVERNING AGENCY, FOR INSPECTION OF THE PARTICULAR TYPE OF CONSTRUCTION OR OPERATION REQUIRING SPECIAL INSPECTION.
3. THE SPECIAL INSPECTOR SHALL OBSERVE THE WORK ASSIGNED FOR CONFORMANCE WITH THE DESIGN DRAWINGS, SPECIFICATIONS AND APPLICABLE WORKMANSHIP PROVISIONS OF THE CODE AND OTHER APPLICABLE REGULATIONS IDENTIFIED WITHIN THE CONSTRUCTION DOCUMENTS. ALL DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE GENERAL CONTRACTOR FOR CORRECTION AND THEN, IF UNCORRECTED, TO THE ATTENTION OF THE ARCHITECT, STRUCTURAL ENGINEER OF RECORD AND THE GOVERNING AGENCY. IT SHALL BE THE GENERAL CONTRACTOR'S RESPONSIBILITY TO COORDINATE WITH THE SPECIAL INSPECTOR AND SCHEDULE THE SPECIAL INSPECTIONS WITH ADEQUATE TIME TO ADDRESS ANY AND ALL POTENTIAL DISCREPANCIES PRIOR TO PROCEEDING WITH SUBSEQUENT WORK THAT COVERS OR OTHERWISE MAKES INACCESSIBLE ANY WORK IDENTIFIED AS DEVIATING FROM THE PROJECT REQUIREMENTS.
4. THE SPECIAL INSPECTOR SHALL FURNISH REGULAR INSPECTION REPORTS TO THE ARCHITECT, STRUCTURAL ENGINEER OF RECORD AND THE GOVERNING AGENCY IDENTIFYING THE WORK INSPECTED AND ANY UNCORRECTED DISCREPANCIES FROM THE CONSTRUCTION DOCUMENTS. AT THE CONCLUSION OF THE PROJECT OR THE SPECIAL INSPECTOR'S ASSIGNED SCOPE OF WORK, THE SPECIAL INSPECTOR SHALL SUBMIT A FINAL SIGNED REPORT STATING WHETHER THE WORK REQUIRING SPECIAL INSPECTION WAS, TO THE BEST OF HIS OR HER KNOWLEDGE, COMPLETED IN CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS AND SPECIFICATIONS (INCLUDING APPROVED RFPS, ADDENDUMS, ETC.) AND THE APPLICABLE WORKMANSHIP PROVISIONS OF THE CODE AND OTHER APPLICABLE REGULATIONS IDENTIFIED WITHIN THE CONSTRUCTION DOCUMENTS.
5. UNLESS NOTED OTHERWISE, SPECIAL INSPECTIONS INDICATED BELOW SHALL BE PROVIDED IN EITHER A CONTINUOUS OR PERIODIC CAPACITY, AS DEFINED BELOW, AS REQUIRED BY THE INDIVIDUAL, CODE OR REFERENCED STANDARD.
6. CONTINUOUS - SPECIAL INSPECTION BY THE SPECIAL INSPECTOR WHO IS PRESENT WHEN AND WHERE THE WORK TO BE INSPECTED IS BEING PERFORMED.
7. PERIODIC - SPECIAL INSPECTION BY THE SPECIAL INSPECTOR WHO IS INTERMITTENTLY PRESENT WHERE THE WORK TO BE INSPECTED HAS BEEN OR IS BEING PERFORMED, FOR STRUCTURAL STEEL. PERIODIC INSPECTION IS FURTHER DEFINED SUCH THAT ITEMS ARE OBSERVED ON A RANDOM BASIS.
8. FOR STRUCTURAL STEEL WELDING AND BOLTING, SPECIAL INSPECTION SHALL BE PROVIDED IN EITHER AN OBSERVE OR PERFORM CAPACITY AS DEFINED BELOW:
* OBSERVE (O) - INSPECTOR SHALL OBSERVE THESE ITEMS ON A RANDOM BASIS
* PERFORM (P) - INSPECTOR SHALL OBSERVE OR PERFORM SPECIFIED TASK FOR EACH WELDED OR BOLTED JOINT OR MEMBER
9. QUALITY CONTROL (QC) INSPECTION TASKS SHALL BE PERFORMED BY THE FABRICATOR'S OR ERECTOR'S QC INSPECTOR (OCI) AS INDICATED. QUALITY ASSURANCE (QA) INSPECTION TASKS SHALL BE PERFORMED BY THE QA INSPECTOR (QA) AS INDICATED. WHEN A TASK IS INDICATED TO BE PERFORMED BY BOTH THE QA AND OCI, COORDINATION IS PERMITTED SO THAT THE INSPECTION FUNCTIONS ARE PERFORMED BY ONLY ONE PARTY. WHEN THE QA RELIES ON THE OCI, THE APPROVAL OF THE SEOR AND AGENCY HAVING JURISDICTION IS REQUIRED.
10. THE FOLLOWING CONSTRUCTION ELEMENTS AND MATERIALS SHALL BE INSPECTED AND EVALUATED BY A SPECIAL INSPECTOR IN ACCORDANCE WITH THE NOTED CBC SECTION AND REFERENCED STANDARDS. WHERE ELEMENTS AND MATERIALS ARE PRESENT ON THE PROJECT, SEE GENERAL NOTES FOR EACH MATERIAL FOR ADDITIONAL REQUIREMENTS. IN ADDITION TO TABLES AND NOTES BELOW.

CONCRETE SPECIAL INSPECTION TABLE: REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION PER CBC TABLE 1705.3

Table with columns: VERIFICATION AND INSPECTION, CONTINUOUS DURING TASK LISTED, PERIODICALLY DURING TASK LISTED, REFERENCE FOR CRITERIA (CBC, AISC, ACI, ASTM, etc.)

- CONCRETE SPECIAL INSPECTION NOTES:
1. SPECIFIC REQUIREMENTS FOR SPECIAL INSPECTION ARE INCLUDED IN THE RESEARCH REPORT FOR EACH POST-INSTALLED ANCHOR ISSUED BY AN APPROVED SOURCE. THESE SPECIAL INSPECTION REQUIREMENTS SHOULD BE FOLLOWED. WHERE SPECIFIC REQUIREMENTS ARE NOT PROVIDED, CONTACT STRUCTURAL ENGINEER FOR SPECIAL INSPECTION REQUIREMENTS PRIOR TO PROCEEDING WITH THE WORK. PROJECT SPECIFIC SPECIAL INSPECTION MEASURES SHALL BE APPROVED BY THE GOVERNING AGENCY PRIOR TO THE COMMENCEMENT OF THE WORK.
2. A STRENGTH TEST SHALL BE THE AVERAGE OF AT A MINIMUM, TWO 6x2 CYLINDERS OR THREE 4x8 CYLINDERS MADE FROM THE SAME SAMPLE OF CONCRETE. A TESTING LABORATORY SHALL MAKE AND TEST ONE SAMPLE SET FOR EACH 150 CUBIC YARDS OF CONCRETE BUT NOT LESS THAN ONE SAMPLE SET FOR EACH 5,000 SQFT OF SURFACE AREA FOR SLABS OR WALLS. IF TOTAL VOLUME OF CONCRETE IS SUCH THAT FREQUENCY OF TESTING WOULD PRODUCE FEWER THAN 4 STRENGTH TESTS FOR A GIVEN CONCRETE MIXTURE, THEN STRENGTH TEST SPECIMENS SHALL BE MADE FROM AT LEAST 5 RANDOMLY SELECTED BATCHES OR FROM EACH BATCH IF FEWER THAN 5 BATCHES ARE USED.

STEEL SPECIAL INSPECTION TABLES:

INSPECTION TASKS PRIOR TO HIGH STRENGTH BOLTING PER AISC 360 TABLE N5-1 table with columns: INSPECTION TASKS PRIOR TO BOLTING, QC, QA

INSPECTION TASKS DURING HIGH STRENGTH BOLTING PER AISC 360 TABLE N5-2 table with columns: INSPECTION TASKS DURING BOLTING, QC, QA

INSPECTION TASKS AFTER HIGH STRENGTH BOLTING PER AISC 360 TABLE N5-3 table with columns: INSPECTION TASKS AFTER BOLTING, QC, QA

INSPECTION TASKS PRIOR TO WELDING PER AISC 360 TABLE N5-4-1 table with columns: INSPECTION TASKS PRIOR TO WELDING, QC, QA

INSPECTION TASKS DURING WELDING PER AISC 360 TABLE N5-4-2 table with columns: INSPECTION TASKS DURING WELDING, QC, QA

INSPECTION TASKS AFTER WELDING PER AISC 360 TABLE N5-4-3 table with columns: INSPECTION TASKS AFTER WELDING, QC, QA

- STEEL SPECIAL INSPECTION AND TESTING NOTES:
1. THE FABRICATOR OR ERECTOR, AS APPLICABLE, SHALL MAINTAIN A SYSTEM BY WHICH A WELDER WHO HAS WELDED A JOINT OR MEMBER CAN BE IDENTIFIED. STAMPS, IF USED, SHALL BE THE LOW-STRESS TYPE.
2. SHOP WELDING WHERE DONE IN THE SHOP OF A LICENSED STEEL FABRICATOR REGISTERED WITH AND APPROVED BY THE GOVERNING AGENCY MAY BE EXEMPT FROM SPECIAL INSPECTION.
3. INSPECTION OF WELDS SHALL BE PERFORMED IN ACCORDANCE WITH AWS D1.101:1M.

STRUCTURAL OBSERVATION:

- 1. THE STRUCTURAL ENGINEER OF RECORD (SEOR), OR HIS/HER DESIGNATED ENGINEER, SHALL PROVIDE VISUAL STRUCTURAL OBSERVATION OF THE STRUCTURAL SYSTEM FOR GENERAL CONFORMANCE TO THE APPROVED CONSTRUCTION DOCUMENTS AND SPECIFICATIONS AT SIGNIFICANT CONSTRUCTION STAGES AND AT COMPLETION OF THE STRUCTURAL SYSTEM. AS REQUIRED BY CBC SECTION 1704 OR 1704.6-B AND AS DEFINED IN CBC SECTION 1702 OR 1702A, WRITTEN REPORTS SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE OR HIS DESIGNEE FOR DISTRIBUTION TO THE SPECIAL INSPECTOR, CONTRACTOR AND BUILDING OFFICIAL.
2. THE STRUCTURAL OBSERVER SHALL SUBMIT A WRITTEN STATEMENT TO THE GOVERNING AGENCY THAT THE SITE VISITS HAVE BEEN MADE. SUCH REPORTS SHALL IDENTIFY ANY OBSERVED DEFICIENCIES, WHICH TO THE BEST OF THE STRUCTURAL OBSERVER'S KNOWLEDGE HAVE NOT BEEN RESOLVED. AT THE COMPLETION OF THE STRUCTURAL SYSTEM, THE STRUCTURAL OBSERVER SHALL PROVIDE A FINAL OBSERVATION REPORT INDICATING THAT TO THE BEST OF HIS/HER KNOWLEDGE ALL OBSERVED DEFICIENCIES HAVE BEEN RESOLVED AND THE STRUCTURAL SYSTEM GENERALLY CONFORMS TO THE APPROVED PLANS AND SPECIFICATIONS.
3. STRUCTURAL OBSERVATION DOES NOT INCLUDE OR WAIVE THE RESPONSIBILITY OF THE INSPECTIONS BY THE BUILDING OFFICIAL AS REQUIRED BY THE CALIFORNIA ADMINISTRATIVE CODE. SPECIAL INSPECTIONS REQUIRED BY CBC SECTION 1705 OR 1705A, OR ANY OTHER INSPECTION REQUIRED BY OTHER SECTIONS OF THE CODE OR AS NOTED ELSEWHERE IN THE CONTRACT DOCUMENTS, THE STRUCTURAL OBSERVER DOES NOT HAVE THE AUTHORITY TO APPROVE COVERING OF CONSTRUCTION AND HIS/HER POSITIVE DISPOSITION OF THE OBSERVATION REPORT DOES NOT WARRANT THAT THE CONSTRUCTION WILL PASS THE BUILDING OFFICIAL'S INSPECTION.
4. STRUCTURAL OBSERVATION FOR THIS PROJECT SHALL BE PROVIDED BY MHP STRUCTURAL ENGINEERS, INC. 3800 COVER STREET, LONG BEACH, CALIFORNIA, 90808. TELEPHONE: (562) 985-3200, FAX: (562) 985-1011.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONSTRUCTION SCHEDULE AND SHALL NOTIFY THE STRUCTURAL OBSERVER NO LESS THAN THREE (3) BUSINESS DAYS IN ADVANCE OF REQUIRED OBSERVATIONS. FAILURE OF THE CONTRACTOR TO PROVIDE ADEQUATE NOTIFICATION MAY RESULT IN DELAYS DUE TO CORRECTIVE WORK OR REMOVAL OF SUBSEQUENT WORK TO ALLOW ADEQUATE OBSERVATION. REMOVAL AND REPLACEMENT OF ANY FINISHED WORK AND/OR FRAMING DAMAGED BY THE REMOVAL PROCESS OR REQUIRED FOR CORRECTIVE ACTION RESULTING FROM INADEQUATE NOTIFICATION SHALL BE AT THE CONTRACTOR'S EXPENSE.
6. THE STRUCTURAL OBSERVER SHALL AS A MINIMUM PERFORM STRUCTURAL OBSERVATION AT THE FOLLOWING STAGES OF CONSTRUCTION (CONSTRUCTION STAGES AND ELEMENTS/CONNECTIONS TO BE OBSERVED):
A. SPECIALTY CONNECTIONS
JOIST PLATE STRENGTHENING.

REVISIONS

100% CD

UNIVERSITY OF CALIFORNIA, RIVERSIDE
950590 SCHOOL OF MEDICINE EDUCATION 1
DATA CENTER RENOVATION
900 UNIVERSITY AVE, RIVERSIDE, CA 92521

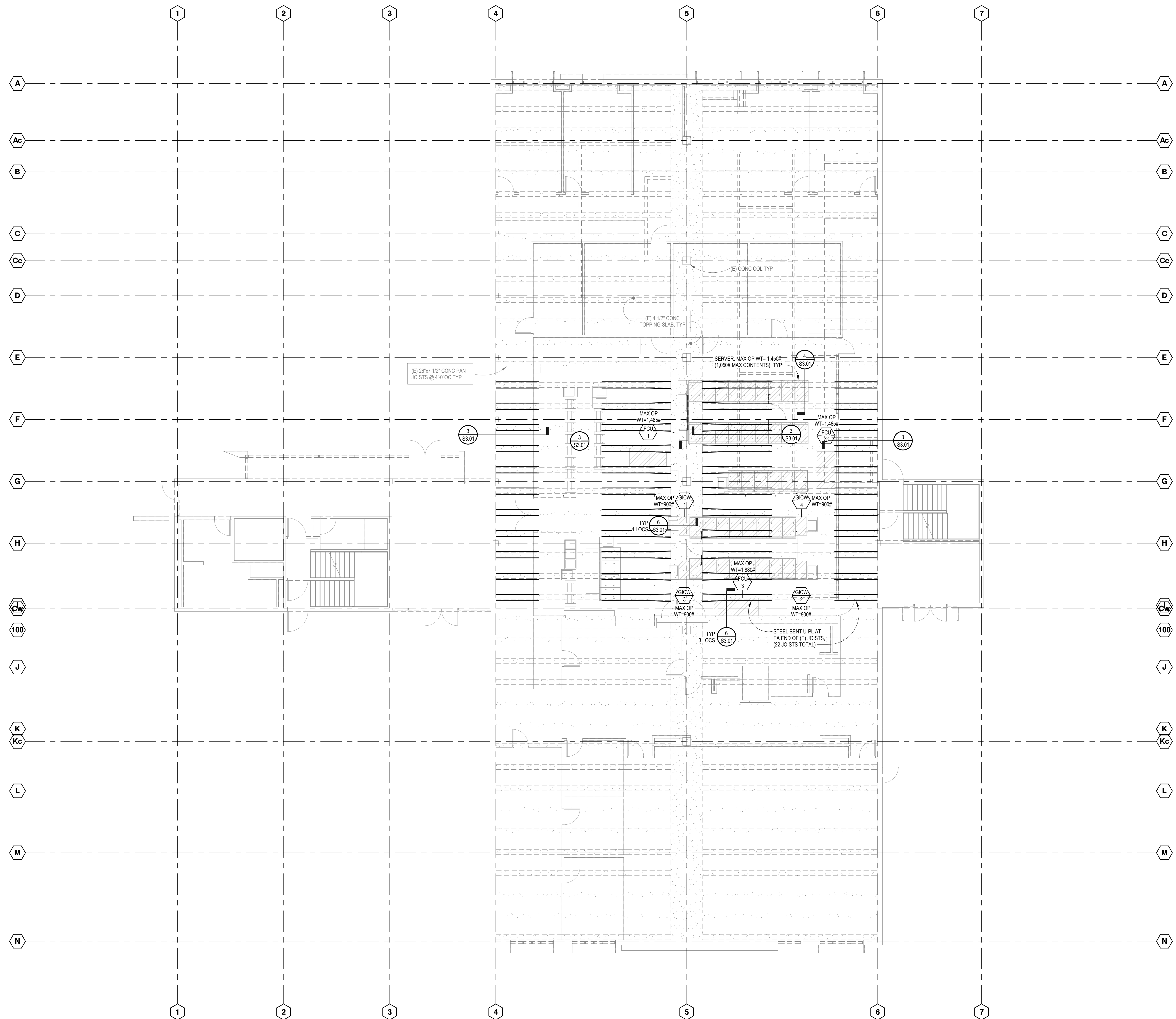


ISSA NO: 20222
DATE: 8/18/21
DRAWN: GL
CHECKED: TLF

STRUCTURAL NOTES

S0.02

- FRAMING PLAN NOTES**
- SEE GENERAL NOTES SHEET(S) FOR APPLICABLE NOTES AND ABBREVIATIONS.
 - EXISTING CONSTRUCTION IS SHOWN FADED AND IS LABELED AS EXISTING OR (E). NEW CONSTRUCTION IS SHOWN DARK AND IS SPECIFICALLY REFERENCED BY DETAILS AND NOTES.
 - EXISTING CONDITIONS ARE SHOWN TO THE BEST OF OUR KNOWLEDGE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ACTUAL CONDITIONS. DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THOSE SHOWN ON THESE DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO PROCEEDING.
 - DO NOT CUT ANY NEW OPENINGS OR ENLARGE ANY EXISTING OPENINGS IN THE ROOF, FLOOR OR WALLS (FOR DUCTS, PIPES, ETC.) UNLESS SPECIFICALLY SHOWN ON THESE STRUCTURAL DRAWINGS.
 - SEE ARCHITECTURAL AND MECHANICAL DRAWINGS FOR DIMENSIONS AND INFORMATION NOT SHOWN ON THESE DRAWINGS.



REVISIONS

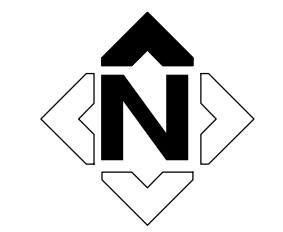
100% CD

UNIVERSITY OF CALIFORNIA, RIVERSIDE
**950590 SCHOOL OF MEDICINE EDUCATION 1
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 900 UNIVERSITY AVE., RIVERSIDE, CA 92521

ISSUE NO: 20222
 DATE: 8/18/21
 DRAWN: GL
 CHECKED: TLF

FIRST FLOOR
 FRAMING PLAN

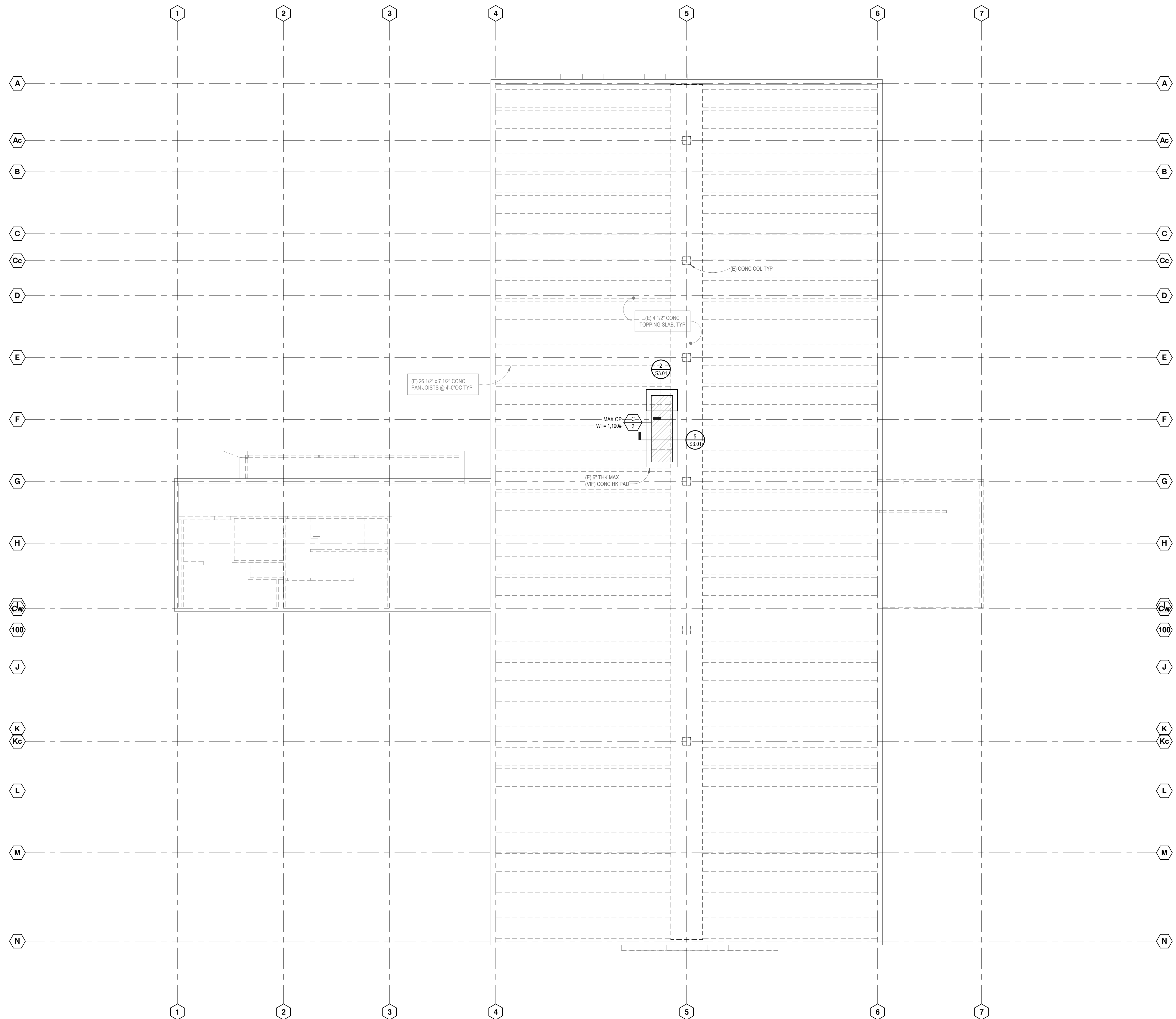
S2.02



1
 S2.02

FIRST FLOOR FRAMING PLAN
 SCALE: 1/8" = 1'-0"

FRAMING PLAN NOTES
1. SEE FLOOR FRAMING PLAN NOTES FOR ADDITIONAL APPLICABLE NOTES.



REVISIONS

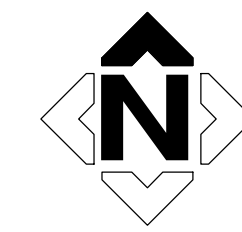
100% CD

UNIVERSITY OF CALIFORNIA, RIVERSIDE
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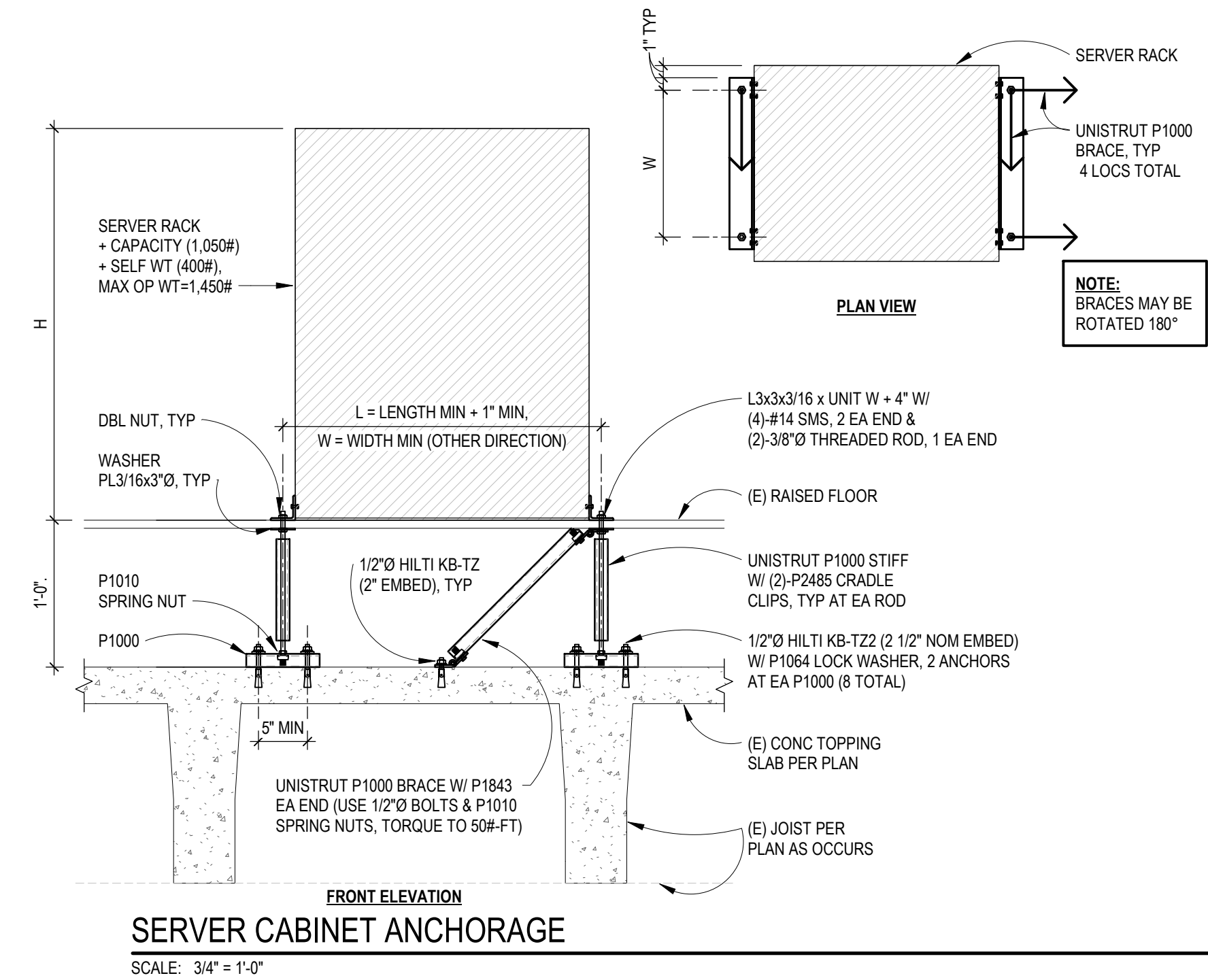
ROOF FRAMING
PLAN

S2.05

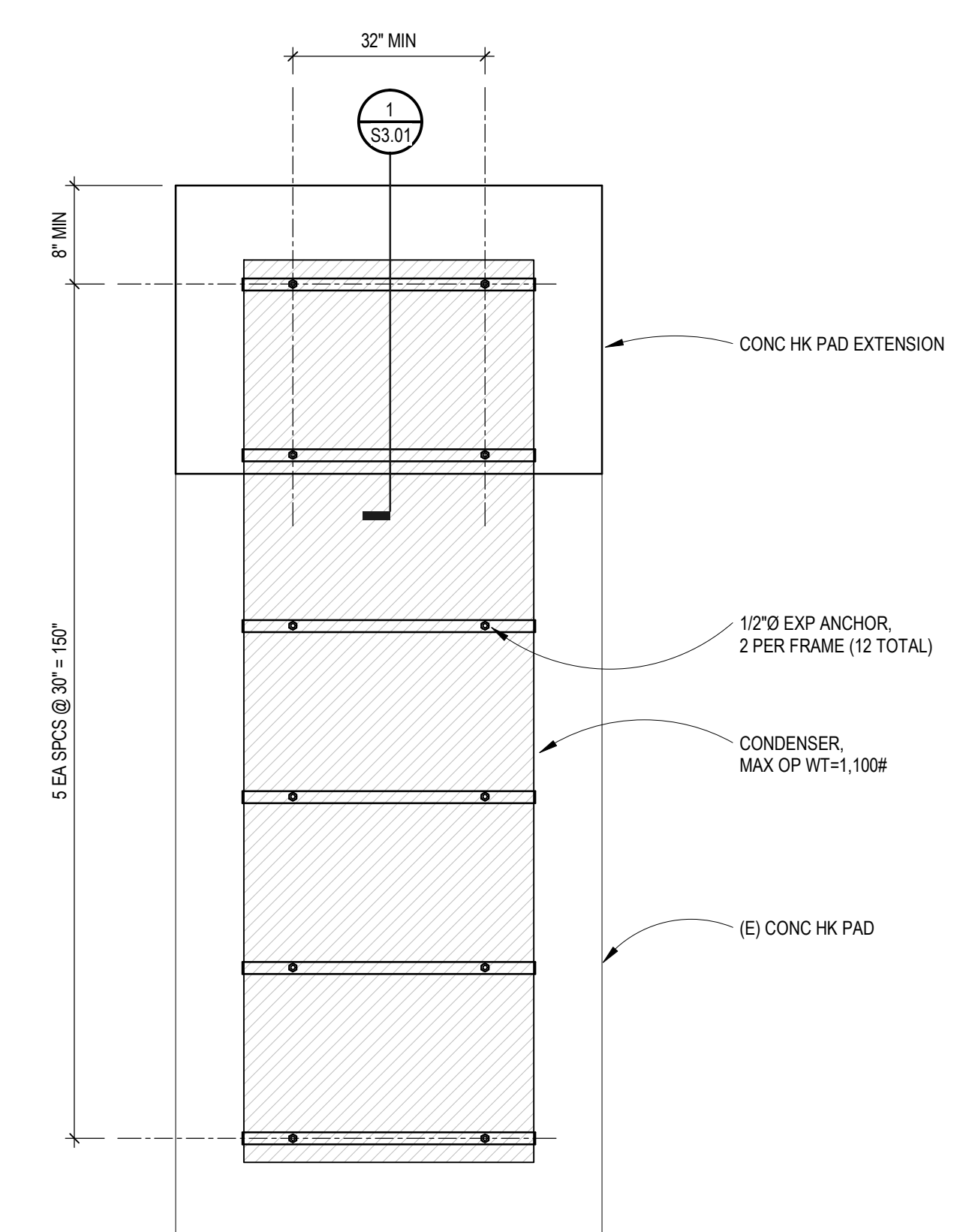


1
S2.05

ROOF FRAMING PLAN
SCALE: 1/8" = 1'-0"

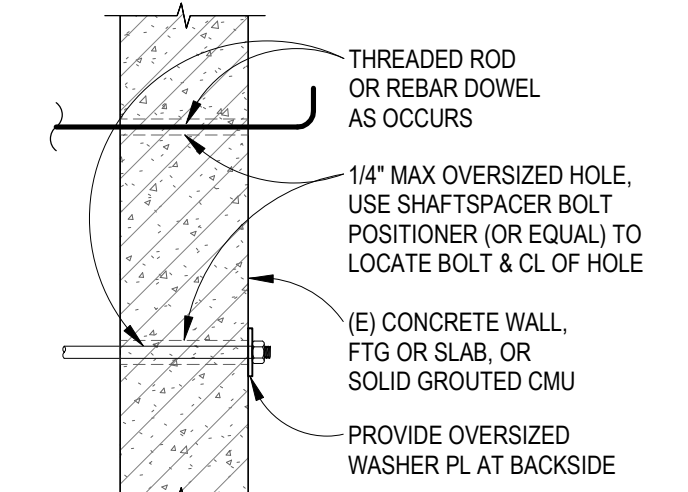


MECHANICAL EQUIPMENT SCHEDULE				
MARK	DIMENSIONS			MAXIMUM OPERATING WEIGHT
	L (MIN)	W (MIN)	H (MAX)	
FCU-1	74"	40"	78"	1,450#
FCU-2	74"	40"	78"	1,450#
GICW-1-4	48"	22"	49"	900#
FCU-3	91"	40"	78"	1,880#

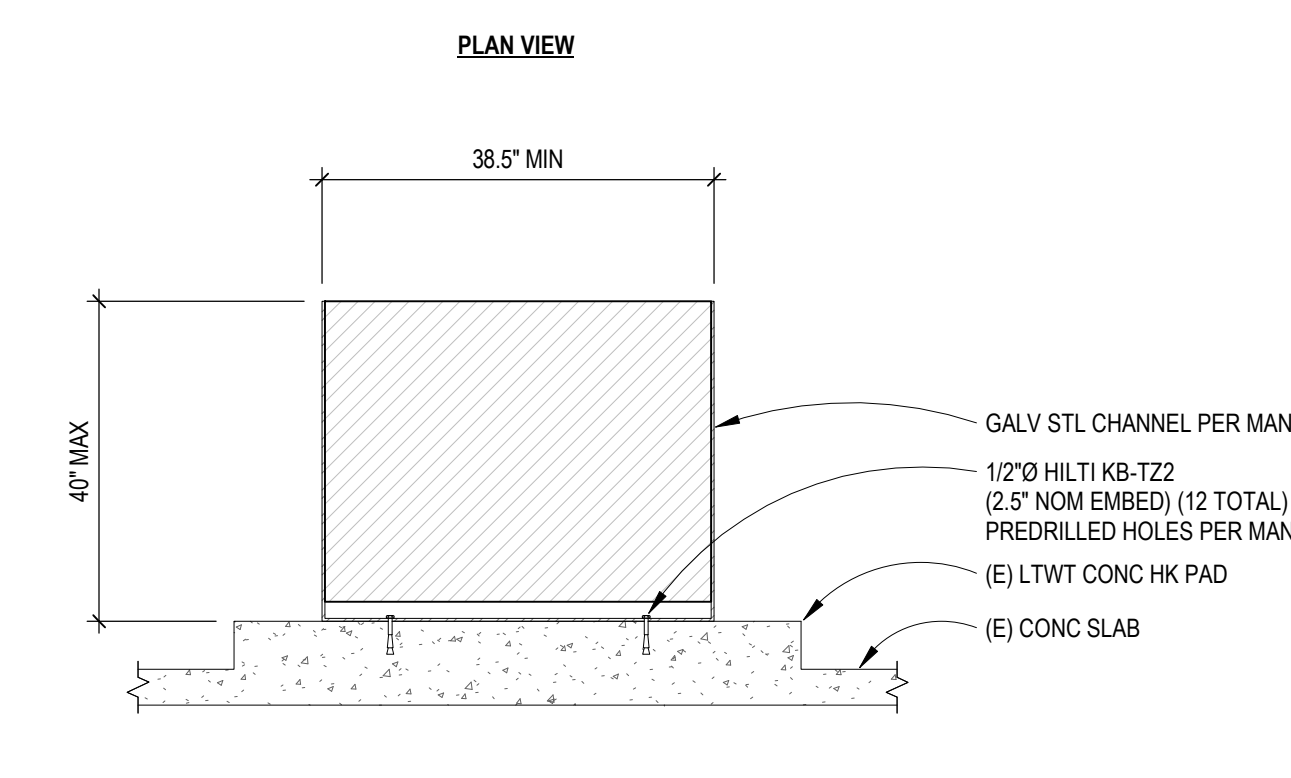


DO NOT CUT OR DAMAGE (E) REINFORCING.
 SEE POST INSTALLED ANCHORS GENERAL NOTES FOR MORE INFORMATION, TYP

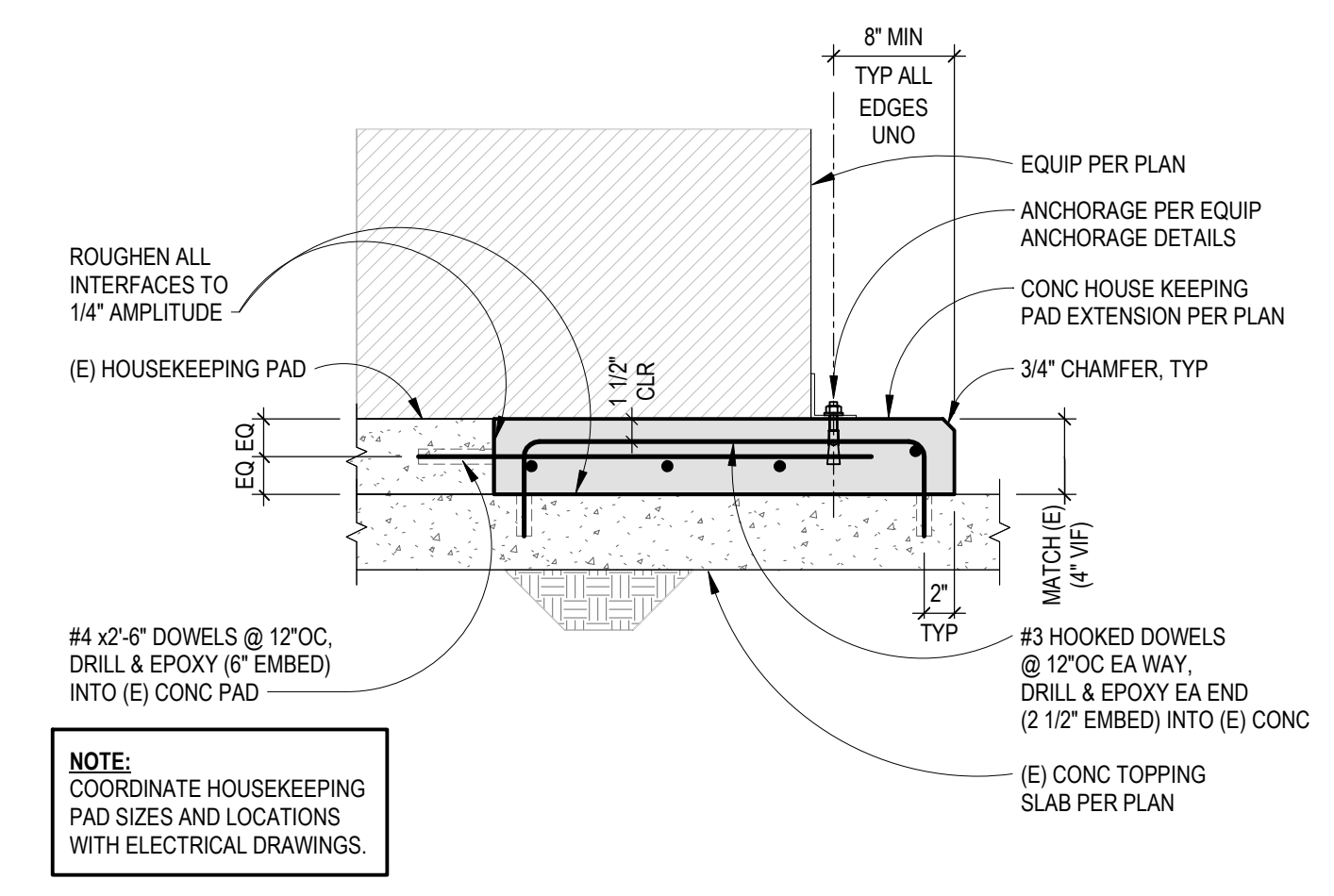
NOTES:
 1. AFTER INSTALLING BOLT OR REBAR, BUT PRIOR TO LOADING, INSTALL INJECTION TUBES, PLUG ENDS (LEAVING "AIR ESCAPE" HOLES ON BACKSIDE) AND FILL WITH Sika ANCHOR FIX-2 (OR APPROVED EQUAL PER MANUFACTURER'S INSTRUCTIONS).
 2. SEE POST-INSTALLED ANCHORS GENERAL NOTES FOR ADDITIONAL INFORMATION.



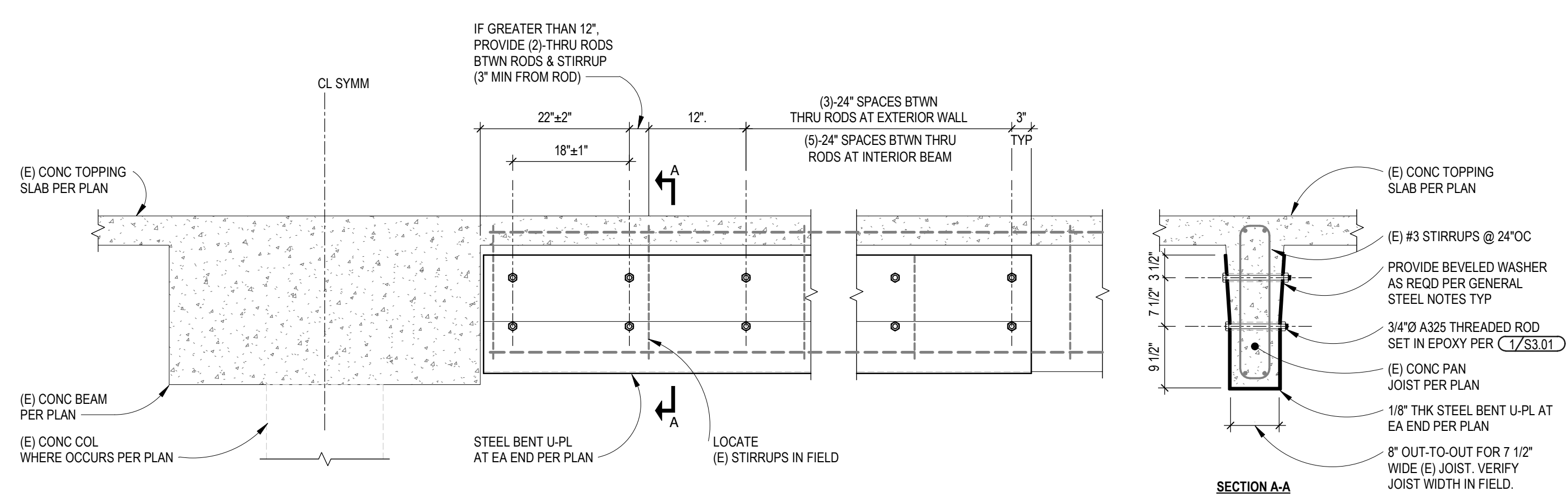
TYPICAL ADHESIVE ANCHORS THROUGH NORMAL-WEIGHT CONCRETE & CMU
 SCALE: NONE



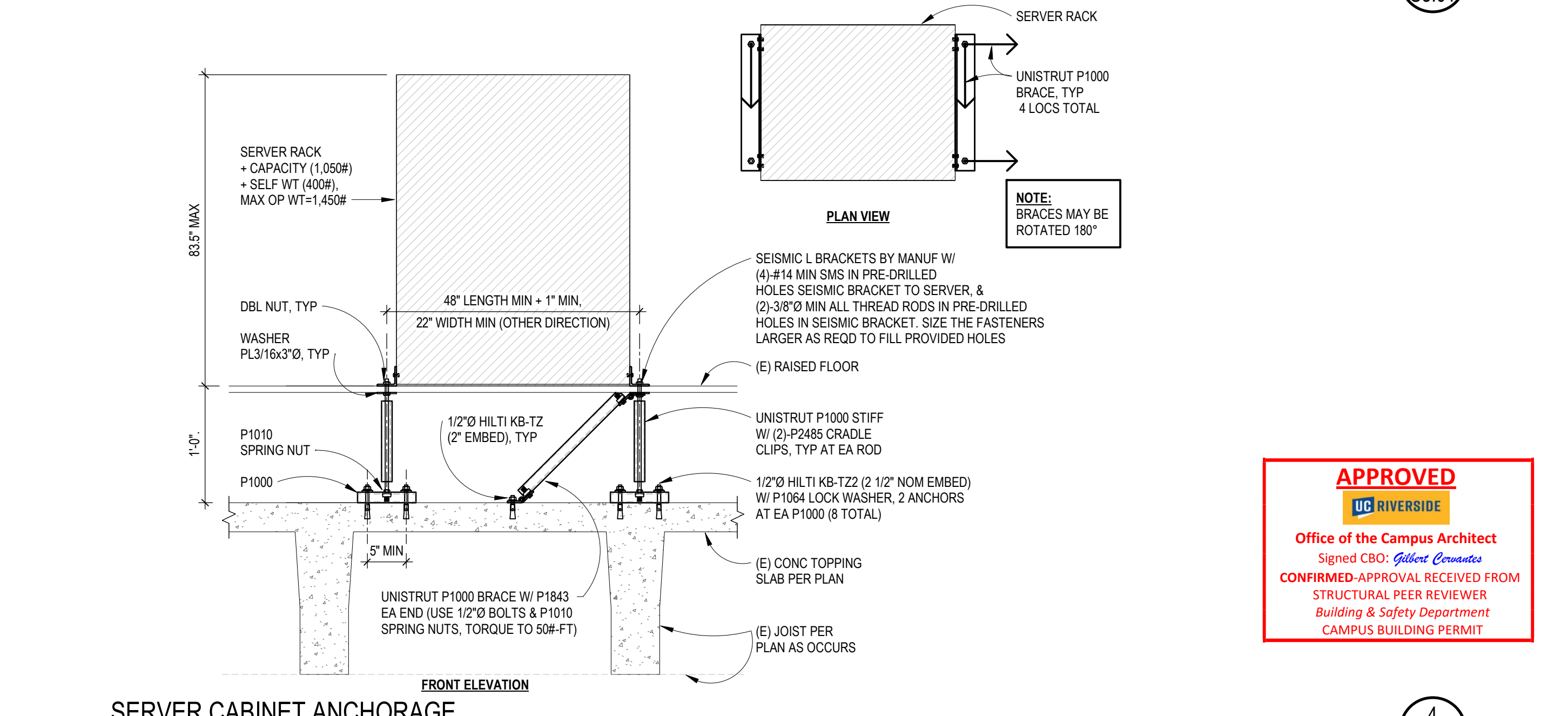
CONDENSER UNIT ON ROOF
 SCALE: 1/2" = 1'-0"



HOUSEKEEPING PAD EXTENSION
 SCALE: 1" = 1'-0"



EXISTING JOIST SHEAR REINFORCING
 SCALE: 3/4" = 1'-0"



SERVER CABINET ANCHORAGE
 SCALE: 3/4" = 1'-0"

APPROVED
 UC RIVERSIDE
 Office of the Campus Architect
 Signed: *Chris Gilbert* (Seal)
 CONFIRMED-APPROVAL RECEIVED FROM
 STRUCTURAL PEER REVIEWER
 Building & Safety Department
 CAMPUS BUILDING PERMIT

REVISIONS

100% CD

UNIVERSITY OF CALIFORNIA, RIVERSIDE
950590 SCHOOL OF MEDICINE EDUCATION 1
DATA CENTER RENOVATION
 900 UNIVERSITY AVE., RIVERSIDE, CA 92521

ISSUE NO: 20222
 DATE: 8/18/21
 DRAWN: GL
 CHECKED: TLF

SECTIONS AND DETAILS

S3.01

SPECIFICATIONS

TABLE OF CONTENTS

Division 01 – General Requirements

<u>Initial Issue</u>	<u>Revision</u>	<u>Section #</u>	<u>Title</u>
		01 1100	Summary of Work
		01 1200	Multiple Contract Summary
		01 1400	Work Restrictions
		01 2100	Allowances
		01 2300	Alternates
		01 2500	Product Options, Requirements & Substitution Procedures
		01 2613	Requests for Information & Instructions (RFI) Procedures
		01 3113	Coordination
		01 3119	Project Meetings
		01 3200	Document Control
		01 3216	Schedules
		01 3280	Electronic Data Transfer
		01 3300	Submittals
		01 3329.08	Buy Clean California Reporting
		01 3520	Design Assist Procedures
		01 3540	Environmental Mitigation
		01 3543	Environmental Procedures
		01 3546	Indoor Air Quality Procedures & Requirements
		01 4100	Regulatory Requirements
		01 4200	References
		01 4300	Inspection of Work
		01 4500	Quality Control
		01 4516	Contractor’s Quality Control Program
		01 4520	Concrete Moisture Testing
		01 5100	Temporary Utilities

<u>Initial Issue</u>	<u>Revision</u>	<u>Section #</u>	<u>Title</u>
		01 5200	Construction Facilities
		01 5300	Temporary Construction
		01 5400	Construction Aids
		01 5500	Vehicular Access and Parking
		01 5600	Temporary Barriers and Enclosures
		01 5700	Temporary Controls
		01 5800	Temporary Signage
		01 6000	Product Requirements
		01 7100	Examination and Preparation
		01 7123	Field Engineering
		01 7329	Cutting and Patching
		01 7400	Cleaning and Waste Management
		01 7700	Contract Closeout
		01 7839	As-Built Documents
		01 8113	Sustainable Design Requirements
		01 9113	General Commissioning Requirements

ABLE OF CONTENTS

**SECTION 01 1100
SUMMARY OF WORK**

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Work Covered by Contract Documents
2. Work Sequence
3. Work by University
4. University Furnished Products

B. In case any Sections contain conflicting requirements, refer to General Conditions, Paragraph 4.1.8.

1.2. WORK COVERED BY CONTRACT DOCUMENTS

A. The University of California, Riverside (UCR) intends to procure the services of a General Contractor (Contractor) to construct In the Data Center, at the School of Medicine Education 1 Building, this project will make tenant improvements that will facilitate adding users and new equipment to the space. Upgrades include changes to the infrastructure, IT equipment and physical conditions of the room. Infrastructure upgrades to the electrical and mechanical systems are aimed at improving efficiency and providing more capacity. New IT equipment includes a cable tray system and technology racks installed in newly designed layout. Upgrade interior finishes are to the flooring and ceiling. Because some of the networks located in this data center are critical to campus, the work for this project will need to happen concurrently while keeping the critical networks online. This project partners with the ITS (Information Technology Solutions) department for assistance and guidance through this process..

B. The Contract Time to complete the Work of this Contract is specified in the Supplemental Instructions to Bidders.

C. Project Location: 900 University Avenue, Riverside, CA. 92507

- D. The University has specified that the requirements and procedures for compliance with certain U.S. Green Building Council's (USGBC) LEED (Leadership in Energy and Environment Design) New Construction (NC) Version 3 (v3) prerequisites and credits will be used to target the Project to obtain the goal of LEED Gold certification. See Section 01 8113 "Sustainability Design Requirements" for additional information.

1.3. WORK SEQUENCE

- A. The work shall be sequenced to occur during a period of (335) calendar days, or as determined by the University's Representative based upon the prevailing conditions at the time of mobilization.
- B. See also Section 01 1200, Multiple Contract Summary.

1.4. WORK BY UNIVERSITY

- A. N/A

1.5. UNIVERSITY FURNISHED PRODUCTS

- A. Equipment provided by the University:
See Sheet M0.02 Mechanical Equipment Schedule:
 - 1. Computer Room Air Conditioning Unit (DX Coil)
 - a. AC-3
 - 2. Condenser
 - a. C-3
 - 3. Computer Room Air Handling Units (Chilled Water Coil)
 - a. FCU-1
 - b. FCU-2

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 1200
MULTIPLE CONTRACT SUMMARY

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Summary of Contracts
2. Contract Interface
3. Multiple Contract Coordination

1.2. SUMMARY OF CONTRACTS

- A. On December 1, 2021, the University tendered to KSR Associates, hereinafter referred to as Supplier, a Purchase Agreement, for mechanical unit equipment, which was executed by Supplier on December 1, 2021. A copy of the foregoing Purchase Agreement is attached as EXHIBIT "A" and shall be incorporated herein by reference; and

1.3. CONTRACT INTERFACE

- A. The University hereby assigns and transfers to Contractor all of its rights under said Purchase Agreement including all liabilities and responsibilities of any kind to the University which may have existed, exist, or may arise under said Purchase Agreement. Contractor accepts all liabilities and obligations.

1.4. MULTIPLE CONTRACT COORDINATION

- A. N/A

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

UNIVERSITY OF CALIFORNIA, RIVERSIDE PURCHASE ORDER

Control no.: KLONG00120210921111706

Date needed: 11/02/2021

Date submitted to Purchasing: 09/21/2021

EXHIBIT A

Estimated Cost:

PO No: SC11107102
Date: 12/01/2021
Page: 1 of 5

User Name: Kara Longtin

Cost not to exceed:

User Phone: (951) 827-2610

Price Adjust to:

Appendix: UC

Requestor Name & Ext: Kara Longtin x22610

Fabrication no.:

Transactor Name & Ext: Kara Longtin x22610

Previous PO:

Department Name:

Description: 950590 SOM ED1 Data Center Ren

KSR ASSOCIATES LLC
 12223 HIGHLAND AVE SUITE 106-530
 RANCHO CUCAMONGA, CA 91739
 USA

University of California, Riverside
 Planning, Design & Construction
 Attn: Tameesha Hayes
 3401 Watkins Dr
 Riverside, CA 92521
 United States

Vendor Contact: Tony Henkel
 Telephone: 909/463-0088
 Fax: 909/463-2896
 UCR account: _____
 Email address: thenkel@ksrassoc.com

Tax Code: Non-Tax Line Item
 Vendor Type: Unknown Vendor Type
 UCR Buyer: Marshall E Holman

<u>F.O.B. Point</u>	<u>Method of Shipment</u>	<u>Payment Terms</u>	<u>Quote No.</u>
Dest. Frt. Ppd & Allowed	Best Method	Net 30 Days	

<u>Line</u>	<u>Qty</u>	<u>Unit</u>	<u>Catalog No</u>	<u>Delivery</u>	<u>Tax</u>	<u>Unit Price</u>	<u>Total Price</u>
1	1	Each			Y	\$54,355.00	\$54,355.00

Description: Data Aire FCU-1,2; Model- GFCD-09134; Description- 91 kW (26-Ton) Nominal Downflow CW System; Voltage- 460/3/60.

Specifications include: Per UCR Approved Mechanical Drawings.
 Indoor Downflow CW Section-
 2-Way, 1.5" Belimo CW Valve (B238)
 Cooling only
 Plug fans with EC motor and VFD
 Downflow supply air configuration, top return
 dap4 microprocessor control panel with unit mounted temperature and humidity sensors
 Ethernet comm card, BACNet IP
 Zone Control
 Unit mounted smoke detector
 Non-fused service disconnect switch
 Unit mounted condensate pump
 Seismic rated floorstand
 4" MERV 8 efficient pleated filters
 18 Months parts warranty from date of shipment (no labor).

2	1	Each			Y	\$44,606.00	\$44,606.00
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Description: Data Aire AC-3; Model- GFAD-09134; Description- 91 kW (26-Ton) Nominal

UNIVERSITY OF CALIFORNIA, RIVERSIDE

Electronically Signed By:

Marshall E Holman

Buyer: Marshall E Holman
 Phone: (951) 827-3025
 Email: mehii@ucr.edu
 CAMPUS COPY (retention period 5 years)

UNIVERSITY OF CALIFORNIA, RIVERSIDE PURCHASE ORDER

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PO No: SC11107102
Date: 12/01/2021
Page: 2 of 5

Appendix: UC

<u>Line</u>	<u>Qty</u>	<u>Unit</u>	<u>Catalog No</u>	<u>Delivery</u>	<u>Tax</u>	<u>Unit Price</u>	<u>Total Price</u>
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Evaporator DX Section; Voltage- 460/3/60.

Specifications Include: Per UCR Approved Mechanical Drawings.
 Indoor Evaporator Section-
 Dual hermetic scroll compressors.
 Copper tube/aluminum fin evaporator coil with dual refrigerant circuits.
 System designed to operate with R-410A refrigerant.
 Cooling Only.
 Plug fans with EC motor and VFD.
 Downflow supply air configuration, top return.
 dap4 microprocessor control panel with unit mounted temperature and humidity sensors.
 Ethernet comm card, BACNet IP.
 Zone control.
 Unit mounted smoke detector.
 Non-fused service disconnect switch.
 Unit mounted condensate pump.
 Seismic rated floorstand.
 4" MERV 8 efficient pleated filters.
 18 Months parts warranty from date of shipment (no labor).
 5-Year compressor from date of shipment (no labor).

C-3; Model-GHRC-15534; Description- Remote Outdoor Condenser; Voltage-460/3/60.

Specifications Include:
 Remote Condenser (sized for 105°F outdoor ambient at sea level)-
 Aluminum construction outdoor condenser cabinet.
 Vertical discharge propeller fan with direct drive high efficiency EC fan motors.
 Copper tube/aluminum fin condenser coil with dual circuits.

3	1	Each			N	\$4,500.00	\$4,500.00
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Description: Assisted start-up by Data Aire factory trained personnel.

***Requirement: COVID-19 safety 2021, in accordance with County of Riverside and while on the University's premises wear face protection, maintain distances of greater than 6 feet at all times.

If there has been a discovery that your company employee(s) had been exposed during any time period while performing working on UC property, please send email message to the UCR Environmental Health and Safety ehspubhealth@ucr.edu and furnish the following information: Name of company, date work performed on campus, building(s)/room(s) visited and your company's contact phone number.

TRAINING: Following completion of installation, Supplier shall provide on-site training of University operators in the use and care of this equipment. Such training shall be sufficient to ensure University operators are reasonably proficient in these operations.

UNIVERSITY OF CALIFORNIA, RIVERSIDE

Electronically Signed By:

Marshall E Holman

Buyer: Marshall E Holman

Phone: (951) 827-3025

Email: mehii@ucr.edu

CAMPUS COPY (retention period 5 years)

UNIVERSITY OF CALIFORNIA, RIVERSIDE PURCHASE ORDER

Control no.: KLONG00120210921111706

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Page: 3 of 5

Appendix: UC

<u>Line</u>	<u>Qty</u>	<u>Unit</u>	<u>Catalog No</u>	<u>Delivery</u>	<u>Tax</u>	<u>Unit Price</u>	<u>Total Price</u>
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Sub Total:	\$103,461.00
Sales Tax:	\$8,659.09
Shipping:	\$.00
Total:	\$112,120.09

Account	Activity	Fund	Function	Cost Center	Project Code	Project Code Corp	Amount
871130	AP0590	01485	9C		P5588		\$103,461.00

Clauses, Notes and Other Terms pertaining to this Order:

ACCEPTANCE OF EQUIPMENT (UNIVERSITY INSTALLED): Within a reasonable time following complete delivery and confirmation of proper operation/performance, the University shall accept the equipment furnished pursuant to this order. Payment alone does not constitute acceptance by the University and shall not be construed as intent to waive any rights to reject non-conforming materials, supplies or services (together, the 'Services')

TELEPHONE NUMBERS: Should any questions arise regarding this transaction, the telephone number for the University PURCHASING Office is indicated below the buyer's signature. The telephone number for the University ACCOUNTING office is (951) 827-3303 or FAX (951) 827-3314.

DELIVERY: Supplier shall take all actions reasonable and appropriate to ensure delivery is not delayed. Supplier understands and agrees that TIME IS OF THE ESSENCE under this transaction.

HOLIDAY CLOSING: The UCR Receiving Department and Campus will CLOSE TO INBOUND SHIPMENTS Friday, December 22, 2021 through January 03, 2022 in observance of the Campus Winter Break Holidays. The Receiving Department will resume normal business on Thursday January 04, 2022 at 8:00 a.m. PLEASE SCHEDULE YOUR SHIPMENTS ACCORDINGLY! Thank you and Happy Holidays!

MAINTENANCE AND OWNER'S MANUALS: The Supplier shall provide with each piece of equipment an owner's manual and/or maintenance manual/maintenance instructions and a parts list at time of delivery.

MARK WITH PO #: Supplier is to mark all cartons, bills, Airway Bills, Bills of Lading, invoices and related documents with the purchase order number.

UNIVERSITY OF CALIFORNIA, RIVERSIDE

Electronically Signed By:

Marshall E Holman

Buyer: Marshall E Holman

Phone: (951) 827-3025

Email: mehii@ucr.edu

CAMPUS COPY (retention period 5 years)

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Page: 4 of 5

Appendix: UC

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OSHA REQUIREMENT: Vendor warrants and represents that the equipment, when delivered shall conform to all applicable standards and requirements of the California Occupational Safety and Health Act.

PARKING ON CAMPUS: All parking on campus is by PERMIT ONLY. Permits are available through the Parking Services Office located at the east end of Linden Street or at the Kiosks located at the University Avenue and the Canyon Crest entrances to the campus. For further details, see the UCR Parking Services website: <http://www.parking.ucr.edu/>.

PURCHASE ORDER ACCEPTANCE: The person whose signature appears below warrants that he/she is duly authorized to execute and accept this contract on behalf of Vendor.

NAME

SIGNATURE

TITLE

DATE

Departmental Notes

UNIVERSITY OF CALIFORNIA, RIVERSIDE

Electronically Signed By:

Marshall E Holman

Buyer: Marshall E Holman

Phone: (951) 827-3025

Email: mehii@ucr.edu

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<u>Line</u>	<u>Qty</u>	<u>Unit</u>	<u>Catalog No</u>	<u>Delivery</u>	<u>Tax</u>	<u>Unit Price</u>	<u>Total Price</u>
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[09/21/2021]

950590 SOM ED1 Data Center Renovation

FCU1,2: \$54,355

AC-3,C3: \$46,606

\$4,500 for assisted start-up by factory trained personnel

Total: \$105,461.00

[09/21/2021]

These items are to be purchased by the University and upon purchase, these items will be assigned to the successful contractor hired to perform the construction.

UNIVERSITY OF CALIFORNIA, RIVERSIDE

Electronically Signed By:

Marshall E Holman

Buyer: Marshall E Holman

Phone: (951) 827-3025

Email: mehii@ucr.edu

CAMPUS COPY (retention period 5 years)

SECTION 01 1400 WORK RESTRICTIONS

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Access to Site
2. Coordination with Occupants
3. Use of Site
4. Scheduling of Work and Work Hours
5. Neighbor Complaint Hotline
6. Site Decorum

1.2. ACCESS TO SITE

A. Special Requirements

1. Existing Site Conditions and Restrictions:
 - a. Maintain access and code required exiting to and from surrounding buildings during construction. This shall include all accessibility requirements for the buildings and site.
2. Contractor shall be responsible for safely securing the work areas, with at a minimum, trench plates, fencing, signage, safety lighting, traffic and pedestrian coordinators.
3. Trench plates shall be provided and safely secured at all roadway, parking lots, and walkways.
4. Trenches shall be protected from vehicles by utilizing trench plates, and from pedestrians by utilizing fully installed galvanized fencing. Excavations and holes shall be protected by utilizing fully installed galvanized fencing, safety lighting, and other methods to safely secure the site. Establishment of the work area in any space requiring the University's vacating shall not commence before notification to University's Representative. Refer to Section 01 1400 - CONTRACTOR'S USE OF THE PROJECT SITE, Notifications.
5. Individual work areas shall not be established until Contractor has labor, materials and equipment ready to commence and complete the Work in that area.
6. Work shall not commence in any area until barriers and other protections are in place.

B. Use of Public Thoroughfares and University Roads

1. Contractor shall make its own investigation of the condition of available public thoroughfares and University roads, and of the clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the Project site.
2. Where materials are transported in the prosecution of the Work, do not load vehicles beyond the capacity recommended by manufacturer of the vehicles or prescribed by any applicable state or local law or regulation.
3. Use only established roads on the campus; provided, however, that such temporary haul roads as may be required in the work shall be constructed and maintained by Contractor, subject to the approval of University's Representative. Refer to Section 01 3540 Environmental Mitigation for description of the approved haul route to and from

the campus.

4. Provide protection against damage whenever it is necessary to cross existing sidewalks, curbs, and gutters in entering upon the University roads and public thoroughfares. Repair and make good immediately at the expense of Contractor all damages thereto, including damage to existing utilities and paving, arising from the operations under the Contract.
5. Contractor shall maintain all existing campus roads, streets, sidewalks, curbs, gutters, and any other infrastructure items that are affected by campus construction activities, clear, clean and maintained while construction is ongoing on campus.
6. Truck staging is not allowed on campus or on any residential street surrounding the campus.

C. See also Section 01 5500, Vehicular Access and Parking.

1.3. COORDINATION WITH OCCUPANTS

- A. The University reserves the right to occupy and to place and install equipment in completed areas of the Work prior to Notice of Completion, provided such occupancy does not interfere with completion of the Work and subject to the General Conditions. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
 1. Partial occupancy of the Work may occur upon University's approval, in which case the University's Representative will prepare a Certificate of Beneficial Occupancy for each specific portion of the Work and specific area of the building to be occupied prior to Final Completion of the entire Work.
 2. Refer to Article 9.6 of the General Conditions.

1.4. USE OF SITE

- A. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 1. Driveways and Entrances: Keep driveways and entrances serving adjacent buildings clear and available to the University, and its employees, students, faculty, visitors, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for use of these areas.
 2. Contractor's use of the Project site for the work, staging, deliveries, and storage is restricted to the project limits on the Drawings, or as directed by the University's Representative.
 3. All material for construction operations shall be brought in and the work conducted so as to avoid any interference with existing University facilities or their normal operations.
 4. Noise from job equipment shall be kept to a minimum by use of adequate mufflers and other appropriate means.
 5. Delivery of Materials: Arrange for delivery of materials and equipment to minimize length of on-site storage prior to installation. Delivery route shall be from South Campus Circle Drive to Big Springs Road to the project site, or as designated by the University's Representative.
 6. The Contractor shall take appropriate steps throughout the term of the project to prevent airborne dust due to work under this contract. Water shall be applied wherever practical to settle and hold dust to a minimum, particularly during excavation and moving of materials. No chemical palliatives shall be used.

1.5. SCHEDULING OF WORK AND WORK HOURS

- A. Work outside of regular work hours, **7:00 a.m. to 3:30 p.m.**, "overtime", required to accomplish work of this contract, such as utility shutdowns, shall be included in the contract sum.
- B. Overtime work requests must be submitted to the University's Representative and the Inspection Request Software System used for the project. Three working days in advance. All Overtime requested for the Inspector of Record (IOR) shall be first authorized by the Campus Building Official before the work is to commence.
 - 1. Acceptable overtime hours are no earlier than 7:00 a.m. and no later than 7:00 p.m., Monday through Friday; and from 8:00 a.m. to 5:00 p.m. on Saturday. Work will not be allowed on Sunday and Holidays.
 - 2. Work at other times may be permitted if it takes place within the enclosed building and the University's Representative determines that it is unlikely to affect University personnel, students, operations and the surrounding neighborhood.
 - 3. Additional overtime operating hours may be approved at the University's Representative sole discretion and only without change to the contract sum.
 - 4. Contractor shall pay all the inspectors (in-house inspectors and University's testing laboratory inspectors) and University's Representative's costs if the overtime request is approved by University's Representative.

1.6. NEIGHBOR COMPLAINT HOTLINE

- A. Contractor to provide a phone number monitored 24 hours a day for the public to use to lodge complaints about construction activities that may harm or degrade their quality of life. Refer to Section 01 5000 "Construction Controls and Temporary Facilities" for more detailed specifications.
- B. Neighbor Complaint Hotline Phone Number: Contractor shall provide signage described elsewhere in this section with the telephone number for the off-campus neighbors to use to notify the contractor and University about construction related issues affecting their persons and properties such as, but not limited to excessive noise, dust and construction vehicle traffic along Valencia Hill Drive which is not allowed under any circumstances.
 - 1. The contractor shall contact a security service which shall provide an answering service for any calls, 24 hours a day and relay the call to a list of designated construction personnel on site for response. The contractor can contact Knight Security at (760) 745-3604 which provided service for the Phase 1 portion of the project for terms and conditions but is not obligated to use this firm and can choose to any service of a similar type.

1.7. SITE DECORUM

- A. Contractor shall control the conduct of its employees (including subcontractor's employees) so as to prevent unwanted interaction initiated by Contractor's employees with University of California Riverside (UCR) students, UCR staff, UCR Faculty or other individuals (except those associated with the Project), adjacent to the Project site. Without limitation, unwanted interaction by Contractor employees would include whistling at or initiating conversations with passersby. In the event that any Contractor employee initiates such unwanted interaction, or utilized profanity, Contractor shall, either upon request of University's Representative or on its own initiative, replace said employee with another of equivalent technical skill, at no additional cost to the University. No radios, other than two-way communication type, will be allowed on the Project site. No smoking is allowed in any University Building.

- B. Contractor shall control the conduct of its employees (including subcontractor's employees) to prevent unwanted interaction initiated by Contractor's employees with UCR students, staff, Faculty or other individuals, adjacent to the Project site. Unwanted interaction by Contractor employees includes whistling at, or initiating conversations with, passersby. If any contractor employee initiates such unwanted interaction, or utilizes profanity, Contractor shall, upon request of University's Representative or on its own initiative, replace said employee with another of equivalent technical skill, at no additional cost to University. No radios, other than two-way communication type, will be allowed on the Project site. No smoking is allowed in any existing University Building or University Building under Construction.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 2100 ALLOWANCES

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes:
 - 1. Allowance Requirements
 - 2. Allowance Descriptions

1.2. ALLOWANCE REQUIREMENTS

- A. Included in the Contract Sum are all Allowances stated in the Contract Documents. Items covered by Allowances shall be provided for such amounts and by such persons or firms as University's Representative may direct.
- B. The following shall apply, unless otherwise provided in the Contract Documents:
 - 1. Allowances shall cover the actual costs incurred by Contractor and each Subcontractor regardless of tier involved, to the extent not otherwise disallowed under Paragraph 1.2. B.4. of this Section, and shall be limited to the following:
 - a. Straight-time wages or salaries for employees employed at the Project site, or at fabrication sites off the Project site, incurred as a result of the performance of the Allowance work.
 - b. Fringe Benefits and Payroll Taxes for employees employed at the Project site, or at fabrication sites off the Project site, incurred as a result of the performance of the Allowance work.
 - c. Overtime wages or salaries, specifically authorized in writing by University's Representative, for employees employed at the Project site, or at fabrication sites off the Project site, incurred as a result of the performance of the Allowance work.
 - d. Fringe Benefits and Payroll Taxes for overtime Work specifically authorized in writing by University's Representative, for employees employed at the Project site, or at fabrication sites off the Project Site, incurred as a result of the performance of the Allowance work.
 - e. Costs of materials and consumable items which are furnished and incorporated into the Allowance work, as approved by University's Representative. Such costs shall be charged at the lowest price available to the Contractor but in no event shall such costs exceed competitive costs obtainable from other subcontractors, suppliers, manufacturers, and distributors in the area of the Project site. All discounts, rebates, and refunds and all returns from sale of surplus materials and consumable items shall accrue to University and Contractor shall make provisions so that they may be obtained.
 - f. Sales taxes on the costs of materials and consumable items which are incorporated into and used in the performance of the Allowance work pursuant to Paragraph 1.2. B.1.e. above.

7. Unless otherwise provided herein, whenever costs are more than or less than Allowances, the Contract Sum shall be adjusted by Change Order based on (1) the difference between actual costs and the Allowances and (2) changes in Contractor's costs.

C. Allowances shall be completed within the Contract Time specified in the Agreement. Adjustments of the Contract Time shall be subject to the provisions of the General Conditions, Article 8.

1.3. ALLOWANCE DESCRIPTIONS

A. Allowance No. 1: Include an Allowance of \$105,600.00 for 3 CRAC Units (1) AC-3/C-3, (1) FCU-1, (1) FCU-2.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 2300 ALTERNATES

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes:
 - 1. Procedures
 - 2. Alternate Descriptions
- B. This Section identifies each Alternate and describes basic changes to the Work only when that Alternate is made a part of the Work by specific provision in the Agreement.
- C. Definition: Refer to the Instructions to Bidders, 1.2 for the term “Alternate.”

1.2. PROCEDURES

- A. The Lump Sum Base Bid and Alternates shall include the costs of all supporting elements required, so that the combination of the Lump Sum Base Bid and any Alternates shall be complete. The scope of Work for all Alternates shall be in accordance with applicable Drawings and Specifications.
- B. Except as otherwise specifically provided by University, the Work described in Alternates shall be completed with no increase in Contract Time.
- C. This Section includes only the non-technical descriptions of the Alternates. Refer to the specific Sections of Divisions 2-33 of the Specifications for technical descriptions of the Alternates.
- D. Coordinate related Work and modify surrounding Work as required to properly and completely integrate the Alternates into the Work.

1.3. ALTERNATE DESCRIPTIONS

- A. Alternate No. 1: Add, Wire Mesh partitions

Wire mesh partitions; welded wire fence to ceiling. See pages G0.01 and A2.03 of drawings.

No extension of the Contract Time will be granted if this Alternate is accepted.

University reserves the right to accept this Alternate within 10 calendar days after the commencement date per the Notice to Proceed.
- B. Alternate No. 2: Add, Painting

Paint walls to match existing. See pages G0.01 and A2.03 of drawings.

No extension of the Contract Time will be granted if this Alternate is accepted.

University reserves the right to accept this Alternate within 10 calendar days after the commencement date per the Notice to Proceed.
- C. Alternate No. 3: Add, Acoustical ceiling tile

Replace acoustical ceiling tile to match existing. See pages G0.01 and A2.04 of drawings.

No extension of the Contract Time will be granted if this Alternate is accepted.

University reserves the right to accept this Alternate within 10 calendar days after the commencement date per the Notice to Proceed.

D. Alternate No. 4: Add, CHW in-row cooling unit.

CHW in-row cooling unit. Set airflow to direct inward towards racks. Extend CHW piping from the taps in underfloor plenum and connect to units. See pages M2.12, P2.11 and E2.11 of drawings.

No extension of the Contract Time will be granted if this Alternate is accepted.

University reserves the right to accept this Alternate within 10 calendar days after the commencement date per the Notice to Proceed.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

MATERIAL/PRODUCT SUBSTITUTION REQUEST FORM

Date: _____ **Material/Product Substitution Request No.** _____

TO: University's Representative **FROM:**

A. We hereby submit for your consideration the following product instead of the specified item:

1. Section: _____ Sub-Article: _____
2. Specified Item: _____
3. Proposed Substitution: (Mfg., Type, Model, etc. Attach a separate sheet if necessary.)

B. Complete all of the following:

1. Does this Substitution offer The Regents a cost credit (including costs for changes by other trades)? Yes No
 If "Yes," state how much and attach an itemized breakdown of all costs: \$ _____
2. Does this Substitution offer earlier delivery or less construction time? Yes No
 If "Yes," state the effect on the Contract Time: (Attach a separate sheet if necessary.)
3. Does this substitution affect any dimensions, layout, or details of other trades as shown on the drawings? Yes No
 If "Yes," explain in the space below: (Attach a separate sheet if necessary.)
4. Describe the specific differences between this Substitution and the specified item in the space below: (Attach a separate sheet if necessary.)

C. Attach the following items as applicable: (Check if attached.)

1. Manufacturer's technical data.
2. Laboratory test or performance results.
3. Drawings and wiring diagrams of the proposed product.
4. Drawings and description of changes required by other trades.
5. Samples.
6. Manufacturer's guarantee and maintenance instructions.
7. Documentation of code compliance for all specific uses.

D. The undersigned agrees to pay for all additional review, design, testing, changes in the contract documents, and construction as a result of the acceptance of this substitution, at no cost to The Regents.

E. Submitted by Contractor: _____
(Signed)

(Printed Name & Title)

UNIVERSITY'S REPRESENTATIVE'S USE ONLY:

Accepted Revise and Resubmit Rejected See attachment dated _____

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SECTION 01 2500 PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes:
1. General Provisions
 2. Special Requirements for Other Than First-Named Product, Material or Equipment
 3. Special Requirements for Substitutions
 4. Material/Product Substitution Request Form

1.2. GENERAL PROVISIONS

- A. This subsection includes the general provisions regarding specification of products, material and equipment by brand or trade name.
- B. Products, material or equipment specified by both brand or trade name and model number are approved for use, provided that Contractor complies with all Contract requirements. Specification of a product, material or equipment by brand or trade name and model number is not a representation or warranty that the product, material or equipment can be used without modification, to meet the requirements of the plans and specifications; Contractor shall, at its sole cost, modify such products, material, or equipment so that they comply with all requirements of the plans and specifications.
- C. The **first-named** product, material or equipment specified by brand or trade name and model number is the **basis for the Project design** and the use of any item other than the first-named one may require modifications of that design. If Contractor uses any product, material or equipment other than the first-named one, Contractor shall, at its sole cost:
1. Make all revisions and modifications to the design and construction of the Work necessitated by the use of the product, material or equipment.
 2. Be responsible for all costs of any changes resulting from the use of the product, material or equipment including without limitation, costs or changes which affect other parts of the Work, the work of Separate Contractors, or any other property or operations of the University.
- D. When a product, material or equipment specified by brand or trade name is followed by the words “**or equal,**” a **substitution** may be permitted if the substitution is equal to or superior to the first-named product, material or equipment in quality, utility and appearance and if the substitution complies with all other requirements of the plans and specifications.
- E. A product, material or equipment specified by brand or trade name followed by the words “**or equal, no known equal,**” signifies that University does not have sufficient knowledge to specify a product, material or equipment, other than the one specified by brand or trade name, that is suitable for use on the Project. The use of the words “no known equal” is not intended to discourage substitution requests in accordance with the requirements specified herein.
- F. When catalog numbers and specific brands or trade names not followed by the designation “or equal” are used in conjunction with a product, material or equipment required by the specifications, **substitutions will NOT be allowed** and the named product, material or equipment must be used.

- G. Specification of a product, material or equipment by brand or trade name and model number is not a representation or warranty that the product, material or equipment is available; Contractor should confirm, prior to submitting its Bid, the availability of any product, material or equipment specified by brand or trade name and model number.
- 1.3. SPECIAL REQUIREMENTS FOR OTHER THAN FIRST-NAMED PRODUCT, MATERIAL OR EQUIPMENT
- A. This subsection includes special requirements for named products, material and equipment, other than the first-named product, material or equipment, specified by both brand or trade name and model number.
- B. In addition to complying with all other submittal requirements of the Contract, **submit within 70 days after the date of commencement specified in the Notice to Proceed**, for review and approval by the University's Representative, Contractor prepared specifications and drawings, including design and engineering calculations, prepared by an appropriate licensed professional, depicting all revisions and modifications to the design and construction of the Work necessitated by the use of the product, material or equipment. **If no revisions or modifications are necessary, submit within 70 days after the date of commencement specified in the Notice to Proceed**, a written representation that no revisions or modifications to the design or construction of the Work are necessitated by the use of the product, material or equipment. Contractor shall utilize the first-named product, material or equipment if Contractor fails to make the appropriate required submittal pursuant to this paragraph within the 70-day period.
- C. A product, material or equipment, other than the first-named product, material or equipment, specified by both brand or trade name and model number may be used if no revisions or modifications to the design or construction of the Work are necessitated by the use of the product, material or equipment. If such revisions or modifications are necessary, the product, material or equipment may be used only if the revisions or modifications are approved in writing by the University's Representative. Contractor has the burden of demonstrating, through the procedures specified herein, that any such revisions or modifications will not be detrimental to the quality, utility or appearance of the Project or any portion of the Project. The University's Representative may refuse to approve any such proposed revisions or modifications where, in the reasonable opinion of the University's Representative, Contractor has failed to demonstrate, through the procedures specified herein, that the revisions or modifications are not detrimental to the quality, utility or appearance of the Project or any portion of the Project.
- 1.4. SPECIAL REQUIREMENTS FOR SUBSTITUTIONS
- A. In addition to complying with all other submittal requirements of the Contract, submit written data demonstrating that the proposed substitution is equal to or superior to the first-named product, material or equipment in quality, utility, appearance, environmental performance criteria, and otherwise complies with all requirements of the plans and specifications, including:
1. Complete technical data including drawings, performance specifications, samples, and test reports of the article proposed for substitution.
 2. Statement by Contractor that the proposed substitution is in full compliance with the requirements of the Contract Documents and Applicable Code Requirements.
 3. List of Subcontractors, if any, that may be affected by the substitution.
 4. Contractor prepared specifications and drawings, including design and engineering calculations, prepared by an appropriately licensed professional, depicting all revisions and modifications to the design and construction of the Work necessitated by the use of the substitution. If no revisions or modifications are necessary, submit a written representation that no revisions or modifications to the design or construction of the Work are necessitated by the use of the product, material or equipment.

- B. Requests for substitutions will only be considered if Contractor completes and submits Material/Product Substitution Request Form and the above supporting data.
- C. At the request of and within the timeframes specified by the University's Representative:
1. Submit samples as deemed necessary by the University's Representative to evaluate the proposed substitution.
 2. Submit proposed substitution to tests deemed necessary by the University's Representative to evaluate the proposed substitution. Such tests shall be made by an independent Testing Laboratory and at the sole expense of Contractor, after review and approval of the test procedures by University's Representative. If re-testing is deemed necessary by the University's Representative to evaluate the proposed substitution, such re-testing shall be made by an independent Testing Laboratory at the sole expense of the Contractor.
 3. Provide any additional information deemed necessary by the University's Representative to evaluate the proposed substitution.
- D. If University's Representative, in reviewing a proposed substitution, requires revisions or corrections to be made to previously accepted shop drawings and supplemental supporting data to be resubmitted, Contractor shall do so within the time period specified by the University's Representative. A proposed substitution may be rejected if Contractor fails to submit such revisions, corrections, or supplemental supporting data within the specified time period.
- E. Except for products, material or equipment designated in the Bidding Documents for evaluation of substitutions prior to award, **requests for substitution, including the data required by Paragraph 1.4.A., must be submitted to the University's Representative not later than 35 days after the date of commencement specified in the Notice to Proceed.** No requests for substitutions of products, material or equipment subject to the 35-day deadline shall be considered unless the request and supporting data is submitted on or before the deadline, except those deemed, in University's Representative's sole opinion, to be necessary because (i) previously specified or approved manufactured products, material or equipment are no longer manufactured, (ii) of University initiated change orders, or (iii) it is in the best interest of University to accept such substitution.
- F. If a product, material or equipment is designated in the Bidding Documents for evaluation of substitutions prior to award, then a request for substitution of the product, material or equipment, including the data required by Paragraph 1.4.A., must be submitted by the deadline specified in the Bidding Documents. Because of time constraints, only one submittal will be allowed for each such substitution request. Requests for substitutions of products, material or equipment designated for evaluation prior to award may not be made after the deadline specified in the Bidding Documents, and such requests be shall not be considered unless the request and supporting data is submitted on or before the deadline specified in the Bidding Documents. Notwithstanding the forgoing, the University may consider, after award of the Contract, requests for substitution of a product, material or equipment designated for evaluation prior to award where, in University's Representative's sole opinion, a substitution is necessary because (i) previously specified or approved manufactured products, material or equipment are no longer manufactured, (ii) of University initiated change orders, or (iii) it is in the best interest of University to accept such substitution.
- G. In reviewing the supporting data submitted for substitutions, University's Representative will use, for purposes of comparison, all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Specifications. If more than 2 submissions of supporting data are required, the cost of reviewing the additional supporting data shall be at Contractor's expense.

- H. Contractor has the burden of demonstrating, through the procedures specified herein, that its proposed substitution is equal to or superior to the first-named product, material or equipment in quality, utility and appearance and complies with all other requirements of the plans and specifications. If revisions or modifications to the design or construction of the work are necessitated by the use of the substitution, Contractor also has the burden of demonstrating, through the procedures specified herein, that the use of the substitution will not be detrimental to the quality, utility or appearance of the Project or any portion of the Project.
- I. The University's Representative may refuse to approve any requested substitution where, in the reasonable opinion of the University's Representative, Contractor has failed to demonstrate, through the procedures specified herein, that the proposed substitution is equal to, or superior to, the first-named product, material or equipment, in quality, utility and appearance and that the proposed substitution complies with all other requirements of the plans and specifications.
- J. University's Representative may reject any substitution not proposed in the manner and within the time limits prescribed herein.
- K. Substitutions are not allowed unless approved in writing by the University's Representative. Any such approval shall not relieve Contractor from the requirements of the Contract Documents.
- L. The 35-day and 70-day submittal periods do not excuse Contractor from completing the Work within the Contract Time or excuse Contractor from paying liquidated damages if Final Completion is delayed.
- M. If revisions or modifications to the design or construction of the Work are necessitated by the use of a substitution, the substitution may be used only if the revisions and modifications are approved in writing by the University's Representative. The University's Representative may refuse to approve any such proposed revisions or modifications where, in the reasonable opinion of the University's Representative, Contractor has failed to demonstrate, through the procedures specified herein, that the revisions or modifications are not detrimental to the quality, utility and appearance of the Project or any portion of the Project.
- N. If a substitution request is finally rejected by the University's Representative, Contractor shall furnish and install:
 - 1. The first-named product, material or equipment; or
 - 2. A product, material, or equipment, other than the first-named product, material or equipment, specified by both brand or trade name and model number, provided Contractor complies with the submittal requirements (including deadlines) of this specification section 01 2500.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

(MATERIAL/PRODUCT SUBSTITUTION REQUEST FORM ON FOLLOWING PAGE)

REQUEST FOR INFORMATION

DATE: mm/dd/yy

RFI #:

TO:

Cc:

FROM:

Subject/Title:

- Architectural
 Civil
 Mechanical
 Electrical
 Plumbing
 Structural
 Fire Protection
 Landscape
 Other:

Reason(s) for RFI:

<input type="checkbox"/> Clarification/Interpretation <input type="checkbox"/> Coordination Issue <input type="checkbox"/> Cost Impact: <u> </u>	<input type="checkbox"/> Conflict in CD's <input type="checkbox"/> Information Not Shown on CD's <input type="checkbox"/> Safety <input type="checkbox"/> Work/Time Impact: <u> </u>
-------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Issue/Question:
 (Reference Attachments)

Specification #: Paragraph #: Sheet #: Detail #:
 Other Reference: Schedule Activity:

Proposed Solution:
 (Reference Attachments)

Signed by Contractor: **Response Required by Date:** mm/dd/yy

RESPONSE TO CONTRACTOR:

From Design Professional:
 (Reference Attachments)

Date Received RFI: mm/dd/yy **Response Date:** mm/dd/yy **Signed:**

From University's Rep.:
 (Reference Attachments)

Date Received RFI: mm/dd/yy **Response Date:** mm/dd/yy **Signed:**

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SECTION 01 2613 REQUESTS FOR INFORMATION & INSTRUCTIONS (RFI) PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section contains the procedures to be followed by Contractor upon discovery of any apparent conflicts, omissions, or errors in the Contract Documents or upon having any question concerning interpretation.

1.2. PROCEDURES

A. Notification by Contractor:

1. Submit all requests for clarification or additional information in writing to Design Professional and University's Representative concurrently using the **Request for Information (RFI) form attached to this Section**.
 - a. All RFI's, and any attachments thereto, must be submitted in PDF format with Optical Character Recognition (OCR) Text.
 - b. For any RFI for which Contractor has indicated a Cost Impact or Work/Time Impact, Contractor must also send a copy of the RFI to University's Responsible Administrator at Richard.Racicot@ucr.edu.
2. Limit each RFI to one subject and number RFI's sequentially. For each resubmission, follow the RFI number with suffix "R" sequentially numbered as necessary. For example, the first RFI would be "1." The second RFI would be "2." The first resubmittal of RFI "2" would be "2R1."
3. Submit a RFI if one of the following conditions occurs:
 - a. Contractor discovers an unforeseen condition or circumstance that is not described in the Contract Documents.
 - b. Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents.
 - c. Contractor discovers what appears to be an omission from the Contract Documents that cannot be reasonably inferred from the intent of the Contract Documents.
4. Contractor shall not submit a RFI:
 - a. As a request for substitution.
 - b. As a submittal.
 - c. Under the pretense of a Contract Documents discrepancy or omission without thorough review of the Contract Documents.
 - d. In a manner that suggests that specific portions of the Contract Documents are assumed to be excluded or by taking an isolated portion of the Contract Documents in part rather than whole.

- e. In an untimely manner without proper coordination and scheduling of Work of related trades.
 - f. As a request for approval of Contractor's means and methods.
- 5. If Contractor submits a RFI contrary to 1.2. A.4. above, Contractor shall pay the cost of any review, which cost shall be deducted from the Contract Sum.
 - 6. Contractor shall submit a RFI immediately upon discovery. Contractor shall submit RFI's within a reasonable time frame so as not to delay the Contract Schedule while allowing the full response time described below.
- B. Response Time:
- 1. Design Professional shall send its RFI response to University's Representative within a reasonable time so that University's Representative can send a final RFI response to Contractor within the time frames in 1.2. B.2. below.
 - 2. University's Representative, or his/her designee, whose decision will be final and conclusive, shall resolve such questions and issue instructions or issue approval of instructions or information from Design Professional, to Contractor within a reasonable time frame. In most cases, RFI's will receive a response within **7 days for architectural issues and within 14 days for issues that require review and response from Design Professional's consultants**. In some cases, the response time may be lengthened for complex issues or shortened for emergencies as approved by University's Representative in writing. If in the opinion of University's Representative more than **14 days** is required to prepare a response to a RFI, Contractor will be notified in writing.
 - 3. Should Contractor proceed with the Work affected before receipt of a response from University's Representative within the response time described above, any portion of the Work which is not done in accordance with University's Representative's interpretations, clarifications, instructions, or decisions is subject to removal or replacement and Contractor shall be responsible for all resultant losses.
 - 4. Failure to Agree: In the event of failure to agree as to the scope of the Contract requirements, Contractor shall follow procedures set forth in Article 4 of the General Conditions.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 3113 COORDINATION

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. Administrative Requirements
2. Facilities Services Coordination and Service Continuity

1.2. ADMINISTRATIVE REQUIREMENTS

A. Coordinate construction operations including, but not limited to, the following:

1. Coordinate the Work and do not delegate responsibility for coordination to any Subcontractor.
2. Anticipate the interrelationship of all Subcontractors and their relationship with the Work.
3. Resolve differences or disputes between Subcontractors and their relationship with the Work.
4. Coordinate the Work of Subcontractors so that portions of the Work are performed in a manner that minimizes interference with the progress of the Work.
5. Do not obstruct spaces and installations that are required to be clear by Applicable Code Requirements.
6. Do not cover any piping, wiring, ducts, or other installations until they have been inspected and approved and required certificates of inspection issued.
7. Remove and replace all Work, which does not comply with the Contract Documents. Repair or replace any other Work or property damaged by these operations with no adjustment of Contract Sum.

B. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation. Coordinate all portions of the Work requiring careful coordination in order to fit in space available. Before commencing such portions of the Work, prepare supplementary Drawings for review by University's Representative and Design Professional. Non-conformance of this task will result in the delay of applications for payment and the contractor responsibility for any remedial works requested by University Representative.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation, including, but not limited to, coordination of furnishing and placing embedded items, sleeves, and block-outs with formwork and reinforcing steel for cast-in-place concrete.
4. Resolve conflicts and coordinate access to, and utilization of, spaces available for construction activities on the site and within structures, and delivery, storage, and installation of materials and equipment.
5. Implement a quality assurance program designed to ensure completion of the Work in accordance with requirements of the Contract Documents.

- C. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the University and separate contractors where coordination of their work is required.

- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.
 - 4. Progress meetings.
 - 5. Project closeout activities.
 - 6. Obtaining required permits and approvals from authorities having jurisdiction.
 - 7. Utility company approvals and installations.

- E. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

- F. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

- G. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

1.3. FACILITIES SERVICES COORDINATION AND SERVICE CONTINUITY

- A. Maintain continuous services to all existing facilities during the period of construction except for the following conditions:
 - 1. Perform Work that involves "shut-down" of existing facilities at such times as will cause the least inconvenience to the University activities, performing at night, on Saturdays, Sundays, holidays and at the discretion of University's Representative. Furnish University's Representative written notice of exact date and time of "shut-down" at least **thirty (30) working days** in advance, unless a longer period is specified or shown on the Drawings. On jobs with short performance time, Contractor shall verify with University's Representative the number of days required in advance for shut-down.
 - 2. The University's preference would be for the contractor to try to coordinate the high voltage utility shut down simultaneously with the Student Recreation Center's shut down to avoid unnecessary inconvenience to the campus. However this preference is not a mandatory requirement if it doesn't fit in with the contractor's schedule.
 - 3. The Contractor's bid shall include the cost of overtime necessary for the Work. No extra payment will be allowed for overtime to meet this requirement or the Contract Schedule.

B. Service Continuity:

1. Within the areas of the Work, investigate and uncover all drainage lines, sewers, electrical ducts, and other piping in use or forming continuations or utility systems required for other buildings or improvements upon the campus, and maintain such services in operation during performance of the Work of the Contract.

- C. Notify University's Representative at least 30 days in advance of all utility shutdowns including date, time and expected duration.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 3119 PROJECT MEETINGS

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes administrative and procedural requirements for the following project meetings:
1. reconstruction Meeting
 2. Pre-Installation Meetings
 3. Progress Meetings
 4. Billing Meetings
 5. 11-Month Warranty Meeting

1.2. PRECONSTRUCTION MEETING

- A. The University's Representative will schedule a preconstruction conference before starting construction, at a time convenient to the University and the University's Representative, but no later than 10 days after execution of the Agreement. The conference will be held at the Project Site or another convenient location. The meeting will review responsibilities and personnel assignments.
1. Distribute written notice of agenda, meeting time, and location a minimum of five calendar days in advance.
- B. Attendees: The University's Representative and authorized representatives of the Architect, and its consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; Contractor's designated safety manager; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Items of significance that could affect progress, including the following:
1. Tentative construction schedule.
 2. Critical work sequencing.
 3. Designation of responsible personnel.
 4. Procedures for processing field decisions and Change Orders.
 5. Procedures for processing Applications for Payment.
 6. Distribution of Contract Documents.
 7. Submittal of Shop Drawings, Product Data, and Samples.
 8. Preparation of record documents.
 9. Use of the premises.
 10. Parking availability.
 11. Office, work, and storage areas.
 12. Equipment deliveries and priorities.
 13. Safety procedures, including emergency notification procedures.
 14. First Aid.
 15. Security.
 16. Housekeeping.
 17. Working hours.
 18. Sustainability requirements, including Contractor staffing.

1.3. PRE-INSTALLATION MEETINGS

- A. The Contractor shall conduct a pre-installation conference at the Project Site before each construction activity that requires coordination with other construction, and as required by other sections of the specifications.
1. The Contractor shall distribute written notice of agenda, meeting time, and location a minimum of five calendar days in advance.
- B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the University's Representative of scheduled meeting dates.
1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:
 - a. Contract Documents
 - b. Options
 - c. Related Change Orders
 - d. Purchases
 - e. Deliveries
 - f. Shop Drawings, Product Data, and quality-control samples
 - g. Possible conflicts
 - h. Compatibility problems
 - i. Time schedules
 - j. Weather limitations.
 - k. Manufacturer's recommendations
 - l. Warranty requirements
 - m. Compatibility of materials
 - n. Acceptability of substrates
 - o. Temporary facilities
 - p. Space and access limitations
 - q. Governing regulations
 - r. Safety
 - s. Inspecting and testing requirements
 - t. Required performance results
 - u. Recording requirements
 - v. Protection.
 2. Record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the University and the University's Representative.
 3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.4. PROGRESS MEETINGS

- A. The Contractor shall conduct progress meetings at the Project Site at regular intervals. Notify the University's Representative and the Design Professional of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request. Document meetings with meeting minutes to be distributed to the University's Representative, the Design Professional and all other attendees.
- B. Attendees: In addition to representatives of the University and the Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these

meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.
1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
 2. Review the present and future needs of each entity present, including the following:
 - a. Interface requirements
 - b. Time
 - c. Sequences
 - d. Status of submittals
 - e. Status of RFI's
 - f. Deliveries
 - g. Off-site fabrication problems
 - h. Access
 - i. Site utilization
 - j. Temporary facilities and services
 - k. Hours of work
 - l. Contractor's Safety Program (including any special hazards and risks)
 - m. Housekeeping
 - n. Quality and work standards
 - o. Contractor's two week "look ahead" schedule and issues
 - p. Change Orders
 - q. Documentation of information for payment requests
 - r. Sustainability review, including tracking and status.
- D. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.5. BILLING MEETINGS

- A. Attend a meeting monthly 5 days prior to submittal of the Application for Payment, at a location acceptable to University's Representative.
- B. Attendees:
1. University's Representative.
 2. Design Professional and Consultants, as appropriate.
 3. Contractor's Project Manager.
 4. Superintendent.
 5. Others as directed by University's Representative.
- C. Agenda:
1. Determination of current schedule progress.
 2. Review of work completed based on the cost loaded schedule to be billed in the Application for Payment.

- D. Schedule Updating: Revise the Contract Schedule prior to the meeting based on information determined at prior progress meetings. Review schedule revisions and prepare a final revised schedule for submission 10 days prior to the application for payment.
- 1.6. 11-MONTH WARRANTY MEETING
- A. Attend a meeting eleven months following the date of Notice of Completion.
 - B. Attendees:
 - 1. University's Representative
 - 2. Design Professional and Consultants, as appropriate
 - 3. Contractor's Project Manager
 - 4. Subcontractors, as appropriate
 - 5. Others as directed by Responsible Administrator.
 - C. Agenda: Review of guarantees, bonds, service and maintenance contracts for materials and equipment.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 3200 DOCUMENT CONTROL

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes the requirements for Contractor provided electronic document control system(s):
 - 1. General Requirements
 - 2. Submittals
 - 3. Software
 - 4. System Maintenance

1.2. GENERAL REQUIREMENTS

- A. Contractor shall provide a web accessible system for electronic document control designed for use during pre-construction and construction to manage documents including RFIs and submittals.
- B. Contractor shall provide an electronic document control system(s) that is accessible via a web browser (including IE version 7.7) from any geographical location.
- C. Contractor shall provide access to University's Representative, University's Inspector of Record, Design Professional, and at least 7 other individuals identified by University's Representative.
- D. The electronic document control system must use the University numbering system specified in the applicable Specification Section.
- E. Hours of Operation: The electronic document control system shall be available 24 hours a day, 7 days a week except for short periods of planned system maintenance.

1.3. SUBMITTALS

- A. Contractor shall submit a narrative description and outline of the proposed electronic document control system for review and approval by University's Representative.
- B. Contractor shall submit an example of the electronic log for both RFIs and Submittals for review and approval by University's Representative.
- C. Contractor shall establish a commercially available web based RFI and submittal processing system capable of posting RFI's and submittals with the following capabilities:
 - 1. Password secured access with varying levels of "write" or action capability, with multiple user defined stamps for action taken.
 - 2. Accessible from any computer with Internet access, whether in the office or the field.
 - 3. Notification of submittal status based on user profile.
 - 4. Automatic Transmittal generation when submittal is released.
 - 5. Extensive and user friendly mark-up tools and capability.
 - 6. Ability to hide mark-up comments based on user profile.
 - 7. Status of submittal and responsible party.
 - 8. Download in PDF format based on user profile.
 - 9. Tracking of resubmittal process, including University designated numbering system.

PART 2 – PRODUCTS

2.1. SOFTWARE

- A. Primavera, Prolog or equal is acceptable as the electronic document control system used for RFIs and submittals.

2.2. SYSTEM MAINTENANCE

- A. University shall be notified at least 48 hours in advance of planned system maintenance of the electronic document control system(s). Planned system maintenance should be scheduled not to interfere with construction activities whenever possible. The system uptime shall be at least 95% based on a rolling monthly average.
- B. Contractor is responsible for installation, maintenance, and backup activities of the electronic document control system(s).

PART 3 – EXECUTION (Not Applicable)

1.1. UPDATES

- A. Every two (2) weeks, Contractor shall export or otherwise generate electronic logs of all RFIs and submittals that can be imported into the University's enterprise system. The format of the electronic logs shall be a spreadsheet in MS-Excel format of all the structured data from each RFI or submittals. The exported or otherwise generated log for RFIs shall be separate from the log for submittals. Samples shall be included in the log of submittals.
- B. Contractor shall also allow, at any time, the University's Representative or designee, to download electronic copies of such RFI and submittal documents in a format that is searchable such as printed PDFs. Scanned PDFs are not acceptable except in the case of drawings.
- C. At least 7 days before the date scheduled for Final Inspection, Contractor shall provide University's Representative a complete electronic copy of all electronic files from the electronic document control system for the project.
 - 1. The electronic files shall be executable on CD or DVD.
 - 2. Each disc shall be fully labeled with the project name, contract number, date, and the sequence number of the disc in the set. Files may be submitted compressed, but the decompression utility used (executable preferred) should be fully described with directions included on the transmittal as well as in digital form.

END OF SECTION

SECTION 01 3216 SCHEDULES

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes administrative and procedural requirements for the Critical Path Method (CPM) of scheduling and reporting progress of the Work:
1. Preliminary Contract Schedule
 2. Contract Schedule
 3. Summary Schedule
 4. Narrative Report
 5. Variance Report
 6. Cash Flow Curve
 7. Manpower Curve
 8. Look-Ahead Schedule
 9. Final As-Built Schedule
 10. Responsibility for Completion
 11. Adjustment of Time for Completion
- B. Refer to the Agreement, General Conditions, and Notice to Proceed for definitions and specific dates of Contract Time.
1. Contractor shall develop a network plan and schedule for the Project demonstrating complete fulfillment of all contract requirements, shall keep the network plans up-to-date and in accordance with the requirements of this Section and shall utilize the CPM in planning, coordination, performing and reporting the Work under this Contract, including all activities of subcontractors, equipment vendors, and suppliers and in assisting University's Representative in monitoring the progress of the Work.
 2. The Precedence Diagramming Method (PDM) shall be utilized in preparing the CPM Schedule network diagrams utilizing MS Project (latest version for Windows.
 3. Contractor shall use Microsoft Project as a computerized critical path scheduling system for producing computer generated reports with the following minimum information:
 - a. Activity identification code keyed to summary and Contract Schedule activities.
 - b. Activity description.
 - c. Status date and remaining duration.
 - d. Activity percentage complete.
 - e. Activity duration.
 - f. Early start/finish and late start/finish.
 - g. Total float.
 - h. Free float.
 - i. The predecessor and successor activities for each individual activity.
 - j. A comparison between the current updated Contract Schedule and the Baseline Schedule.
 - k. Designation of the planned work day/work week for each activity.
 - l. A critical item list of activities with ten (10) working days or less total float.
 - m. Scheduled and actual manpower loading for each activity.
 - n. Scheduled and actual progress payment for each activity.

C. Definitions:

1. Critical Path activities are defined as Work activities that, if delayed or extended, will cause a critical delay as defined in Article 8 of the General Conditions. All other Work activities are defined as non-critical Work activities and are considered to have float.
2. Float is defined as the time that a non-critical Work activity can be delayed or extended without causing a critical delay as defined in Article 8 of the General Conditions. Neither Contractor nor University shall have an exclusive right to the use of float. Float is a shared resource available to Contractor and University.
 - a. Float for any Work Activity shall be calculated as the difference in days between the Latest Finish and its Earliest Finish. Any such calculated float that results in a negative number is considered Negative Float.

D. Submittals:

1. Preliminary Contract Schedule
2. Contract Schedule
3. Summary Schedule
4. Narrative Report
5. Variance Report
6. Cash Flow Curve
7. Manpower Curve
8. Look-Ahead Schedule
9. Final As-Built Schedule

1.2. PRELIMINARY CONTRACT SCHEDULE

A. Submittal

1. Submit the Preliminary Contract Schedule to University's Representative within the time specified in the Instructions to Bidders and Supplementary Instructions to Bidders.
2. Submit to University's Representative **1 hardcopy, 1 electronic copy** in PDF, and **1 electronic copy** in the computerized critical path scheduling system software per 1.1.A.2. above approved by University's Representative.
3. Use the form of a bar chart, GANT chart, or other system approved by University's Representative showing the Work from the construction start date through the final completion date, with the work activities involved and other information relative to the progress of the Work, in a continuous flow from left to right.
4. Show sufficient detail to demonstrate adequate planning for the Work and to show a practical plan to complete the Work within the Contract Time, and suitable for monitoring progress of the Work.

B. Approval

1. Within **5 days** after receipt of the Contract Schedule, University's Representative will notify Contractor of its acceptance or return with comments for resubmittal.

C. Activities and Milestones

1. Identify all Work activities which constitute the Critical Path.
2. Include submittals and lead times.

3. Identify the milestone for completion of the Project. At a minimum, identify the following milestones:

- Commencement Date
- Substantial Completion
- Final Completion

4. Identify all holidays and non-working days. Contractor shall perform no work that requires the University's observation or inspection on the following University holidays and campus closure days:

- a. Regular University Holidays and Campus Closure Days:

- New Year's Day
- Martin Luther King, Jr. Day (3rd Monday in January)
- Presidents' Day (3rd Monday in February)
- Cesar Chavez Day (Last Friday in March)
- Memorial Day (Last Monday in May)
- Independence Day (July 4)
- Labor Day (1st Monday in September)
- Veterans' Day (November 11)
- Thanksgiving Day (4th Thursday in November)
- Friday following Thanksgiving Day
- Christmas Eve
- Christmas Day
- Campus Closure: business days between Christmas Day and New Year's Eve
- New Year's Eve

Exception: A University Holiday that falls on a Saturday is observed on the preceding Friday, and a University Holiday that falls on a Sunday is observed on the following Monday, unless an alternate day to observe the University Holiday is designated by the University.

1.3. CONTRACT SCHEDULE

A. Submittal

1. Submit the Contract Schedule, or updated Contract Schedule as applicable, within **7 days** prior to submitting an Application For Payment.
 - a. The initial Contract Schedule submitted to and approved by University's Representative shall be known as the Baseline Schedule, and shall be used by Contractor to execute the Work of the Contract, including planning, organizing and directing the Work, and reporting its progress until subsequently updated.
 - b. In no event shall Contractor submit an updated Contract Schedule less than monthly.
 - c. If the commencement or completion of any Work activity on the critical path is more than 30 days behind the date set forth in the Contract Schedule for such Work activity, at University's Representative's sole discretion, University's Representative may require Contractor to submit an updated Contract Schedule at a more frequent interval without additional cost to the University.

If the Contract Time is less than 300 days, and if the commencement or completion of any Work activity on the critical path is more than 10% of the Contract Time behind the date set forth in the Contract Schedule for such Work activity, at University's Representative's sole discretion, University's Representative may require Contractor

to submit an updated Contract Schedule at a more frequent interval without additional cost to the University.

2. Submit to University's Representative **1 hardcopy, 1 electronic copy** in PDF, and **1 electronic copy** in the computerized critical path scheduling system software per 1.1.A.2. above approved by University's Representative.
3. Submit the Contract Schedule or updated Contract Schedule in the same form as required in 1.2.A. above.
4. The presentation of each Work activity on the Contract Schedule or updated Contract Schedule shall include a brief description of the Work activity, the duration of the Work activity in days, and a responsibility code identifying the organization or trades performing the Work activity.
5. The Contract Schedule or updated Contract Schedule shall be a computerized, detailed, task level CPM diagram in PDM format. A clear delineation of construction activities shall be shown. This schedule shall be manpower and cost loaded and not extending beyond the Contract Time.
6. The work activities comprising the Contract Schedule shall be of sufficient detail to ensure adequate planning and execution of the Work to provide an appropriate basis for monitoring and evaluating the progress of the Work. A work activity is defined as an activity which requires time and resource (manpower, equipment, and/or material) to complete in a continuous operation. No activity shall be less than 1 day, no more than 14 days duration for any onsite operation.
7. Failure by Contractor to include any element of the Work required for the performance of this Contract and completion of the Project shall not excuse Contractor from completing all work required within the Contract Time, regardless of University's Representative's acceptance of the Contract Schedule or any updated Contract Schedule.
8. No more than 30% of the total number of activities shown shall be critical or near critical. Near critical is defined as float less than 10 days.
9. These schedules shall indicate the sequence and interdependency of work activities and shall be coordinated with all submittal, review and approval requirements.
10. Each approved Change Order and Field Order shall be listed and plotted as a separate and independent activity. Schedule components shall be organized into logical groupings by location, responsibility, Specification Section, etc.

B. Approval

1. Within **5 days** after receipt of the Contract Schedule or updated Contract Schedule, University's Representative will notify Contractor of its acceptance or return with comments for resubmittal.
 - a. Contractor shall participate in a review of the proposed Contract Schedule or updated Contract Schedule by University's Representative when requested.
 - b. Contractor shall resubmit any revisions within **3 days**.
2. The accepted Contract Schedule or updated Contract Schedule shall be the Contract Schedule of record for the period it is current and shall be the basis for payment during that period. Contractor shall perform the Work in accordance with the Contract Schedule or updated Contract Schedule as accepted.

3. No Application For Payment will be processed nor shall any progress payment become due for work performed until the Contract Schedule or updated Contract Schedule is accepted by University's Representative. University's Representative's acceptance of the Contract Schedule or updated Contract Schedule is a condition precedent to University making any progress payment for work performed.
4. Updating
 - a. Contractor shall meet with University's Representative at least **once per month**, or as directed by University's Representative, to review the latest approved Contract Schedule for actual progress made to date, activities started and completed to date, and the percentage of work completed to date on each activity started but not completed, and to incorporate in the Contract Schedule all changes in the progress, sequences, and scope of Work activities.
 - (1) The updated Contract Schedule shall accurately represent the as-built condition of all completed and in-progress Work activities as of the date of the updated Contract Schedule.
 - (2) The updated Contract Schedule shall incorporate all changes mutually agreed upon by Contractor and University during preceding periodic reviews and all changes resulting from Change Orders and Field Orders.
 - (3) Contractor shall document the effect on the updated Contract Schedule whenever float has been used.

C. Activities and Milestones

1. Identify all Work activities which constitute the critical path.
2. Identify all Work activities in correct sequence for the completion of the Work. Work activities shall include the following:
 - a. Major Contractor-furnished equipment, materials, and building elements, and scheduled activities requiring submittals or University's prior approval.
 - b. Show dates for the submission, review, and approval of each submittal. Dates shall be shown for the procurement, fabrication, delivery, and installation of major equipment, materials, and building elements, and for scheduled activities designated by University.
 - c. System test dates.
 - d. Scheduled overtime Work if required by Contract Documents.
 - e. Dates of Contractor requests for designated working spaces, storage areas, access, and other facilities to be provided by University.
 - f. Dates of Contractor requests for approvals and decisions from University on designated items.
 - g. Dates of Contractor requests for University-furnished equipment.
 - h. Dates of Contractor requests for University-furnished utilities.
 - i. Connection and relocation of existing utilities.
 - j. Connecting to or penetrating existing structures.

- k. Inspections and testing.
- l. Commissioning Sequence and activities for all building systems.

- 3. Include the milestones per 1.2.C.
- 4. Include all holidays and non-working days per 1.2.C.

1.4. SUMMARY SCHEDULE

- A. All activities in the Contract Schedule shall be grouped to enable “rollup” of the activities in the form of a Summary Schedule which shall be submitted along with the updated Contract Schedule within **7 days** prior to submitting Contractor’s next Application For Payment. A clear delineation of construction activities shall be shown on the summary schedule. The summary schedule shall be manpower and cost loaded.
- B. Review and approval by University’s Representative of the Summary Schedule is a condition precedent to University making any progress payments for work performed.

1.5. NARRATIVE REPORT

- A. With each updated Contract Schedule, Contractor shall provide an accompanying Narrative Report within **7 days** prior to submitting its next Application For Payment.
- B. The Narrative Report shall describe the progress achieved over the past period since the prior update, the progress anticipated during the upcoming period, critical activities, delays encountered during the prior period, delays anticipated during the upcoming period, and an audit of the Contract Time. The narrative shall also discuss the status of major project milestones. The audit shall show current days allowed by Contract, days used through the end of the period, days remaining, percent of time used to date, and percent complete as measured by a cost loaded schedule, and days ahead of or behind schedule. In the event that the Contractor was delayed by any occurrence during the prior period, the narrative report shall include a listing of all delays that affected the critical path and shall clearly explain the impact the claimed delay(s) had on the critical path and shall include an accounting of days lost or gained.
- C. In the event the monthly update shows the Contractor to be behind schedule (negative float), the narrative shall include a description of actions needed to bring the project back on schedule.
- D. Review and approval by University’s Representative of the Narrative Report is a condition precedent to University making any progress payments for work performed.

1.6. VARIANCE REPORT

- A. A variance report shall be submitted along with the updated Contract Schedule within **7 days** prior to submitting Contractor’s next Application For Payment.
- B. The variance report shall compare the approved Baseline Schedule and the latest updated Contract Schedule. The report shall include a description of all activities completed during the preceding period (last approved updated Contract Schedule), a description of progress made and planned for activities listed as started but not completed on the updated Contract Schedule, and shall report noncritical activities which have been delayed 10 or more days and critical (8 days or less total float) activities that have incurred any delay. The format of this report shall include:
 - 1. Activity code and description.
 - 2. Baseline scheduled early start/finish dates.
 - 3. Current anticipated early start/finish dates.
 - 4. Days remaining to complete the activity.

5. Percentage complete of the activity.
6. Total float of the activity.

C. Review and approval by University's Representative of the Variance Report is a condition precedent to University making any progress payments for work performed.

1.7. CASH FLOW CURVE

- A. Contractor shall submit its Cash Flow Curve of expected progress payments over the time of the Project along with its Contract Schedule within **7 days** prior to submitting its first Application For Payment. The curve shall be plotted against the Contract Schedule using the Cost Breakdown approved by University's Representative.
- B. Contractor shall furnish costs for each Work activity that cumulatively equal the total Contract Sum. Mobilization costs may be shown separately; however, other costs, such as profit and bonds, shall be pro-rated throughout all activities.
- C. Contractor shall update the Cash Flow Curve with actuals from the approved progress payments and forecasted progress payments and submit it to University's Representative along with Contractor's updated Contract Schedule per 1.3. The total of approved progress payments and forecasted progress payments shall equal the Contract Sum plus approved Change Orders. The updated curve shall be plotted against the Baseline Schedule and updated Contract Schedule.
- D. Review and approval by University's Representative of the Cash Flow Curve is a condition precedent to University making any progress payments for work performed.

1.8. MANPOWER CURVE

- A. Contractor shall submit a Manpower Curve of the labor requirements per calendar week over the time of the Project along with its Contract Schedule within **7 days** prior to submitting its first Application For Payment. The curve shall be plotted against the Baseline Schedule. The curve shall show the number of persons in each craft for each week.
- B. Contractor shall update the Manpower Curve with actual labor employed and forecasted labor requirements necessary to complete the Project within the Contract Time, and shall submit it to University's Representative along with Contractor's updated Contract Schedule per 1.3. The updated curve shall be plotted against the Baseline Schedule and updated Contract Schedule.
- C. Review and approval by University's Representative of the Manpower Curve is a condition precedent to University making any progress payments for work performed.

1.9. LOOK-AHEAD SCHEDULE

- A. The Look-Ahead Schedule is a schedule derived from the Contract Schedule or updated Contract Schedule that indicates in detail all activities scheduled for work for the next 2 weeks and all activities scheduled to occur during the next 4 weeks.
- B. Submit in 11" x 17" Gantt chart format. Provide as many copies as requested by University's Representative.
- C. The Look-Ahead Schedule shall be generated from the then current Preliminary Contract Schedule, Contract Schedule, or updated Contract Schedule.

1.10. FINAL AS-BUILT SCHEDULE

- A. A combined 2-week Look-Ahead Schedule with a 2-week As-Built Schedule for previous two weeks shall be submitted by Contractor for review and approval as often as requested by the University's Representative, at no additional cost.

- B. As a condition precedent to final acceptance of the Project, Contractor shall submit a final As-Built Schedule and all final reports which accurately reflect the manner in which the Project was constructed and includes actual start and completion dates for all work activities on the last updated Contract Schedule.
- C. As a condition precedent to the release of retention, the last update of the Contract Schedule submitted shall be identified by the Contractor as the "As Built Schedule". The As-Built Schedule shall be submitted when all activities are 100 percent complete. The As-Built Schedule shall reflect the exact manner in which the Project was actually constructed (including start and completion dates, activities, sequences, and logic) and shall include a statement signed by the Contractor that the As Built Schedule accurately reflects the actual sequence and timing of the construction of the Project.

1.11. RESPONSIBILITY FOR COMPLETION

- A. Delays of any non-critical Work activity shall not be the basis for an extension of Contract Time until the delays consume the float associated with that non-critical Work activity and cause the Work activity to become critical.
- B. Contractor shall not sequester float through strategies including extending activity duration estimates to consume available float, using preferential logic, using extensive or insufficient crew/resource loading, use of float suppression techniques, special lead/lag logic restraints or imposed dates. Use of float time disclosed or implied by the use of alternate float suppression techniques shall be shared for the benefit of both the University and contractor.
- C. It is acknowledged that University generated time savings (critical path submittal reviews returned in less time than allowed by the Contract Documents, approval of substitution requests which result in a savings of time for contractor) create shared float. Accordingly, University caused delays may be offset by University generated time savings.
- D. Contractor agrees that whenever it becomes apparent from the current updated Contract Schedule that the Contract completion date will not be met, it will take some or all of the following actions, with prior approval of University's Representative, at no additional cost.
 - 1. Increase construction manpower in such quantities and crafts as will eliminate, in the judgment of University's Representative, any delay.
 - 2. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of construction equipment, or any combination of the foregoing, sufficiently to eliminate, in the judgment of University's Representative, any delay. This paragraph shall not be construed to permit Contractor to violate the work hour restrictions specified in the Contract Documents.
 - 3. Reschedule activities to achieve maximum practical concurrent completion activities within the requirements of the specifications.

1.12. ADJUSTMENT OF TIME FOR COMPLETION

- A. Contractor shall submit a detailed time impact analysis of the Contract Schedule to support an adjustment of the Contract Time for delay under Article 8 of the General Conditions or an adjustment of the Contract Sum for delay under Article 7 of the General Conditions.
- B. Each time impact analysis shall provide information justifying the request and stating the extent of the adjustment requested for each specific change or alleged delay. Each time impact analysis shall be in form and content acceptable to University's Representative, and shall include, but not be limited to the following:

1. A fragmentary CPM type network (Fragnet) illustrating how Contractor proposes to incorporate the change or alleged delay into the current updated Contract Schedule.
 2. Identification of activities in the current updated Contract Schedule which are proposed to be amended due to the change or alleged delay, together with engineering estimates and other appropriate data justifying the proposal.
- C. The time impact analysis shall be determined on the basis of the date when the change was issued, or the date when the alleged delay began. The status of completion of the Work and time impact analysis shall include event time computations for all affected activities.
- D. Contractor shall provide time impact analysis at no additional cost to demonstrate the time impact upon the Contract Time.
- E. If University's Representative finds, after review of the time impact analysis, that Contractor is entitled to any extension of time, the Contract Time will be adjusted per the General Conditions, and Contractor shall revise the updated Contract Schedule accordingly.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 3280 ELECTRONIC DATA TRANSFER

PART 1 – GENERAL

1.1. SUMMARY

- A. Section includes Terms and Conditions for the transfer of Electronic Data to Contractor for use in preparation of Submittals, Record Documents, coordination drawings, and related documents to be produced by Contractor and submitted to University:

1. CONTRACTOR'S ACCEPTANCE OF ELECTRONIC DATA IN ANY FORM SHALL CONSTITUTE ACCEPTANCE OF THE TERMS AND CONDITIONS OF THIS SECTION, INCLUDING PAYMENT OF INDICATED FEES.

- B. The University and the Contractor acknowledge that established administrative procedures for management of construction Projects anticipate paper documentation and methods for the exchange of such documents. To the extent the administrative and procedural requirements of the Contract Documents are predicated on established practices the University and the Contractor agree to accept reasonable modifications to certain procedural requirements to facilitate electronic exchange of information and the use of digital media.
- C. Submittals: Only a material original stamped and signed by the University's Representative shall be acceptable as an official record of the processed submittal. When directed, quantities of document submittals specified in the Contract Documents may be adjusted as permitted to facilitate utilization of electronic transfer of information.

1.2. TERMS AND CONDITIONS

- A. In consideration of Contractor's request to the University to deliver certain Electronic Data for use on the Project, Contractor agrees to the following:
1. Electronic Data includes but is not limited to, computer-aided design (CAD) files including native file formats (DWG) and drawing exchange formats (DXF), and files produced by word processing, spread sheet, scheduling, data base and other software programs. The Electronic Data may be provided in an original format produced by Design Professional or other University consultant, or an alternate, "translated" format as requested by other parties to this Agreement.
 2. The means by which the Electronic Data is transferred may include but are not limited to, electronic mail, File Transfer Protocol (FTP) sites, project websites, and disk copies transmitted between the parties to this Agreement. Contractor acknowledges that Electronic Data transferred in any manner or translated from the system and format used by Design Professional or other University consultant, to an alternate system or format is subject to errors that may affect the accuracy and reliability of the data and that the data may be altered, whether inadvertently or otherwise. Accordingly, the University and Design Professional make no warranty, express or implied, as to the accuracy of the information transferred. The Electronic Data are not the Bidding Documents and differences may exist between these electronic files and corresponding hard-copy Bidding Documents. University reserves the right to retain hard copy originals in addition to electronic copies of the Electronic Data transferred, which originals shall be referred to and shall govern.
 3. As consideration to University for the transfer of the Electronic Data, Contractor agrees that the University, University's Design Professional, and University's agents and consultants shall not be liable for and hereby waives all claims and agrees to indemnify and hold University harmless from all liabilities, losses, damages or expenses (including attorneys' fees) arising out of, or connected with: (1) the transfer of Electronic

Data by any means; (2) the use, modification or misuse by parties other than University and Design Professional of the Electronic Data; (3) the limited life expectancy and decline of accuracy or readability of the Electronic Data due to storage; (4) any use of the Electronic Data by any third parties receiving the data from other parties to this Agreement; or (5) the incompatibility of software or hardware used by University and Design Professional and the other parties participating in the Work.

4. The Electronic Data provided under the terms of this Agreement are the proprietary information of University. All Electronic Data shall be treated as confidential and shall not be disclosed to or shared with others without express, written consent from the University's.
5. The University shall issue the most current information available, but does not undertake the responsibility for providing updated information as the Project proceeds. Contractor may make a specific written request for such updated information as Contractor deems necessary, which University will then provide subject to the Terms and Conditions hereof.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SUBMITTAL SCHEDULE

Section	Shop Dwgs	Prod. Data/List	Samples Mock-ups	Extend. Guarantee	Op/Maint. Manuals	Tests	Extra Mat'l	Certs.	Other
01 1100									
01 1400									
01 2300									
01 2500									
01 2613									
01 3100									
01 3119									
01 3200									
01 3300									
01 3520									
01 3540									
01 4100									
01 4200									
01 4300									
01 4339									
01 4500									
01 4520									
01 5000									
01 5739									
01 6000									
01 7123									
01 7329									
01 7419									
01 7423									
01 7700									
01 7836									
01 7839									
01 8113									
01 9113									
02 4000									
03 3000									
03 3600									
03 3816									
03 4816									
03 4819									
03 4830									
03 4900									
03 5415									

SUBMITTAL SCHEDULE									
Section	Shop Dwgs	Prod. Data/List	Samples Mock-ups	Extend. Guarantee	Op/Maint. Manuals	Tests	Extra Mat'l	Certs.	Other
03 5600									
04 2113									
04 2200									
05 1200									
05 1213									
05 3100									
05 4000									
05 5000									
05 5010									
05 5100									
05 5813									
05 7000									
06 1643									
06 2013									
06 4023									
06 4100									
06 6420									
07 1416									
07 1716									
07 1900									
07 2114									
07 2129									
07 2616									
07 2620									
07 4646									
07 5300									
07 5400									
07 5565									
07 6113									
07 6200									
07 6500									
07 7723									
07 8400									
07 8720									
07 9200									
07 9513									
08 1113									
08 1216									
08 1316									

SUBMITTAL SCHEDULE									
Section	Shop Dwgs	Prod. Data/List	Samples Mock-ups	Extend. Guarantee	Op/Maint. Manuals	Tests	Extra Mat'l	Certs.	Other
08 1400									
08 3100									
08 3213									
08 3323									
08 3816									
08 4213									
08 4313									
08 4330									
08 4413									
08 4500									
08 5113									
08 6200									
08 7100									
08 7113									
08 8000									
08 9110									
09 2116									
09 2216									
09 2400									
09 2900									
09 3000									
09 5113									
09 5426									
09 6453									
09 6500									
09 6813									
09 6816									
09 7200									
09 8200									
09 9000									
10 1400									
10 2213									
10 2226									
10 2813									
10 4400									
10 5113									
10 5500									
10 7113									
10 8214									

SUBMITTAL SCHEDULE									
Section	Shop Dwgs	Prod. Data/List	Samples Mock-ups	Extend. Guarantee	Op/Maint. Manuals	Tests	Extra Mat'l	Certs.	Other
11 1200									
11 1300									
11 1630									
11 3100									
11 4000									
11 5200									
11 8226									
12 2116									
12 2400									
12 3623									
12 3661									
12 5219									
12 9300									
12 9313									
13 1101									
13 1102									
13 1103									
13 1104									
13 1105									
13 1106									
13 1107									
13 1108									
14 2100									
14 2400									
14 9182									
20 0548									
21 0517									
21 0518									
21 0548									
21 1313									
22 0553									
22 0719									
22 0800									
22 1116									
22 1119									
22 1123									
22 1316									
22 1319									
22 1323									

SUBMITTAL SCHEDULE									
Section	Shop Dwgs	Prod. Data/List	Samples Mock-ups	Extend. Guarantee	Op/Maint. Manuals	Tests	Extra Mat'l	Certs.	Other
22 1413									
22 1423									
22 3400									
22 3450									
22 4000									
22 4613									
23 0500									
23 0513									
23 0514									
23 0516									
23 0519									
23 0523									
23 0529									
23 0548									
23 0553									
23 0593									
23 0713									
23 0719									
23 0800									
23 0900									
23 0993									
23 2113									
23 2123									
23 2300									
23 2500									
23 2516									
23 3113									
23 3300									
23 3416									
23 3423									
23 3433									
23 3713									
23 3723									
23 4100									
23 5100									
23 5216									
23 6500									
23 8119									
23 8126									

SUBMITTAL SCHEDULE									
Section	Shop Dwgs	Prod. Data/List	Samples Mock-ups	Extend. Guarantee	Op/Maint. Manuals	Tests	Extra Mat'l	Certs.	Other
23 8127									
23 8128									
23 8146									
26 0501									
26 0519									
26 0524									
26 0526									
26 0529									
26 0533									
26 0543									
26 0553									
26 0570									
26 0573									
26 0800									
26 1219									
26 2213									
26 2413									
26 2416									
26 2716									
26 2726									
26 2811									
26 2816									
26 3100									
26 3214									
26 3623									
26 5110									
26 5610									
27 0000									
28 3100									
31 1000									
31 2000									
31 2333									
32 0513									
32 1100									
32 1216									
32 1300									
32 1316									
32 1413									
32 1723									

SECTION 01 3300 SUBMITTALS

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Certificates
2. Shop Drawings, Product Data, and Samples
3. LEED Documentation
4. Refrigerant Management Documentation
5. Contractor Certification Form
6. Subcontractor Certification Form
7. Submittal Schedule

B. Definitions:

1. Mockups are full-size assemblies for review of construction, coordination, testing, or operation, appearance, and finish by which the Work will be judged; they are not Samples.
2. The terms "Shop Drawings" and "Product Data" are defined in Article 3.12 of the General Conditions.
3. As used herein, the term "manufactured" applies to standard units usually mass-produced. The term "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements. Shop drawings shall establish the actual detail of all manufactured or fabricated items, indicate proper relation to adjoining Work, and amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure.
4. The terms "Shop Drawings" and "Product Data" are defined in Article 3.12 of the General Conditions.

~~C. Manufacturers' Instructions: Where any item of Work is required by the Contract Documents to be furnished, installed, or performed in accordance with a specified product manufacturer's instruction, Contractor shall procure and distribute the necessary copies of such instructions to University's Representative and all other concerned parties, and Contractor shall furnish, install, or perform the Work in strict accordance therewith.~~

OR

Manufacturer's Instructions: Where it is required in the specifications that materials, products, processes, equipment or the like to be installed or applied in accordance with manufacturer's instructions, directions or specification, or words to this effect, it shall be construed to mean that said application or installation shall be in strict accordance with printed instructions furnished by the manufacturer of the material concerned for use under conditions similar to those at the job site. Three (3) copies of such instructions shall be furnished to the University's Representative and his/her approval thereof obtained before work is begun.

D. The University's Representative or its Design Professional reserves the right to review and request the removal or redesign of manufacturers' trade marks and names on items of materials and equipment which will be exposed to view in the completed Work. Such removal or redesign shall be at no increase in Contract Sum.

- E. Materials and equipment, for which Underwriters' Laboratories, Inc. standards have been established and their label service is available, shall bear the appropriate UL label.

1.2. CERTIFICATES

- A. Certifications of Review and Coordination: Within 10 days of Notice to Proceed, submit completed Contractor Certification of Review and Coordination and all Subcontractor Certifications of Review and Coordination.
- B. Certifications of Review and Coordination: As required by the General Conditions, perform a thorough review of the Contract Documents prior to commencing the Work. If there are no exceptions, write "NO EXCEPTIONS" in the space provided.
 - 1. Complete a copy of the Contractor Certification of Review and Coordination Form following this Section.
 - 2. Require all subcontractors to perform a thorough review of the Contract Documents and complete a copy of the Subcontractor Certification of Review and Coordination Form following this Section.
 - 3. Review all completed Forms and resolve conflicting comments, if any, among the various parties so as to present a clear, concise view of items noted.
 - 4. Submitting the required certifications does not relieve the Contractor from responsibility to continue to immediately report new discrepancies, errors, omissions, conflicts, code violations, and improper use of materials discovered in the Contract Documents during the course of construction.
 - 5. Applications for Payment will not be processed by the University's Representative until all certificates have been received.

1.3. SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- A. Shop drawings, product data, and samples, other than in connection with proposed substitutions, shall be submitted to University's Representative only when specifically required; and University's Representative will not review any other such submittals. Product data and samples for proposed substitutions shall be submitted to University's Representative in accordance with Section 01 2500. Contractor shall be responsible for obtaining such copies of shop drawings, product data, and samples as it may require for its own use. Submittals Not Required: No shop drawings of supplemental data are required unless specifically requested by the University or specified herein. No shop drawings shall be submitted unless specifically requested.
 - 1. Submittal Schedule:
 - a. Refer to Specific Specification Sections for the list of submittals required under each section and indicate the required submittals on the attached Submittal Schedule for review by University's Design Professional. A schedule of submission of shop drawings, product data, and samples by Contractor ("Submittal Schedule"), and their processing and return by the University's Design Professional shall be agreed upon by both parties in order that the items covered by these submittals will be available when needed by the construction process and so that each party can plan its workload in an orderly manner. Submit Submittal Schedule no later than 30 days after Award of Contract.
 - b. Contractor shall prepare the Submittal Schedule in the form as attached or similar form acceptable to the University's Representative, and coordinate it with the Contract Schedule. No submittals will be processed before the Submittal Schedule has been submitted to and accepted by University's Representative, except in such cases where the processing of submittals is required to maintain job progress before the acceptance of the Submittal Schedule.
 - c. In preparing the Submittal Schedule, Contractor must first determine from the Contract Schedule the date a particular item is needed for the Work. Working

- backwards, Contractor will establish the number of days required for fabrication, shipment, placement, and similar activities to determine the date required for the first submittal.
- d. Allow 14-28 day duration for the University's Design Professional's initial review of submittals depending on the submittal/shop drawing and specification section. Allow 7 days for Design Professional to re-review revised or unapproved submittal/shop drawings.
 - e. Contractor to indicate whether the submittal is a "Full" or "Partial" submittal on the schedule and on the submittal.
2. Material List: Provide complete material list of products proposed for use. Submit Material Safety Data Sheets (MSDS) for Owner's use. Neither the University Representative nor its Design Professional will review MSDS.
3. Contractor's Review:
- a. Contractor Review: The shop drawings and supplemental data, when called for, shall be submitted as the instruments of the Contractor, even though they may have been prepared by a subcontractor, supplier, dealer, manufacturer, or by any other person, firm or organization. Prior to submission, the Contractor shall undertake his/her own review and stamp with his/her acceptance those shop drawings and supplemental data he/she is requested to submit to the University's Architect/Design Professional for his/her review. By accepting and submitting shop drawings and supplemental data, the Contractor represents that the Contractor has determined and verified all field measurements, the physical construction, the quality of materials, the applicability of catalog numbers, and similar data, or will do so, and that the Contractor has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. Conflicts with other trades shall be resolved by the Contractor in the shop drawings, if possible, but in any event prior to the actual construction. Drawings submitted in response to a request of the University's Architect shall show rearrangements, if any, made necessary by the use of materials or equipment other than those specified. Review, mark-up as appropriate, and stamp show drawings, product data, and samples prior to submission. Submittals shall clearly show that they have been reviewed and approved by Contractor for conformance with the requirements of the Contract Documents and for coordination with other Sections.
 - b. Submittals not stamped and signed by Contractor will be returned without review.
 - c. Determine and verify:
 - (1) Field measurements.
 - (2) Field construction criteria.
 - (3) Catalog numbers and similar data.
 - (4) Conformance with Contract Documents.
 - d. Coordinate each submittal with requirements of the Work and of the Contract Documents.
 - e. Notify University's Representative and its Design Professional in writing, at time of submission, of any changes in the submittals from requirements of the Contract Documents. Contractor is responsible to correct the deficiencies from the requirements of the contract documents when any changes are not made in writing to the University Representative or its Design Professional at the time of submission. The approval of submittals will be deemed null and void.
 - f. Begin no fabrication or Work which requires submittals until the return of the University's Design Professional's final reviewed submittals.

4. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities as specified in Section 01 3300. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - a. Show the relationship of components shown on separate Shop Drawings.
 - b. Indicate required installation sequences.
 - c. Comply with requirements contained in this Section.

5. BIM Procedures:
 - a. Contractor shall establish procedures for coordinating work using BIM methods and protocols.
 - b. Format and Development: Prepare coordination drawings according to the following requirements:
 - (1) Prepare BIM files for the project based on original hard copy documents as received from the University.
 - (2) Prepare all files using BIM software program, version, and operating system as approved by University.
 - (3) Prepare BIM Execution Plan establishing BIM protocols for project, including standards, responsibilities of Contractor and sub-contractors, schedules, clash detection, and quality control.
 - (4) Designate a specific staff person as Contractor's BIM Coordinator.
 - (5) Submit or post coordination drawing files using format same as file preparation format or Portable Data File (PDF) format.
 - c. Clash Detection:
 - (1) Using BIM procedures perform clash detection as part of preparation of coordination drawings.
 - (2) Include clash detection protocol in the BIM execution plan.
 - (3) BIM Coordinator will review and assemble the various design and trade models, create clash reports and conduct coordination meetings with University's Representative as defined by the BIM execution plan.
 - (4) Run Parameters: Clash detection, at minimum, shall be set to report any hard clashes within a 1 /4 inch tolerance. Clearance tolerances shall be used to account for additional material applied to modeled elements, such as fire proofing or required clearances.
 - (5) At a minimum, review Clash Detection documents on a weekly basis. Identify conflicts requiring document modifications and review with University's Representative.
 - (6) Update model elements based on field verification of dimensions and orientation.
 - d. Following resolution of conflicts and clash detection, prepare coordination drawings for review as follows:
 - (1) Comply with shop drawing requirements for sheet size and submittal methods specified in Section 01 3300 "Submittals".
 - (2) Refer to Specifications in Divisions 2-33 technical specification sections for specific Coordination Drawing requirements.
 - (3) Provide composite coordination drawings for equipment and system installations in mechanical and electrical rooms and spaces where two or more entities will provide the work.
 - (4) Provide composite coordination drawings showing planned locations of core cuts, sleeves, and other penetrations intended for placement in

- concrete decks, slabs, and structural components. Indicate intended use such as openings for conduit, piping, ducts, and utility services.
- (5) Provide composite coordination drawings showing planned locations of fire and sound rated wall penetrations, including dampers. Indicate intended use such as openings for conduit, piping, ducts, and utility services.
 - (6) Prepare above-ceiling coordination drawings showing all above-ceiling work including structural members and required clearances and dimensions.
- e. At the end of the project as part of the close out submittals the Contractor shall provide an “as-built” BIM model to be given to the University in addition to the hard copy as built drawings.
6. Submission Requirements:
- a. Make submittals promptly in accordance with the Specifications and in such sequence as to cause no delay in the Work.
 - (1) Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - (a) Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 - (b) Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - (c) The University's Representative reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - (2) Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - (a) Allow sufficient time from receipt by University's Representative, for initial review and comment. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The University's Representative will promptly advise the Contractor when a submittal being processing must be delayed for coordination.
 - (b) If an intermediate submittal is necessary, process the same as the initial submittal.
 - (c) Allow additional time for reprocessing each submittal.
 - (d) No extension of Contract Time will be authorized because of failure to transmit submittals to the University's Representative sufficiently in advance of the Work to permit processing.
 - b. Number of Submittals Required: Refer to Specification Section 01 3500 “Document Control” for distribution of Shop Drawings and Product Data submittals. After each submittal has been reviewed by the Design Professional and returned to the Contractor. The Contractor shall make (two) 2 hard copies of all approved submittals and shall submit the hard copies to the University's Representative for project record filing.
 - (1) Samples: Contractor to submit a minimum of (five) 5 physical samples each of products and or samples for Design Professional's review and approval. After review and approval one sample will be retained by the architect, two (2) for

the contractor and its subcontractor and two (2) for the University's Representative.

- (2) Shop drawings and supplemental data, where called for, shall be prepared and submitted as per General Conditions. Final corrected copies of schedules and shop drawings or supplemental data to University's Design Professional for review shall be such as to provide one (1) for University's Architect's files, two (2) for the University and two (2) to the Contractor's job files and for distribution by the Contractor to subcontractors or vendors. Exceptions shall be as noted in Specifications sections.

c. Submittals shall contain:

- (1) Identification data number assigned by the Contractor, consisting of the specification section number followed with the number 001 and continuing in sequence.
 - (a) Resubmittals: Add a letter to the previous identification, for instance 01 3400/005/R1 would be a first resubmittal.
 - (b) Use a separate number for each product, assembly, or system. Similar or related items may be grouped only if compatible with review process as approved.
- (2) Date of submission and dates of any previous submissions.
- (3) Project name and number, and contract identification.
- (4) Names of Contractor, Subcontractor, Supplier and Manufacturer.
- (5) Identification of item, with Specification Section number and article/paragraph references.
- (6) Field dimensions, clearly identified as such.
- (7) Relation to adjacent or critical features of the Work or materials.
- (8) Reference standards, such as ASTM or Federal Specification numbers.
- (9) Identification of changes from requirements of the Contract Documents.
- (10) Identification of revisions on resubmittals.
- (11) An 8-inch x 3 inch blank space for review stamps, as necessary.
- (12) Contractor's stamp, initialed or signed, certifying to the review of the submittal; verification of materials and field measurements and conditions; and compliance of the information within the submittal with requirements of the Work and of the Contract Documents.

d. Interpretation of Terms:

- (1) "As directed", "as required", "as permitted", "acceptable", "satisfactory", means by or to the University's Architect. The term "equal" means "equal in the opinion of the University's Architect after submittal data is reviewed". The term "favorable review" means that the submittals for material list, shop drawings, material substitutions, schedules, etc., will be reviewed by the University's Architect and copies returned to the Contractor marked as "Review Completed", "No Exceptions Taken" or "Make Corrections Noted" in which case no further submittals are needed.
- (2) Submittals returned marked "Resubmit", "Amend and Resubmit" or "Rejected - Resubmit" shall be corrected to comply with project requirements and shall be resubmitted for review

7. Resubmission Requirements:

a. Shop Drawings and Product Data:

- (1) Revise shop drawings or product data, and resubmit as specified for the initial submittal, only if required by University's Design Professional.
- (2) Identify any changes which have been made other than those requested.

- (3) Note any departures from the Contract Documents or changes in previously reviewed submittals which were not commented upon by University's Design Professional.
 - b. Samples: Submit new samples as required for initial submittal.
 - c. University's Design Professional's Review: The University's Design Professional will review shop drawings and supplemental data submitted by the Contractor only for general design conformance with the concept of the Project and compliance with the information given in the Contract Documents. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of Contractor as required by the Contract Documents.
8. Distribution:
- a. Reproduce and distribute copies of Submittals including Shop Drawings and Product Data, which carry the University's Design Professional's review stamp, to the following locations:
 - (3) Contractor's Project site file.
 - (4) Record documents file maintained by Contractor.
 - (5) Separate Contractors.
 - (6) Subcontractors.
 - (7) Supplier or manufacturer.
 - (8) Other involved parties as directed by University's Representative.
9. Design Professional's or Design Professional's designee's or University Representative's Review will be under the following conditions.
- a. Review of submittals is only for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instruction for installation for performance or equipment or systems, all of which remain the responsibility of contractor as required by the Contract Documents.
 - b. The review does not affect the Contractor's responsibility to perform all Contract requirements with no change in Contract Sum or Contract Time. Any actions shown are subject to the requirements of the Drawings, Specifications and other Contract Documents. The Contractor is responsible to confirm and correlate dimensions at the site, for information that pertains to the fabrication processes, for the means, methods, techniques, procedures, sequences and quantities necessary to complete the Contract and for coordination of the work of all trades and satisfactory performance of his work. The review is undertaken solely to satisfy Consultant's obligations, if any to the University and shall not give rise to any claim by the Contractor or other parties against the University's Representative, his/her Consultants or University.

B. Shop Drawings

1. Present information required on shop drawings in a clear and thorough manner. Identify details by reference to drawings and detail, schedule, or room numbers shown and specified.
2. Shop drawings shall be original drawings by the Contractor. Direct reproductions of the Contract Drawings will not be acceptable as shop drawings.

3. Shop Drawings Delineation: The Shop Drawings shall be drawn to scale and shall be completely dimensioned, giving the plan together with such sections as are necessary to clearly show construction detail.
4. Responsibility: These Shop Drawings and all supporting data, catalogs, etc., shall be prepared by the Contractor or his/her suppliers, but shall be submitted as the instruments of the Contractor. Therefore, the Contractor shall review and approve the drawings of his/her suppliers as well as his/her own drawings before submitting them to the University's Representative. In particular, the Contractor shall ascertain that the drawings meet all requirements of the Drawings and Specifications and also conform to the structural and space conditions. Each Shop Drawing submitted for review shall bear a stamp certifying that it has been reviewed and approved by the Contractor in accordance with the Contract Documents. If such Shop Drawings show variations from Contract Documents, whether because of standard shop practice or other reasons, the Contractor shall make special mention thereof in his/her letter of transmittal. The Contractor shall be fully responsible for observing the need for and making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the equipment he/she proposes to supply both as pertains to his/her own work and any work affected under other parts, heading or divisions of Drawings and Specifications.
5. Identification: Shop Drawings shall be entitled with the name of the project on each sheet and shall otherwise be identified by listing the particular division, section, article or reference of the work pertaining. Submit different items on separate sheets. All submittals shall be numbered sequentially.
6. Manner: Furnish for University's Design Professional's approval separate sheets of submittal of each specialty item in the following manner:
 - a. Catalog cuts shall be photocopied or reproduced in some other acceptable manner and submitted on one (1) side only of an 8-1/2" x 11" sheet, noting only the items in question, together with the descriptive (specification) data complete. Once the Design Professional has reviewed the submittal provide two (2) hard copies of each approved, stamped shop drawing and other supporting data to the on-site University's Representative.
 - b. Each sheet shall be identified with the division, section, article or reference in the Contract Documents which covers the item submitted for approval.
 - c. Each sheet shall be identified with the project name, the University's Representative and the project's Design Professional.
 - d. Each sheet shall bear the Contractor's stamp and signature of approval.
7. All shop drawings shall be drawn accurately suitable for duplicate copying by black line, blue line printing processes or photocopy.
8. Supplemental Data: Supplemental data shall include information as noted in the specification paragraphs requiring them, or as requested by the University.
9. Review Required: Shop drawings, if requested, must be submitted to and favorably reviewed by the University's Architect/Design Professional before being used by the Contractor on the job.

C. Product Data

1. Clearly mark each copy to identify pertinent Products or models.
2. Show performance data consisting of capabilities, rpm, kw pressure drops, design and operating pressures, temperatures, performance curves, noise level curves, power characteristics and consumption; conforming as closely as possible to the test methods referenced in the plan and specifications.

3. Show dimensions, weights and clearances required.
4. Show wiring or piping diagrams and controls.
5. Modify the standard schematic drawings and other diagrams to delete information, which is not applicable to the Work.
6. Supplement standard information to provide information specifically applicable to the Work.

D. Samples

1. Office samples shall be of sufficient size and quality to clearly illustrate the following:
 - a. Functional characteristics of the products, with integrally related parts and attachment devices.
 - b. Full ranges of color, texture, and pattern.
 - c. Provide a minimum of 5 samples plus any additional number for Contractor needs.
2. Samples herein referred to shall include all materials, equipment, surface textures, colors, fabrics, etc., as required by Drawings and Specifications or as requested by the University's Design Representative. They shall be submitted as required by the Specifications or requested by the University's Representative or its Design Professional.
3. Submittal: Samples, properly identified and described, shall be submitted as noted herein, or as may be required by the University's Representative. They shall be submitted and resubmitted until approved. No approval of a sample shall be taken in itself to change or modify any contract requirement. Finishes, materials, or workmanship in the completed building shall match the approved samples.
4. Manner: Contractor shall forward all samples under cover letter in five (5) copies, including a complete listing of such samples designated for use on the project, with complete identification on each sample by project name, ultimate destination of material, manufacturer, brand, lot, style, model, etc., Contract Document reference as well as the names of the Contractor, Supplier, Project, Design Professional and University's Representative. All submittals shall be numbered sequentially.
5. Return: Samples of value will be returned to the Contractor for use in the project after review, analysis, comparison and/or testing as may be required by the University's Architect.
6. Test Sample: Test samples, as the University's Representative designates, will be selected from the materials or equipment delivered by the Contractor for use in the work. If any test sample fails to meet the specification requirements, all previous approvals will be withdrawn and such materials or equipment which fail the testing shall be subject to removal and replacement by the Contractor with materials or equipment meeting the specification requirements.

E. Mockups

1. Provide mock-ups as described in Specification Section 01 4339 and on the following drawings:
2. Material List: Provide complete material list of products proposed for use. Submit Material Safety Data Sheets (MSDS) for Owner's use. Neither the University Representative nor its Design Professional will review MSDS.
3. Contractor's Review: Review, mark-up as appropriate, and stamp show drawings, product data, and samples prior to submission. Submittals shall clearly show that they have been reviewed and approved by Contractor for conformance with the requirements of the Contract Documents and for coordination with other Sections.

1.4. LEED DOCUMENTATION

- A. Sustainable Design and LEED submittals are in addition to other submittals. If submittal item is identical to that submitted to comply with other requirements, submit duplicate electronic copies as a separate submittal to verify compliance. Any discrepancies shall be referred to the Universities Representative for clarification.
- B. LEED documentation submittals shall be prepared and submitted using the LEED-Online credit website.
- C. Refer to Section 01 8113 "Sustainability Design Requirements" item 1.5 Submittals; for the complete listing of all LEED documentation and submittals required for the project.

1.5. REFRIGERANT MANAGEMENT DOCUMENTATION

- A. UCR has instituted a requirement to comply with end-of-year refrigerant inventory for reporting to UCOP and with the South Coast Air Quality Management District's policies to account for the use of refrigerant gas delivery, recovery and charging installed with new HVAC and any other equipment using gas refrigerant on UCR projects.
- B. To provide accurate accounting for the reporting of the refrigerant charge in a mechanical system and/or equipment, the actual quantity must be known in order to document gas lost from leaks etc. when repairs are done.
- C. HVAC and other equipment utilizing gas refrigerant that are delivered to the site intact with the factory charge quantity listed on the nameplate or in literature submitted for the design professional's review, can sometimes be charged in the field according to various indications. Therefore the contractor who delivers and installs any system and/or equipment which uses refrigerant shall provide startup reports that list the exact quantity of gas charged into each system and submit these reports to the University's Representative who will provide to UCR EH&S.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

CONTRACTOR CERTIFICATION

COMPLETE THIS CERTIFICATE, INCLUDING SIGNATURE BY PERSON DIRECTLY RESPONSIBLE FOR WORK ON THIS PROJECT. REVIEW EACH SUBCONTRACTOR CERTIFICATION FOR COMPLETENESS AND COORDINATION WITH COMMENTS MADE ON THIS CERTIFICATE AND OTHER SUBCONTRACTOR CERTIFICATES. SUBMIT THIS CERTIFICATE AND ALL SUBCONTRACTOR CERTIFICATES TO THE UNIVERSITY'S REPRESENTATIVE WITHIN 10 DAYS OF RECEIVING NOTICE TO PROCEED.

1. As required by the General Conditions of the Contract for Construction, the undersigned certifies that a thorough review has been made of all of the Contract Documents, including, but not limited to the Agreement, General and Supplementary conditions, Drawings, specifications, and Addenda (if any) for the Work. The undersigned also acknowledges each subcontractor has been required to perform a similar thorough review and that Contractor and subcontractors have related and coordinated requirements of individual units of Work to requirements for the entire Work.
2. The undersigned acknowledges his/her obligation to identify below discrepancies, errors, omissions, conflicts, code violations, and improper use of materials discovered in the Contract Documents. Except as noted below and on subcontractor certificates, the undersigned certifies, to the best of his/her knowledge, information, and belief that the Work can be completed in a workmanlike manner without extensive modifications or additional expense.

EXCEPTIONS: _____

NAME, ADDRESS, TELEPHONE OF
CONTRACTOR: _____

AUTHORIZED
SIGNATURE: _____ DATE: _____

NAME (PRINTED CLEARLY OR TYPED): _____

TITLE: _____

END OF CONTRACTOR CERTIFICATION

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INTENTIONALLY

SUBCONTRACTOR CERTIFICATION

COMPLETE THIS CERTIFICATE, INCLUDING SIGNATURE BY PERSON DIRECTLY RESPONSIBLE FOR WORK ON THIS PROJECT, AND SUBMIT TO THE GENERAL CONTRACTOR WITHIN 5 DAYS OF RECEIVING NOTICE TO PROCEED FROM GENERAL CONTRACTOR.

1. As required by the General Conditions of the Contract FOR construction, the undersigned certifies that a thorough review has been made of all of the Contract Documents, including, but not limited to the Agreement, General and Supplementary Conditions, Drawings, Specifications, and Addenda (if any) for the Work. The undersigned also certifies that Contractor and subcontractor have related and coordinated requirements for the entire Work.
2. The undersigned acknowledges his/her obligation to identify below discrepancies, errors, omissions, conflicts, code violations, and improper use of materials discovered in the Contract Documents. Except as noted below, the undersigned certifies, to the best of his/her knowledge, information, and belief that no such discrepancies, errors, omissions, conflicts, code violations, or improper use of materials occur in the Contract Documents.
3. Except as noted below, the undersigned has no objection to, or reservation about, the materials to be furnished or the conditions under which they will be installed, and is satisfied that contractual responsibilities for units of Work for which undersigned is responsible can be completed in a workmanlike manner without extensive modifications or additional expense.

EXCEPTIONS: _____

UNITS OF WORK FOR WHICH UNDERSIGNED IS RESPONSIBLE:

NAME, ADDRESS, TELEPHONE OF
SUBCONTRACTOR: _____

AUTHORIZED

SIGNATURE: _____ DATE _____

NAME (PRINTED CLEARLY OR TYPED) _____

TITLE: _____

END OF SUBCONTRACTOR CERTIFICATION

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INTENTIONALLY

Standard Specification

SECTION 01 33 29.08 BUY CLEAN CALIFORNIA REPORTING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Section includes general requirements and procedures for compliance with Buy Clean California Act per California Public Contract Code, Sections 3500-3505.
- B. Contractor is requested to submit current facility-specific environmental product declaration for each eligible material proposed to be used on the Project.

1.2 DEFINITIONS

- A. Environmental Product Declaration (EPD): Type III environmental impact label, as defined by the International Organization for Standardization (ISO) standard 14025, or similarly robust life cycle assessment methods that have uniform standards in data collection consistent with ISO standard 14025, industry acceptance, and integrity.
- B. Eligible Materials: Any of the following:
 - 1. Carbon steel rebar.
 - 2. Flat glass.
 - 3. Mineral wool board insulation.
 - 4. Structural steel.

1.3 SUBMITTALS

- A. General: Buy Clean California submittals are requested to be submitted along with other required submittal items for eligible materials as described in the Specifications.
- B. Facility-specific Environmental Product Declaration: For each eligible material proposed to be used on the Project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 33 29.08

SECTION 01 3520 DESIGN ASSIST PROCEDURES

1.1 SUMMARY

A. Section includes requirements of Contractor for design-assist work including, but not necessarily limited to, those identified in the various Sections of the Specifications and the following:

1. Contractor's Responsibility
2. Coordination with Architectural Design Intent

B. The following require design assistance:

1. Pre-Fabricated metal stairs including guardrails and the application of concrete filled metal pans and precast treads.
2. Pedestrian Bridges.
3. Other railing and guardrails.
4. Fixed sunshades.
5. Fiber reinforced cementitious wall siding and furring rain screen system.
6. Translucent canopy system.
7. Storefronts and curtain walls.
8. Fire sprinkler system.
9. Fire alarm system.

B. Design-assist procedures are specified to assist Contractor in coordinating design-assist work.

1.2 CONTRACTOR'S RESPONSIBILITY

A. Contractor acknowledges that it shall be responsible for the design, method of construction, and coordination and integration with other trades to achieve the architectural design intent of the Contract Documents, of those portions of the design-assist work including sizing, sequence, placement and details of construction.

B. Contractor guarantees the following:

1. Design-assist work shall be constructed in compliance with building codes and ordinances in effect and shall be fit and proper for its intended use.
2. Where relevant, design and method of construction of the design-assist work shall not incorporate or employ the use of any product, process or technique which may be protected by common law or statutory patent, copyright or trade secret rights unless Contractor or subcontractor shall be the lawful owner or licensee of same.

C. Contractor shall indemnify and hold harmless University, University's Representative, Architect and its consultants, and agents and employees of any of them from and against claims, damages and expenses resulting from breach or failure by Contractor to perform fully any of the forgoing obligations and specifically agrees to indemnify and hold University harmless from any and all claims of the Contractor's employees, agents, subcontractors, suppliers or third parties and to make good any damages to the Work, and attorneys' fees and costs of additional work by University's Design Professional resulting from the inadequacies of the design, techniques or methods of construction of the design-assist Work.

- D. The design and the drawings and specifications for the techniques and method of construction of the design-assist work shall be prepared and shall result in work which is fit to perform its intended purpose.
- E. For design-assist work, Contractor shall provide plans, specifications, and calculations that are prepared, stamped, and signed by qualified, registered, licensed engineers authorized to practice their professions under the laws of the State of California. The plans, specifications, and calculations shall be acceptable to the University's Representative.
- F. Prior to commencement of the design-assist work at the Project Site, Contractor shall provide the University with copies of current insurance policies covering the errors or omissions of persons designing the design-assist work with maximum deductibles and limits per occurrence as mutually agreed by the University and Contractor, together with an endorsement providing for a 30-day notice to University prior to cancellation or material reduction in coverage.
- G. Maintain insurance at least the period equal to the applicable statute of limitations for claims arising out of latent defects in works of improvement to real property, if such insurance is not written on an "occurrence" basis during the time the design-assist work is designed and constructed.

1.3 COORDINATION WITH ARCHITECTURAL DESIGN INTENT

- A. Ceilings:
 - 1. Coordinate the work of all trades involved to ensure clearances for fixtures, ducts, piping, ceiling suspension systems and other above-ceiling work as necessary to maintain finished ceiling heights.
 - 2. Paint all exposed items at ceilings. Paint air grilles to match adjacent ceiling finish.
 - 3. Locate light fixtures, sprinkler heads, and diffuser grilles in the center of ceiling panels.
- B. Areas Where Structure Is Exposed:
 - 1. Install sprinkler lines, ductwork, conduit, plumbing, process piping, lighting and all other overhead items at regular intervals, parallel to and/or perpendicular with building column grid lines.
 - 2. Align all hangers, wires, braces, struts, chains, junction boxes, etc. in any given line aligned with one another, and install in the same fashion, for a neat, uniform appearance.
- C. Review proposed layouts with University's Representative and other trades in the field prior to commencing work. Layouts which have not been so reviewed will be subject to change at no additional expense to the University if found unsatisfactory. Areas subject to such review include but are not necessarily limited to exposed structure areas.
- D. Do not locate sprinkler lines, piping, ductwork, conduit, access panels, and cleanouts in "Special Feature Areas" and finishes, including walls and ceilings, except as otherwise specifically shown on the Drawings.
 - 1. Engineering design and construction shall be by alternative route and not necessarily direct route method.

2. Special Feature Areas include:
 - a. Network Rack Systems
 - b. In-Row Cooling Units
 - c. Cable Tray System
 - d. Wire-Mesh Fencing
 - e. Structural Construction

END OF SECTION

SECTION 01 3540 ENVIRONMENTAL MITIGATION

PART 1 – GENERAL

1.1 SUMMARY

- A. The Environmental Mitigation requirement for this project is recorded in this specification Section 01 3540. The mitigation measures may include, but are not limited to, procedures and standards to control:

1. Air Quality
2. Dust Control Measures
3. Asbestos
4. Biological Resources
5. Cultural Resources
6. Hazards and Hazardous Materials
7. Water Quality
8. Noise Attenuation Measures
9. Transportation and Traffic Control
10. Light and Glare

Please note additional project-specific mitigation measure(s) shall be incorporated once the project-specific CEQA analysis has been prepared.

- B. Related Sections

1. Section 01 5639 Tree and Plant Protection
2. Section 01 5700 Temporary Controls
3. Where Sections contain conflicting requirements the more stringent requirement shall apply. Notify University's Representative in writing when conflicts or discrepancies are found. The University's Representative will notify the Contractor/Design Builder where one supersedes.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Submittal Procedures:

1. Submittals shall be submitted in accordance with Section 01 3300, "Submittals."
 - a. Submit Traffic Control Plan for Project Construction prior to the start of construction
 - b. Submit Pedestrian Circulation Plan for Project Construction prior to the start of construction.

PART 2 - MITIGATION MEASURES

2.1 AIR QUALITY

- A. Low NOx diesel fuel and construction equipment shall be used to the extent that is readily available at the time of construction. Contractor shall maintain on-going, updated records for University Representatives to review for compliance.
- B. The following Air Quality reduction procedures shall be implemented throughout the construction process:
1. Compliance with all South Coast Air Quality Management District (SCAQMD) rules and regulations.
 2. Maintenance programs to assure vehicles remain in good operating condition.
 3. Avoid unnecessary idling of construction vehicles and equipment.
 4. Use of alternative fuel construction vehicles.
 5. Provision of electrical power to the site to eliminate the need for on-site generators.
- C. Post a publicly visible sign with the telephone number and person to contact at the University regarding dust complaints, as well as the SCAQMD telephone number. This University's Representative is required to respond and direct corrective action. The Contractor/Design Builder will take directed correction action within 48 hours.
- D. The Contractor/Design Builder shall prepare a construction emissions control plan that includes a comprehensive inventory of all off-road construction equipment, equal to or greater than 50 hp, that will be used for an aggregate of 40 more hours during any portion of the construction project. All contractors, and overseen by the Contractor/Design Builder, shall utilize California Air Resources Board (CARB) certified equipment or better for all on-site construction equipment to meet the following:
1. All off-road diesel-powered construction equipment greater than 50 hp shall meet the Tier 4 emission standards, where available. In addition, all construction equipment shall be outfitted with BACT devices certified by CARB. Any emissions control device used by the contractor shall achieve emissions reductions that are no less than what could be achieved by a Level 3 diesel emissions control strategy for a similarly sized engine as defined by CARB regulations.
 2. A copy of each unit's certified specification, BACT documentation and CARB or SCAQMD operating permit shall be provided at the time of mobilization of each applicable unit or equipment.
 3. Contractors are encouraged to apply for AQMD "SOON" funds. Incentives could be provided for those construction contractors who apply for AQMD "SOON" funds. The "SOON" program provides funds to accelerate clean-up of off-road diesel vehicles, such as heavy-duty construction equipment. More

information on this program can be found at the following website:
<http://www.aqmd.gov/home/programs/business/business-detail?title=off-road-diesel-engines&parent=vehicle-engine-upgrades>

- E. The Contractor/Design Builder shall also implement the following measures during construction:
1. Prohibit vehicle and engine idling in excess of 5 minutes and ensure that all off-road equipment is compliant with the CARB in-use off-road diesel vehicle regulation and SCAQMD Rule 2449.
 2. Configure construction parking to minimize traffic interference.
 3. Provide temporary traffic controls such as a flag person, during all phases of construction to maintain smooth traffic flow.
 4. Provide dedicated turn lanes for movement of construction trucks and equipment on- and off-site.
 5. Schedule construction activities that affect traffic flow on the arterial system to off-peak hour to the extent practicable.
 6. Improve traffic flow by signal synchronization, and ensure that all vehicles and equipment will be properly tuned and maintained according to manufacturers' specifications.
 7. Use diesel-powered construction vehicles and equipment that operate on low-NOx fuel where possible.
 8. Reroute construction trucks away from congested streets or sensitive receptor areas.
 9. Maintain and tune all vehicles and equipment according to manufacturers' specifications.
- F. To minimize VOC emissions from the painting/finishing phase, for each construction project on the campus, the project contractor will implement the following VOC control measures:
1. Construct or build with materials that do not require painting, or use pre-painted construction materials.
 2. If appropriate materials are not available or are cost-prohibitive, use low VOC-content materials more stringent than required under SCAQMD Rule 1113.
- G. Install filters over air handling units of neighboring facilities: Air distribution systems of neighboring facilities shall be aggressively protected from dust during the construction process to ensure that no contamination of the duct system occurs. Special provisions shall be made at no additional cost to the university to provide adequate filtration to protect all air handling equipment of immediately adjacent facilities, distribution and return ductwork from exposure to dust, with filters being changed on a regular and frequent basis during the period of construction.

2.2 DUST CONTROL MEASURES

- A. All contractors, and those overseen by the Contractor/Design Builder, shall implement dust control measures consistent with SCAQMD Rule 403 – Fugitive Dust during the construction phases of the project development.
1. Apply water and/or approved non-toxic chemical soil stabilizers according to manufacturer's specifications to all inactive construction areas (previously graded areas that have been inactive for 10 or more days).
 2. Replace ground cover in disturbed areas as quickly as possible.
 3. Enclose, cover, water twice daily, or apply approved chemical soil binders to exposed piles with 5 percent or greater silt content.
 4. Water active grading sites at least twice daily.
 5. Suspend all excavating and grading operations when wind speeds (as instantaneous gusts) exceed over 25 mile per hour over a 30-minute period.
 6. All trucks hauling dirt, sand, soil, or other loose material are to be covered or should maintain at least two feet of freeboard (i.e., minimum vertical distance between top of the load and top of the trailer) in accordance with section 23114 of the California Vehicle Code.
 7. Sweep streets at the end of the day if visible soil material is carried over to adjacent roads.
 8. Install wheel washers where vehicles enter and exit unpaved roads onto paved roads, or wash off trucks and any equipment leaving project site for each trip.
 9. Apply water three times daily of chemical soil stabilizers according to manufacturer's specifications to all unpaved parking or staging areas or unpaved road surfaces.
- B. Construction Site Speed Limit.
1. All contractors, and those overseen by the Contractor/Design Builder, shall ensure that construction site and access road speed limits be established and enforced during the construction period. Post and enforce traffic speed limits of 15 miles per hour or less on all unpaved roads.

2.3 ASBESTOS

- A. Compliance with SCAQMD Rule 1403
1. All contractors, and those overseen by the Contractor/Design Builder, shall implement SCAQMD Rule 1403 – Asbestos when demolishing existing buildings on campus.

2.4 BIOLOGICAL RESOURCES

- A. Nesting Bird Surveys
1. Prior to the onset of construction activities that would result in the removal of mature trees that would occur between March and mid-August, surveys for nesting special status avian species and raptors shall be conducted on the affected portion of the campus following the U.S Fish and Wildlife Service

(USFWS) and/or the California Department of Fish and Game (CDFW) guidelines. If no active avian nests are identified on or within 250 feet of the construction site, no further mitigation is necessary.

2. If active nests for avian species of concern or raptor nests are found within the construction footprint or a 250-foot buffer zone, exterior construction activities shall be delayed within the construction footprint and buffer zone until the young have fledged or appropriate mitigation measures responding to the specific situation have been developed and implemented in consultation with USFWS and CDFW.

~~B. Protection of Naturalistic Open Space~~

- ~~1. Unnecessary driving in sensitive or otherwise undisturbed areas shall be avoided. New roads or construction access roads would not be created where adequate access already exists.~~
- ~~2. Removal of native shrub or brush shall be avoided, except where necessary.~~
- ~~3. Drainages shall be avoided, except where required for construction. Limit activity to crossing drainages rather than using the lengths of drainage courses for access.~~
- ~~4. Excess fill or construction waste shall not be dumped in washes.~~
- ~~5. Vehicles or other equipment shall not be parked in washes or other drainages.~~
- ~~6. Overwatering shall be avoided in washes and other drainages.~~
- ~~7. Wildlife including species such as fox, coyote, snakes, etc. shall not be harassed. Harassment includes shooting, throwing rocks, etc.~~

C. Tree Preservation and Replacement Guidelines

1. Preserve and protect mature specimen trees, memorial trees, landmark trees, and historic trees, to the extent feasible. All contractors, and those overseen by the Contractor/Design Builder, shall refer to the Tree Preservation and Replacement Guidelines for information pertaining to tree replacement requirements and ratio. All contractors, and those overseen by the Contractor/Design Builder shall plant any replacement (or relocated) trees to the satisfaction of the University's Representative.

2.5 CULTURAL RESOURCES

A. Protection and Recovery of Buried Artifacts

1. If an archaeological resource is discovered during construction, all soil-disturbing work within 100 feet of the find shall cease and the University's Representative shall contact a qualified archaeologist meeting the Secretary of Interior standards within 24 hours of discovery to inspect the site. If a resource within the project area of potential effect is determined to qualify as a unique archaeological resource (as defined by CEQA), the University shall devote adequate time and funding to determine if it is feasible, through project design measures to preserve the find intact. If it cannot be preserved, the University shall retain a qualified non-University archaeologist to design and implement a treatment plan, prepare a report and salvage the material,

- as appropriate. Any important artifacts recovered during monitoring shall be cleaned, catalogued, and analyzed, with the results presented in a report of finding that meets professional standards.
- a. If significant Native American cultural resources are discovered, as determined by the consulting archaeologist for which a Treatment Plan must be prepared, the Contractor/Design Builder or his archaeologist shall immediately contact the University's Representative. The University's Representative shall contact the appropriate Tribal representatives.
 - b. If requested by Tribal representatives, the University, the Contractor/Design Builder or his project archaeologist shall in good faith, consult on the discovery and its disposition (e.g. avoidance, preservation, return of artifacts to tribe, etc.).
2. Construction specifications shall require that if a paleontological resource is uncovered during construction activities:
- a. A qualified paleontologist shall determine the significance of the find.
 - b. The campus shall make an effort to preserve the find intact through feasible project design measures.
 - c. If it cannot be preserved intact, then the University shall retain a qualified non-University paleontologist to design and implement a treatment plan to document and evaluate the data and/or preserve appropriate scientific samples.
 - d. The paleontologist shall prepare a report of the results of the study, following accepted professional practice.
 - e. Copies of the report shall be submitted to the University and the Riverside County Museum.
3. In the event of the discovery of a burial, human bone, or suspected human bone, all excavation or grading in the vicinity of the find shall halt immediately and the area of the find shall be protected and the University immediately shall notify the Riverside County Coroner of the find and comply with the provisions of State Health & Safety Code § 7050.5 and Public Resource Code Section 5097.

2.6 HAZARDS AND HAZARDOUS MATERIALS

A. Health and Safety

1. All contractors, and those overseen by the Contractor/Design Builder, shall implement the current (or equivalent) health and safety plans, programs, and practices related to the use, storage, disposal, or transportation of hazardous materials, including, but not limited to, the Business Plan, the BROADSCOPE Radioactive Materials License, and the following programs: Biosafety, Emergency Management, Environmental Health, Hazardous Materials, Industrial Hygiene and Safety, Laboratory/Research Safety, Radiation Safety, and Integrated Waste Management. These programs may be subject to modification as more stringent standards are developed or if the programs are

replaced by other programs that incorporate similar health and safety protection measures as determined by the Campus Building Official and Campus Fire Marshal.

B. Remediation

1. If applicable, prior to demolition activities, when remediation is deemed necessary, all contractors, and those overseen by the Contractor/Design Builder, shall identify all potential hazardous materials within the structure to be demolished, and identify handling and disposal practices to ensure construction worker and public safety.

2.7 WATER QUALITY

A. National Pollutant Discharge Elimination System (NPDES)

1. All contractors, and those overseen by the Contractor/Design Builder, shall comply with NPDES requirements and implement Best Management Practices (BMPs) as identified in the UCR Stormwater Management Plan.

2.8 NOISE ATTENUATION MEASURES

A. Construction Hours of Operation

1. Construction activities shall be limited to between the hours of 7:00 AM and 9:00 PM Monday through Friday and 8:00 AM to 6:00 PM on Saturdays when necessary and no construction on Sunday and national holidays in order to minimize disruption to area residences surrounding the campus and to on-campus uses that are sensitive to noise. Construction traffic shall follow transportation routes prescribed for all construction traffic to minimize the impact of traffic (including noise impacts) on the surrounding community.

B. Construction Noticing

1. All contractors, and those overseen by the Contractor/Design Builder shall notify the University's Representative when notice shall be given to all academic and residential facilities within 300 feet of approved construction sites of the planned schedule of vibration causing activities so that the occupants and/or researchers can take necessary precautionary measures to avoid negative effects to their activities and/or research.
2. All contractors, and those overseen by the Contractor/Design Builder shall notify the University's Representative when to conduct regular meetings, as needed, with on-campus constituents to provide advance notice of construction activities in order to coordinate these activities with the academic calendar, scheduled events, and other situations, as needed.
3. All contractors, and those overseen by the Contractor/Design Builder shall notify the University's Representative when to conduct meetings, as needed, with off-campus constituents that are affected by campus

construction to provide advance notice of construction activities and ensure that the mutual needs of the particular construction project and of those impacted by construction noise are met, to the extent feasible.

C. Vibration

1. If applicable, all contractors, and overseen by the Contractor/Design Builder, shall require that large bulldozer; large, heavy trucks; vibratory rollers; and other similar equipment not be used within 50 feet of occupied academic buildings. The work shall be done with medium-sized equipment or smaller within these preserved distances. Vibratory rollers operated in the static mode would be allowed.

D. Require Mufflers and Other Noise Attenuators on Project Construction Equipment.

1. All contractors, and overseen by the Contractor/Design Builder, shall ensure that noise-producing construction equipment and vehicles using internal combustion engines will be equipped with mufflers; air-inlet silencers where appropriate; and any other shrouds, shields, or other noise-reducing features in good operating condition that meet or exceed original factory specification. Mobile or fixed “package” equipment (e.g., arc-welders, air compressors) will be equipped with shrouds and noise-control features that are readily available for that type of equipment.
2. Stationary construction equipment, material and vehicle staging shall be placed to direct noise away from sensitive receptors.

E. Require Use of Electrically Powered Equipment.

1. All contractors, and overseen by the Contractor/Design Builder, shall ensure that work use electrically powered equipment instead of pneumatic or internal combustion-powered equipment, where feasible.

~~F. New Construction of Residence Halls~~

- ~~1. Ensure that the construction residence halls incorporate adequate acoustic insulation such that interior Ldn would not exceed 45 dB(A) during the daytime and 40 dB(A) during the nighttime (10 PM to 7 AM) in rooms facing major streets.~~

2.9 TRANSPORTATION AND TRAFFIC CONTROL

A. Traffic Control Plan for Project Construction.

1. All contractors shall comply with a University reviewed and approved Traffic Control Plan for project construction prepared by the Contractor/Design Builder prior to the commencement of construction.

- ~~2. To the extent feasible, all contractors, and those overseen by the Contractor/Design Builder, shall restrict vehicle traffic not associated with parking personal vehicles in permitted parking lots to the Contractor/Design Builder provided temporary construction service road and North Campus Drive.~~
3. To the extent feasible, all contractors, and those overseen by the Contractor/Design Builder, shall maintain at least one unobstructed lane in both directions on existing campus roadways while performing the Work. At any time only a single lane is available, all contractors, and those overseen by the Contractor/Design Builder, shall provide a temporary traffic signal, signal carriers (i.e., flag persons), or other appropriate traffic controls to allow travel in both directions. If construction activities require the complete closure of a roadway segment, all contractors, and those overseen by the Contractor/Design Builder, shall provide appropriate signage indicating alternative routes.
4. To maintain adequate access for emergency vehicles when construction activities would result in roadway closures, the contractor will give fourteen (14) calendar day notice to the University's Representative, so that the University Office of Planning, Design & Construction can consult with the UCPD, EH&S, and RFD, as appropriate to disclose closures and identify alternative travel routes.
5. The hauling and disposal of any excess clean soil excavated from or already stockpiled on the site will be the responsibility of the Contractor/Design Builder to transport and stockpile it at the UCR Ag Ops area, or University approved location as directed by the University's Representative.

B. Pedestrian Access Plan for Project Construction.

1. All contractors will comply with a University reviewed and approved Pedestrian Access Plan for project construction prepared by the Contractor/Design Builder prior to the commencement of construction. At a minimum the Plan will include, alternate routes, appropriate signage, and curb cuts at street crossings to assure alternate routes around all construction sites or areas under the control of the Contractor/Design Builder are accessible during all phases of the Project.

2.10 LIGHT AND GLARE

A. Outdoor lighting

1. All contractors, and overseen by the Contractor/Design Builder, shall ensure that all outdoor lighting on campus resulting from new development shall be directed to the specific location intended for illumination (e.g., roads, walkways, or recreation fields) to prevent stray light spillover onto adjacent residential areas. In addition, all fixtures on elevated light standards in parking lots, parking structures, and athletic fields shall be shielded to reduce glare. Lighting plans shall be reviewed and approved by the University's Representative prior to project-specific design and construction document approval.

END OF SECTION 01 3540

SECTION 01 3543 ENVIRONMENTAL PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes:
 - 1. Hazardous Materials Procedures
 - 2. Toxic Materials Procedures
 - 3. University of California – Approved TSDFs (Attached to end of Section.)
- B. Submittals:
 - 1. Submit Material Safety Data Sheets (MSDS) for all materials, whether existing or incorporated into the work, which are identified as potentially hazardous but not required to be abated.

1.2. HAZARDOUS MATERIALS PROCEDURES

- A. Except as otherwise specified, in the event Contractor encounters on the Project site material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), or other hazardous materials which have not been rendered harmless, Contractor shall immediately stop Work in the area affected and report the condition to University and University's Representative in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of University and Contractor if in fact the material is asbestos, PCB, or other hazardous materials and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos, PCB, or other hazardous materials, or when such materials have been rendered harmless.
- B. If material has been encountered on site and the Contractor has reported the condition to the University's Representative, then the University Representative shall contact UCR Environmental Health and Safety office (EH&S) and **Ambient Environmental**, the University's hazardous material consultant to conduct an on-site assessment of the material and if it is found to be hazardous then **Ambient Environmental** shall prepare a plan to remove it off site and dispose of it at a University of California approved Treatment, Storage, and Disposal Facility (TSDF). See the list of University of California – Approved TSDFs attached to the end of this Section.

1.3. TOXIC MATERIALS PROCEDURES

- A. Not Used

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

University of California - Approved TSDFs

This document is a list of permitted treatment, storage, and disposal facilities (TSDFs) that have been deemed acceptable for use in managing hazardous waste generated by the University of California (UC) or at UC facilities. Neither UC nor any of its employees makes any warranty, express or implied, as to the merchantability or fitness for a particular purpose of the goods or services provided by the TSDFs listed above. Except as stated above, reference to the TSDFs in this document does not necessarily constitute or imply its endorsement or recommendation by UC and UC expresses no opinion as to any TSDF that does not appear in this document. This document shall not be used for advertising or product endorsement purposes or for any other use not expressly authorized in writing by UC.

TSDF name	Street	City	State	Zip phone	EPA ID
Altamont Landfill	10840 Altamont Pass Road	Livermore	CA	94550 (925) 455-7306	CAD981382732
AERC INC (MTI)	30677 Huntwood Avenue	Hayward	CA	94544 (510) 429-1129	CAD982411993
Azusa Land Reclamation Co.	1201 W. Gladstone	Azusa	CA	91702 (626) 334-0719	CAD009007626
Bethlehem Apparatus	890 Front Street	Hellertown	PA	18055 (610) 838-7034	PAD002390961
Chemical Waste Management (CWM) - Kettleman Hills	35251 Old Skyline Roac	Kettleman	CA	93239 (559) 386-9711	CAT000646117
Chemical Waste Management (CWM) - TWI	7 Mobile Drive	Sauget	IL	62201 (618)271-2804	ILD098642424
Chem-Nuclear Systems, Inc (Barnwell)	140 Stoneridge Drive	Columbia	SC	29210 (803) 758-1826	SCD048372429
Clean Harbors (Aragonite), LOC Inc.	P.O. Box 22890	Aragonite	UT	84122 (801) 323-8100	UTD981552177
Clean Harbors (Chicago)	11800 S. Stony Island Ave.	Chicago	IL	60617 (800)678-4844	ILD000608471
Clean Harbors (Deer park), Inc	2027 Battleground Road	Deer Park	TX	77536 (713) 930-2300	TXD055141378
Clean Harbors (Kimball, Incinerator Facility)	2247 S. Highway 71	Kimball	NE	69145 (308)235-4012	NED981723513
Clean Harbors (Lokern)	2500 West Lokern Rd.	Buttonwillow	CA	93206 (805) 762-6200	CAD980675276
Clean Harbors (Los Angeles), Inc.	5756 Alba Street	Los Angeles	CA	90058 (213) 585-5063	CAD050806850
Clean Harbors (Phoenix)	1340 West Lincoln Street	Phoenix	AZ	85007 (602)258-6155	AZD049318009
Clean Harbors (Sacramento)	6000 - 88th Street	Sacramento	CA	95828 (916) 386-4999	CAD000084517
Clean Harbors (San Jose)	1040 Commercial St. Suite 109	San Jose	CA	95112 (408) 453-6046	CAD059494310
Clean Harbors (Spring Grove Resources Recovery)	4829 Spring Grove Ave.	Cincinnati	OH	45232 (513)681-5738	OHD000816629
Crosby & Overton, Inc.	1630 W 17th Street	Long Beach	CA	98013 (562) 432-5445	CAD028409019
DeMenno/Kerdoon	22000 N. Alameda Street	Compton	CA	90222 (310)537-7100	CAT080013352
Diversified Scientific Services (DSSI)	P.O. Box 863	Kinston	TN	37831 (615) 376-0084	TND982109142
Duratek	1560 Bear Creek Road	Oak Ridge	TN	37831 (423) 481-0222	TND982157570
ENSCO	309 American Circle	El Dorado	AR	71730 (870) 862-0272	ARD069748192
ENSCO West	1737 East Denni Street	Wilmington	CA	90744 (310) 835-9997	CAD044429835
Envirocare of Utah, Inc	US I-80, Exit 49	Clive	UT	84029 (801) 532-1330	UTD982598898
Environmental Management & Controls (EMC)	3106 South Faith Home Road	Turlock	CA	95380 (209)-667-1102	Radioactive Material License # 3546-5C
Envirosafe	hwy 78 Missile Base Roac	Grand View	ID	82624 (208)834-2275	IDD073114654
Heritage Environmental Services, Inc	7901 West Morris Street	Indianapolis	IN	46231 (317) 243-0811	IND093219012
Heritage Environmental Services, LLC	5122 East Story Road	Coolidge	AZ	85228 (520)723-4167	AZD081705402
Heritage Landfill	4370 W.CR 1275N	Roachdale	IN	46172 (317)243-0811	IND980503890
Kinsbursky Brothers Incorporated	1314 Lemon Street	Anaheim	CA	92801 (714)738-8516	CAD088504881
Mercury Waste Solutions, Inc.	21211 Durand Avenue	Union Grove	WI	53182 414-878-2599	WIR 000 000 356
Merry X-Ray	131 South Maple #1	S. San Fran	CA	94080 (650)6742-6630	CAL000512065
ONYX (formerly AETS)	1125 Hensley Street	Richmond	CA	94801 (510) 233-8001	CAT080014079
Onyx (formerly CWM OSCO)	1704 W. First Street	Azusa	CA	91702 (626) 815-2215	CAD008302903
Onyx (Superior Special Services, Inc.)	5736 West Jefferson	Phoenix	AZ	85043 (602) 233-2955	AZD983473539
Perma-Fix (Quadrex)	1940 NW 67th Street	Gainesville	FL	32653 (405) 468-2000	FLD980711071
Philip Environmental (Burlington)	20245 - 77th Avenue, south	Kent	WA	98032 (206) 872-8030	WAD991281767
Philip Environmental (Georgetown)	734 Lucile Street	Seattle	WA	98108 (206) 762-3362	WAD000812909
Philip Environmental (Rho-Chem)	425 Isis Avenue	Inglewood	CA	90301 (213) 776-6233	CAD008364432
Photo Waste Recycling Co., Inc.	2980 Kerner Boulevard	San Rafael	CA	94901 (415)459-8807	CAD981429673
Photo Waste Recycling Co., Inc.	12898 Bradley Avenue, Suite B	Sylmar	CA	91342 (818)362-0668	CAD000121946
Ramos Environmental Services Inc.	1515 South River Road	W. Sacramento	CA	95691 (916)-371-5747	CAD044003556
Romic Environmental Technologies Corp	2081 Bay Road	East Palo Alto	CA	94303 (650)-324-1638	CAD009452657
Romic Environmental Technologies Corp (Southwest)	6760 West Allison Road	Chandler	AZ	85226 (602) 796-1040	AZD009015389
Ross Environmental Services	36790 Giles Road	Grafton	OH	44044 (440) 748-5800	OHD 048415665
Stericycle, Inc. (Formerly BFI)	4135 West Swift Avenue	Fresno	CA	93722 (559)275-0991	None
Stericycle, Inc. (Formerly BFI)	90 North 1100 West	North Salt Lake	UT	84054 (801) 295-1555	UTD988078150
Systech Environmental Corp.	South Cement Road	Fedonia	KS	66736 (316) 378-4451	KSD980633259
SET Environmental INC. (Treatment One)	5743 Chestwood	Houston	TX	77087 (713)645-8710	TXD055735388
U.S. Filter Recovery Services (Norris Environmental)	5375 South Boyle Ave.	Los Angeles	CA	90058 (213) 277-1500	CAD097030993
Von Roll America (WTI)	1250 Saint George Street	East Liverpool	OH	43920 (800) 403-4888	OHD980613541
Waste Control Specialists (WCS)	1710 West Broadway	Andrews	TX	79714 (713) 944-5900	TXD988088464

Pacific Resource Recovery Services Big Bear CA CAD008252405
 Yellow Highlight indicates TSDF pending approval.

**SECTION 01 3546
INDOOR AIR QUALITY (IAQ) PROCEDURES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section includes, without limitation, the following:
 - 1. IAQ Submittals
 - 2. Quality Assurance
 - 3. IAQ Management During Construction
 - 4. Sequence of Finish Installation
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Indoor Air Quality Procedures include:
 - 1. IAQ Management Plan During Construction:
 - a. Prepare plan to comply with the requirements for LEED EQ 3.1 as specified in Section 01 8113, "Sustainable Design Requirements" and in this Section.
 - b. Procedures to prevent indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.
 - 2. Sequence of Finish Installation: Scheduling/sequencing requirements and procedures necessary to optimize Indoor Air Quality (IAQ) levels for the completed Project.
- B. Related Work Specified in Other Sections:
 - 1. Section 01 8113, "Sustainable Design Requirements (for LEED Certification)" for additional requirements.
 - 2. Section 01 5000, "Construction Facilities and Temporary Controls" for environmental-protection measures during construction and location of waste containers at Project site.
 - 3. Section 01 7419, "Construction Waste Management" for handling requirements of construction waste.
 - 4. Application Sections for indoor air sampling prior to occupancy. (Sections to be identified)

1.3 IAQ SUBMITTALS

- A. IAQ Construction Management Plan. Submit 5 copies of plan within 30 days of date established for commencement of the Work.
 - 1. Include a schedule of all IAQ-related construction activities in the IAQ Construction Management Plan submittal.
 - 2. Update plan as required during the construction process to reflect Project conditions.
- B. Meeting Minutes: Submit minutes from Contractor meetings related to the execution and verification of the IAQ Construction Management Plan.
- C. Project Photographs: Submit to document IAQ measures implemented.
- D. Product Data: Submit cut sheets of filtration media proposed for use.

- E. LEED Submittal: LEED letter template for Credit EQ 3.1, signed by Contractor, with copy of plan and a statement that requirements for the credit have been met.

1.4 QUALITY ASSURANCE

- A. Comply with the requirements of LEED Credit EQ 3.1, "Construction IAQ Management Plan During Construction."
- B. Contractor's Plan shall meet or exceed the recommended design approaches of SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," (1995 Edition, Chapter 3).
- C. IAQ Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
 - 1. Review methods and procedures related to IAQ management during construction.
 - 2. Review IAQ management requirements for each trade.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 IAQ MANAGEMENT DURING CONSTRUCTION

- A. General: Contractor's IAQ Construction Management Plan shall include procedures to prevent indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.
 - 1. Prepare and submit an Indoor Air Quality (IAQ) Management Plan to comply with the requirements for LEED EQ 3.1, as specified in Section 01 81 13, "Sustainable Design Requirements" and in this Section.
 - 2. Contractor's detailed plan shall be based on the particular characteristics of the Project, and include the items listed in this Section as a minimum.
 - 3. The IAQ Management Plan shall highlight the five requirements of the Sheet Metal and Air Conditioning National Design/Builders Association (SMACNA), "IAQ Guidelines for Occupied Buildings Under Construction," 1995, Chapter 3 and shall embody the principles and practices set forth hereinafter.
 - 4. Subcontractors and their employees shall be provided instruction and training in the IAQ Management Plan.
- B. Plan Implementation:
 - 1. Implement waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 2. Comply with Section 01 5000 for operation, termination, and removal requirements.

C. Monitoring of IAQ Plan:

1. Hold weekly Contractor Site Co-ordination Meetings with the superintendents of all trade contractors. Review the appropriate components of the IAQ Construction Management Plan as a regular action topic at these meetings, and update the Plan as required. Document the implementation of the Plan in the meeting minutes. As a recording format, use SMACNA IAQ Guidelines Appendix C (Planning Checklist) and Appendix D (Inspection Checklist) as a guide.
2. Take a specific series of record photographs at the appropriate stages to document adherence with the IAQ requirements. Submit at least 18 photographs (six photos taken on three different occasions during construction) along with identification of the SMACNA approach featured by each photo, in order to show consistent adherence to the LEED Credit requirements.

D. HVAC Protection:

1. Store HVAC equipment in a clean, dry location. Until HVAC equipment (ducting, registers, air handler VAV boxes components, fans, and motors) has been installed, it shall be kept covered and secured with plastic film or in a location where it will not be exposed to moisture, dust, or other contaminants.
2. Seal off all louvers and air intake/discharge points to prevent construction dust and debris from entering.
3. Seal off all ductwork openings and air outlets with plastic sheeting to protect the duct system from dust and debris. Do not re-open until the end of activities that produce dust or pollution, such as drywall sanding, concrete cutting, masonry work, wood sawing, and so forth.
4. Seal all HVAC inlets and outlets. Use of the HVAC system shall be avoided during construction until drywall construction is complete. Temporary ventilation may be installed to remove contaminants. All air inlets and outlets shall be sealed securely with tape during construction. These include, but not limited to, outside air inlets, grilles, diffusers, supply ducts, return ducts, ceiling plenums, VAV (variable-air volume) plenum intakes, exhaust ducts, and window ventilator or air conditioning units. Openings shall be sealed with plastic film and tape that can be removed cleanly.
5. Seal HVAC components during installation. For ducting runs that require several days to install, sections shall be sealed off as they are completed. Seals shall be removed prior to continuing the ducting run. Other components of the HVAC system shall be subjected to the same requirements to protect them from contamination.
6. Use temporary filtration media. If the HVAC system is to be used while construction work is being done, temporary filtration media shall be installed on all intakes. Such filtration media shall have a minimum filtration efficiency (Minimum Efficiency Reporting Value-MERV per ASHRAE 52.2) of 8 or higher. For air intakes into parts of a building that are very sensitive to dust contamination, such as computer rooms, filtration media with a MERV rating of 13 or higher is required. New filtration with a MERV rating of 13 or higher shall be installed after construction.
7. If, for some unforeseen reason, there should arise a circumstance wherein the return air system is required to be used during the construction phase, install temporary MERV 8 filters or higher (as determined by ASHRAE Standard 52.2-1999) at each return air opening and provide frequent inspection and maintenance. If inspections by University Representatives reveal that the ductwork has become contaminated due to inadequate protection, the ductwork shall be cleaned professionally prior to the first phase of occupancy, using procedures established in ACR 2005 published by the National Air Duct Cleaners Association.
8. Under no circumstances shall air be returned from a construction area and then re-circulated through the permanent supply ductwork, unless and until the level of construction in the relevant area involves final finishes and trim and the construction has reached a point of complete building dry-in with no sanding and is free from dust, debris, and contaminants.
9. Do not use fan rooms to store construction or waste materials, and keep them clean and neat.

10. Inspect filters regularly. When the HVAC system is being used during construction and temporary filters are installed, filters shall be inspected weekly and replaced as needed.
11. Avoid contaminated air entry into enclosed parts of the building. When outdoor construction activities generate dust, combustion emissions, or other contaminants, operable windows and outside air supplies to enclosed portions of the building shall be closed.

E. Source Control:

1. Limit construction traffic and motor idling in the vicinity of air intake louvers when the HVAC systems are activated. Restrict motor vehicles to the loading dock area, well-removed from air intakes, preventing emissions from being drawn into the building.
2. Use electric or natural gas alternatives for gasoline and diesel equipment where possible and practical.
3. Cycle equipment off when not being used or needed.
4. Avoid the use of materials and products with high VOC and/or particulate levels. Use products and installation methods with low VOCs such as paints, sealers, sealants, filler materials, insulation, adhesives, caulking and cleaners. Comply with the requirements in other specification sections.
5. Keep containers of wet products closed as much as possible. Cover and seal waste materials which can release odor or dust.
6. Protect all materials, especially absorbent materials such as insulated ductwork, against moisture during delivery to and storage at the job site. Store materials inside the structure in a dry and clean environment pending installation. Building materials shall be kept dry to avoid the introduction of moisture into the building interior.
7. Avoid the use of moisture-damaged materials. Any porous materials that have been wetted shall be dried thoroughly before installation. Any porous materials that have been damaged, remained wet longer than 48 hours, or show signs of visible mold shall be discarded.
8. Ensure that the construction process will not result in moisture intrusion. In the event of rain or groundwater gaining entry to the building interior during construction, notify the University.
9. Avoid tracking pollutants into work areas.
 - a. Once the framing and mechanical system installation starts, access to the building interior shall be controlled to minimize the tracking in of contaminants.
 - b. Material deliveries and construction waste removal shall be routed via the most direct route to the building exterior of the building rather than through the space.
 - c. Provide rough track-off grates or matting at the entryway to remove moisture and contaminants from workers shoes.
 - d. Prevent the ingress of rodents and pests.
 - e. Use procedures to ensure that there is no smoking inside the building.

F. Pathway Interruption:

1. Use dust curtains or temporary enclosures to prevent dust from migrating to other areas when applicable. During construction, isolate areas of work to prevent contamination of clean or occupied areas.
2. Keep pollutant sources as far away as possible from ductwork and areas occupied by workers when feasible.
3. Isolate work areas and/or create pressure differentials to prevent the migration of contaminants.
4. Use portable fan systems to exhaust contaminated air directly to the outside of the building, and discharge the air in a means to prevent it from re-entering.

G. Housekeeping:

1. Minimize accumulation of dust and other contaminants. Construction practices shall be used that minimize the production of dust and other contaminants from construction activities. Use integral dust-collection systems on drywall sanders, cut-off saws, and

- routers. Confine dust-generation activities to areas where clean-up can be carried out easily and contaminants will not be tracked to other areas.
2. Suppress Dirt. Wetting agents or sweeping compounds shall be used to deep dust from becoming airborne.
 3. Clean up dust. Wet clothes, damp mops, wet scrubbers, and vacuum cleaners with high-efficiency particulate (HEPA) filters shall be used to clean up dust generated by construction activities.
 - a. Cleaning frequency shall be increased when dust accumulation is noted.
 - b. Institute cleaning activities of building areas on a daily basis, and of HVAC equipment as required.
 4. Keep all coils, air filters, dampers, fans, and ductwork clean during installation, and clean them as required prior to performing the testing, adjusting and balancing of the systems.
 5. Clean up spills. All spills and excess applications of solvent-containing products should be cleaned up using approved methods as soon as practicable. Water spills shall be mopped up promptly.
 6. Keep work area dry. Avoid accumulations of water inside the building, and promptly remove any that may occur.
 - a. Especially protect porous materials such as insulation and ceiling tiles from exposure to moisture.
 - b. The entire area shall be kept as dry as practicable by promptly repairing any leaks that allow rainwater entry and mopping up any water accumulation.
 - c. Use dehumidification if necessary for prompt drying of wetted spaces. Unvented combustion (e.g., propane or diesel "salamander" space heaters) shall not be used.
 7. Seal containers containing volatile liquids. Containers of fuel, paints, finishes, and solvents shall be kept tightly sealed and preferably stored outside of the building when not in use.

H. Scheduling:

1. Comply with the scheduling requirements of Article, "Sequence of Finish Installation" of this Section.
 - a. Schedule the installation of porous materials only after closing in building.
 - b. Porous materials, such as insulation, fireproofing, and drywall shall not be installed in a building open to the weather.
 - c. To avoid potential contamination of porous or absorbent materials such as ceiling tiles, install furnishings after interior finishes (drywall, paint, and floor finishing) have cured.
2. Phased Completion: Implement IAQ control measures in each tenant area until construction in that area is complete. Do not allow contaminants from an area under construction to enter the HVAC ductwork systems or to migrate to completed areas.
3. Filters:
 - a. Install new MERV 13 filters at the central fan system, immediately prior to the first phase of building occupancy.
 - b. Install new MERV 13 filters at fan systems serving limited areas immediately prior to occupancy for each respective area.

I. Ventilation:

1. Provide adequate ventilation during curing period. To aid in curing of interior finishes and other products used during construction and to remove pollutants after drywall installation is complete, provide adequate ventilation with 100% outside air, and proper filtration. In humid periods or when very high-moisture materials are present, supplementary dehumidification may be required during this curing period.
2. Flush-Out: Comply with the requirements of LEED credit EA 3.2.

3.2 SEQUENCE OF FINISH INSTALLATION

- A. Sequence of Finish Installation: Project schedule shall address construction scheduling/sequencing requirements and procedures necessary to optimize Indoor Air Quality (IAQ) levels for the completed Project.
1. Scheduling: Contractor's Project Schedule for finish applications should allow for:
 - a. Dissipation of high emissions from finishes that off-gas perceptible quantities of deleterious material during curing.
 - b. Separation of off-gassing effects from the installation of adsorptive materials that would act as a "sink" for storage and subsequent release of these unwanted substances into building spaces and mechanical systems after project occupancy.
 2. When Contractor's "Project Schedule" requires less than optimal sequencing of finish installation, related to IAQ, provide supplemental filtered "fresh air" ventilation of work areas during construction and restrict / control the use of permanent building mechanical systems prior to Owner acceptance of building to prevent contamination of systems by construction wastes and other deleterious substances.
- B. Finish Types:
1. Type 1 Finishes: Materials and finishes which have a potential for short-term levels of off-gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing. Type 1 Finishes include, but are not limited to the following:
 - a. Composite wood products, specifically including particleboard from which millwork, wood paneling, doors or furniture may be fabricated.
 - b. Adhesives, sealants, and glazing compounds, specifically those with petrochemical vehicles or carriers.
 - c. Wood preservatives, finishes, and paint.
 - d. Control and/or expansion joint fillers.
 - e. All hard finishes requiring adhesive installation.
 - f. Gypsum board and associated finish processes.
 - g. Sealants and associated filler materials.
 2. Type 2 Finishes: "Fuzzy" materials and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals off-gassed by Type 1 finishes or may be adversely affected by particulates. These materials become "sinks" for deleterious substances which may be released much later, or collectors of contaminants that may promote subsequent bacterial growth. Type 2 Finishes include, but are not limited to the following:
 - a. Carpet and padding.
 - b. Fabric wallcovering.
 - c. Insulation exposed to the airstream.
 - d. Acoustic ceiling materials.
 - e. Fabric covered acoustic wall panels.
 - f. Upholstered furnishings.
 3. Materials that can be categorized as both Type 1 and Type 2 materials shall be considered to be Type 1 materials.
- C. Optimal Order of Installation: Apply all Type 1 interior finishes throughout the entire controlled air zone of each enclosed building or building segment and allow such finishes to completely cure according to intervals and times stated in respective finish manufacturer's printed instructions before commencing installation of any Type 2 materials in the same area.
1. Do not store any Type 2 materials in areas where installation or curing of Type 1 materials is in progress.

- D. Materials Test Data - Required For Substitutions Only:
1. All manufacturers/producers of materials listed below that are proposed for substitution on this Project are required to provide test data for their materials which show permanent, in-place Indoor Air Quality performance in accordance with requirements of this Specification.
 2. Material Safety Data Sheets: Review all MSDS's of materials to be submitted for testing as well as MSDS's for other products where specifically requested in this Project Manual and identify those classified as "Prohibited Materials".
 3. Prohibited Materials:
 - a. Any building materials or products that emit pollutants included on the International Agency for Research on Cancer (IARC) "List of Chemical Carcinogens", the "Carcinogen List" of the National Toxicology Program, and the "Reproductive Toxin List" of the "Catalog of Teratogenic Agents" must have approval in writing from the Owner's Representative before that building material or product may be used on this Project.
 - b. Carcinogens: Use of materials emitting carcinogens will not be permitted unless a suitable substitute is not available. Do not proceed with procurement of any carcinogen emitting product or material without prior review and written approval of the University's Representative.

END OF SECTION

SECTION 01 4100 REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.1. SUMMARY

- A. Section includes:
 - 1. Applicable Codes, Regulations, and Authorities
 - 2. Regulatory Notifications
 - 3. Plan Review and Permit Issuance Requirements, Notifications, and Certificates
 - 4. Fees
- B. References in the Specifications to "code" or to "building code," not otherwise identified, shall mean the foregoing specified codes, together with the additions, changes, amendments, and interpretations adopted by the enforcing agency and in effect on the date of these Contract Documents. Nothing on the Drawings or in the Specifications shall be interpreted as requiring or permitting work that is contrary to these rules, regulations, and codes.
- C. Where other regulatory requirements are referenced in these Specifications, the affected work shall meet or exceed the applicable requirements of such references.
- D. Nothing stated in this Section of the Specifications or other Sections of the Specifications, the other Contract Documents or shown on the Drawings shall be construed as allowing Work that is not in strict compliance with all applicable Federal, State, regional, and local statutes, laws, regulations, rules, ordinances, codes and standards.
- E. Regulatory requirements referred to shall have full force and effect as though printed in these Specifications.
- F. Discrepancies between these codes/rules/etc. and the Contract Documents shall be brought to the attention of the University's Representative for resolution. Unless otherwise directed by the University's Representative, if a conflict exists between referenced regulatory requirements and the Contract Documents, comply with the one establishing the more stringent requirements, but which shall not be less than minimum code requirements.

1.2. APPLICABLE CODES, REGULATIONS, AND AUTHORITIES

- A. All applicable federal, state, and local laws and the rules and regulations of governing utility districts and the various other authorities having jurisdiction over the construction and completion of the Project, including the latest rules and regulations of the Campus Building Official, state fire marshal, DCFM, OSHA, and the California Labor Code, shall apply to the Contract throughout, and they shall be deemed to be included in the Contract the same as though printed in these Specifications.
- B. Codes and regulations that apply to this Project include, but are not limited to, the following including additions, changes, and interpretations adopted by the enforcing agency in effect as of the date of these Contract Documents.
 - 1. California Code of Regulations (CCR):
 - a. Title 8, Industrial Relations
 - b. Title 17, Public Health
 - c. Title 19, Public Safety
 - d. Title 20, Public Utilities and Energy

- e. Title 21, Public Works
 - f. Title 22, Environmental Health
 - g. Title 24: Building Standards Code
 - (1) Part 1, California Administrative Code
 - (2) Part 2, California Building Code (Volume 1 and 2)
 - (3) Part 3, California Electric Code
 - (4) Part 4, California Mechanical Code
 - (5) Part 5, California Plumbing Code
 - (6) Part 6, California Energy Code
 - (7) Part 9, California Fire Code Part 11, California Green Building Standards Code
 - (8) Part 12, California Referenced Standards Code
2. In addition to the above, work shall comply with the following:
- a. California Environmental Quality Act (CEQA).
 - b. California Health and Safety Code.
 - c. California Occupational Safety and Health Act Standards (Cal-OSHA).
 - d. California Department of Transportation (Caltrans): Standard Specifications, latest edition.
 - e. National Fire Protection Association (NFPA): Standards 13, 24, 72, and 80.
 - f. Americans with Disabilities Act - Title II (ADA).
 - g. Federal Occupational Safety and Health Act (OSHA).
 - h. Federal Environmental Protection Agency – Clean Air Act.
 - i. Storm Water Pollution Prevention Act.
3. All work shall meet or exceed code and regulatory requirements.
- C. Copies of Regulations: Obtain copies of the following regulations and retain at the Project site to be available for reference by parties who have a reasonable need:
- 1. California Code of Regulations, Title 8, 9 and 19
 - 2. California Code of Regulations, Title 24, including:
 - a. Part 1, California Administrative Code
 - b. Part 2, California Building Code, Volumes 1 and 2
 - c. Part 3, California Electrical Code
 - d. Part 4, California Mechanical Code
 - e. Part 5, California Plumbing Code
 - f. Part 6, California Energy Code
 - h. Part 9, California Fire Code
 - i. Part 11, California Green Building Standards Code
 - i. Part 12, California Referenced Building Standards Code
 - 2. California Health and Safety Code regulations as referenced in the specifications.
 - 1. CAL/OSHA Construction Safety Orders.
 - 2. City of Riverside "Department of Public Works Standards and Specifications.
 - 3. ~~National Electrical Code.~~ Covered by Part 3
 - 4. National Fire Protection Association standards as referenced within the specifications
 - 5. State of California, Department of Transportation, Division of Highways, "Materials Specifications." [should keep this in]
 - 6. State of California, Department of Transportation, Division of Highways, "Standard Specifications." [should keep this in]
 - 7. ~~State of California, Office of State Fire Marshal~~ Covered by Title 19 and Part 9
 - 8. California Industrial Accident Commission, Safety Bulletins .
 - 9. ~~Uniform Building Code~~
 - 10. ~~Uniform Mechanical Code~~
 - 11. ~~Uniform Plumbing Code~~

12. Standard Specifications for Public Works, (Greenbook), with local agency amendments.

D. 2010 ADA Accessibility Standards for Accessible Design

1.3. REGULATORY NOTIFICATIONS

- A. Submit all required notifications to Federal, State of California, State in which disposal facility is located if not in California, regional, and local agencies with regulatory responsibilities associated with the Work activities that are included in the Contract. All notifications shall be served in writing, in the form required by the agency requiring notification, and in a timely manner so as not to negatively impact the Project schedule. Serve notifications at least 10 business days in advance (or earlier if required by agency) of activity requiring notice. The Contractor shall serve all required notifications in writing to all governmental and quasi-government agencies having notification requirements pertaining to any portion of the Work included in the Project.
- B. Using the "SMARTS" Website: <https://smarts.waterboards.ca.gov>, the Contractor shall file a Notice of Intent for coverage under State General Construction Activity Storm Water Permit National Pollutant Discharge Eliminate System (NPDES). Contractor shall comply with applicable permit requirements including the project Storm Water Pollution Prevention Plan.

1.4. CAMPUS BUILDING PERMIT PROCESS REQUIREMENTS (Contact Lezlie Howard, Permit Program Manager (Lezlie.howard@ucr.edu), for any questions regarding the Campus Building Permit Process),

- A. Prior to commencement of construction and permit issuance by the UC Riverside Department of Building and Safety, a permit application shall be entered into the Building and Safety Departments portal along with completed project construction documents for review, approval and permit issuance. The portal address is found at the PD&C Webpage, <https://pdc.ucr.edu/>
- B. Building and Safety staff will distribute all submitted Project Construction Documents to all campus reviewers for their respective review and approval.
- C. Once all campus reviewers have approved their respective plan reviews and returned them to Building and Safety, the Permit Program Manager will issue the Campus Building Permit and stamped approved construction documents for the project. Once this process is completed, construction and inspections may commence.
- D. Inspections may then be requested through the same portal found at the PD&C webpage. (Contact Lezlie Howard, Permit Program Manager, for assistance with the Inspection request process).
- E. Outside agency Permits, Licenses, and Certificates: For the University's records, submit copies of permits, licenses, certifications, Special inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgment, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 NOTIFICATIONS, AND CERTIFICATES

- F. Underground Service Alert (USA) Notifications: Prior to commencing clearing, excavation and trenching, coordinate with Underground Service Alert of Southern California for field verification and marking of utilities within the limits of Project site. Contractor shall be responsible for outlining limits of excavation with white chalk paint prior to coordination with USA. Coordination shall require 2 business days advance notification prior to start of excavation work. Provide USA notification permit number to the University's Representative prior to starting site Work.
- G. In no event, shall the Contractor install materials that contain asbestos, PCB, lead or other known hazardous materials unless prior approval is obtained from the University.

- H. Regulated Carcinogens by Title 8 California Code of Regulations (CCR), Subchapter 7, Group 16 (Control of Hazardous Substances), Article 110 (Regulated Carcinogens).
1. Products containing chemicals regulated as carcinogens by the State of California are not allowed for use on University projects.
 2. Case-by-case exceptions may be considered for products containing the following Cal/OSHA recognized carcinogens:
 - Methylene Chloride, 5202
 - Cadmium, 1532, 5207
 - Inorganic Arsenic, 5214
 - Formaldehyde, 5217
 - Benzene, 5218
 3. Case-by-case exceptions may only be made when suitable alternative products are not available. Such exceptions are subject to written approval by the University's Representative.
 4. Exceptions require that the Contractor shall have an established carcinogen program as required by Cal/OSHA (§5203. Carcinogen Report of Use Requirements) and shall submit to University's Representative, a copy of the Cal/OSHA Confirmation of Report for Cal/OSHA carcinogens.
 5. When exceptions are granted, the Contractor is responsible for providing to the University's Representative a copy of the semi-annual Confirmation of Report received from Cal/OSHA or, in lieu of that, a copy of the Contractor's semi-annual report as submitted to Cal/OSHA at periods not to exceed 6 months, or at project closeout, whichever occurs first.
- I. Fire Department and Additional Notifications, Manifests, and Requirements: As required by University and coordinated by Contractor with the University's Representative.

~~1.6 FEES~~

A. _____

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 4200 REFERENCES

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Specification Format and Content Explanation
2. Definitions
3. Reference Standards
4. Abbreviations and Acronyms

1.2. SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the 49-division format and CSI/CSC's "Master Format" numbering system.
- B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon is used within a sentence or phrase.

1.3. DEFINITIONS

- A. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," "detailed" and "specified" are used to help the user locate the reference. Location is not limited.
- B. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the University's Representative or University, requested by the University's Representative or University, and similar phrases.
- C. "Approved": The term "approved," when used in conjunction with the University Representative's action on the Contractor's submittals, applications, and requests, is limited to the University Representative's duties and responsibilities as stated in the Conditions of the Contract.
- D. "Regulations," "building code," "code": The terms "regulations," "building code", and "code" include laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

- E. “Furnish”: The term “furnish” means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- F. “Install”: The term “install” describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing protecting, cleaning, and similar operations.
- G. “Provide”: The term “provide” means to furnish and install, complete in place, operating, tested, approved, and ready for the intended use.
- H. “Installer”: An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. Unless specified otherwise in other Sections, the term “experienced,” when used with the term “installer,” means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 2. Trades: Using a term such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter.” It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
- I. “Project site” is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- J. “Testing Agencies”: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- K. “Similar”: The term “similar” means in the general sense and not necessarily identical.
- L. See also the Instructions to Bidders and General Conditions.

1.4. REFERENCE STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
 - 1. Requirements for packaging, packing, marking, and preparation for shipment or delivery included in referenced federal specifications are not mandatory for products provided for this Work.
- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents except where a specific publication date or issue is included with the reference in other Sections of these Specifications.
 - 1. When a named or proposed product complies with a referenced standard of different publication date or issue than required by these Specifications, submit the product as a substitute under provisions of Division 1 Section “Substitutes.” Provide a detailed written summary of changes in product or workmanship quality and performance as a result of the product complying with a different version of a standard from the version referenced.

- C. **Conflicting Requirements:** Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the University's Representative for a decision before proceeding.
 - 1. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicate numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the University's Representative for a decision before proceeding.
 - 2. Where a product is specified by both brand name and reference to 1 or more standards, provide that product only if it actually complies with the required standards. Listing of a product by brand or trade name in these Specifications is not a warranty that the product complies with the standards which may also be listed. If a named product does not comply with 1 or more of the required standards and no alternative product is listed which does comply, submit a substitute product under provisions of Division 1 Section "Substitutes" which complies with the required standards.

- D. **Copies of Standards:** Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.

1.5. **ABBREVIATIONS AND ACRONYMS**

- A. **Trade Abbreviations and Association Names:** Trade association names and titles of general standards are frequently abbreviated. The following abbreviations and acronyms, as referenced in the Contract Documents, mean the associated names. Names and addresses are subject to change and are believed, but not assured, to be accurate and up-to-date as the date of the Contract Documents.

- B. **Federal Government Agencies:** Names and titles of Federal Government standards- or specification-producing agencies are often abbreviated. The following abbreviations and acronyms referenced in the Contract Documents indicate names of standards- or specification-producing agencies of the Federal Government. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

- C. The following are commonly used abbreviations which may appear in the Project Manual. Refer to Construction Specifications Institute Document TD-2-4 "Abbreviations" for explanation of other abbreviations.

C	degree Centigrade
Co.	Company
Corp.	Corporation
F	degree Fahrenheit
ft.	foot (feet)
ga.	gage or gauge
gal.	gallon(s)
in.	inch(es)

Inc.	Incorporated
HVAC	Heating, Ventilating and Air Conditioning
lb(s).	pound(s)
o.c.	on center
psi	pounds per square inch
psf	pounds per square foot
sq.	square
yd.	yard(s)

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 4300 INSPECTION OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes, without limitation, the following:
 - 1. Access to the Work
 - 2. Testing and Approval
 - 3. University's Inspectors
 - 4. Inspection Requests
 - 5. Inspection Request Form
 - 6. Nonconforming Work Notice
- B. The University will provide a Project Inspector or Inspector of Record (IOR) for this project. Contractor shall not cover any work requiring inspection until the IOR has inspected and approved the subject work. For uncovering of work, refer to General Conditions, Article 12.

1.2 ACCESS TO THE WORK

- A. In addition to the requirements of the General Conditions, University, University's Representative and their representatives shall at all times have access to the Work wherever it is in preparation or progress and Contractor shall provide safe and proper facilities for such access and for inspection. The inspection and written acceptance of material and workmanship, unless otherwise stated in these Specifications, shall be final except as provided in Article 12.2 of the General Conditions.

1.3 TESTING AND APPROVAL

- A. In addition to the requirements of the General Conditions, if any law, ordinance or public authority or the Specifications or University's Representative's instructions require any work to be specially tested or approved (including use of ionizing radiation for radiography), Contractor shall give University's Representative timely notice of its readiness for inspection, and if the inspection is by another authority, other than University's Representative, of the date fixed for such inspection.
- B. Re-examination of questioned work may be ordered by University's Representative.

1.4 UNIVERSITY'S INSPECTORS

- A. The IOR shall work in close coordination with the University's Representative findings of completed inspections. The IOR is a direct report to the Director of Building, Safety and Emergency Management. The IOR shall observe construction in progress and shall have the following responsibilities and limitations on authority.
 - 1. Act in coordination with the University's Representative.
 - 2. Observe installation and work in progress as a basis for determining conformance of the work, materials and equipment with the Contract Documents. IOR will report any discrepancies observed to University's Representative and Contractor. Only University's Representative has the final authority to make approvals or rejections.
 - 3. Only University's Representative shall interpret the requirements of the Contract Documents. If any item is ambiguous, University's Representative shall make a written interpretation. If Contractor requests changes or modifications to the Contract Documents, University's Representative shall make a written

determination on the requested changes or modifications.

4. Prepare and submit an inspection report to University's Representative for each inspection performed.
 5. Review application for payments.
 6. Assist University's Representative in reviewing the test and inspection results of testing laboratories.
 7. The IOR is not authorized to permit deviations from the requirements of the Contract Documents unless such deviation has been approved by University's Representative in writing.
 8. The IOR shall not supervise, coordinate, or direct the Work. The IOR has no responsibility or control over Contractor's construction means, methods, techniques, sequences, procedures, or coordination of any portions of the Work, or over any safety programs in connection with the Project.
- B. The failure of University, University's Representative and its representatives and consultants, or University's IOR to observe or inspect the Work, or to detect deficiencies in the Work, or to inform Contractor of any deficiencies which may be discovered, shall not relieve Contractor, its subcontractors regardless of tier, or suppliers from their responsibility for construction means, methods, techniques, sequences and procedures, construction safety, nor from their responsibilities to carry out the work in accordance with the Contract Documents and to detect and correct defective work as defined in the General Conditions.

1.5 INSPECTION REQUESTS

- A. Contractor shall request inspection of completed portions of the Work through University's Representative, using the UC Riverside Department of Building and Safety, Inspection Request Software. Contractor shall submit a request for inspection using University's Inspection Request Software, with instructions for using that software attached to the end of this Section.
1. Contractor shall submit an Inspection Request **at least 3 working days prior** to the time the work will be ready for inspection.
 2. For work to be inspected by a third party testing laboratory, whether Contractor's or University's, Contractor shall submit an Inspection Request **at least 3 working days prior** to the time the work will be ready for inspection.
 3. For work not in conformance with the Contract Documents, the IOR shall submit to the Contractor a Nonconforming Work Notice.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

- 2.1 Refer to the Inspection Request Software instructions attached at the end of this Section.
- 2.2 Refer to the Nonconforming Work Notice form attached at the end of this Section.

END OF SECTION

INSPECTION REQUEST SOFTWARE INSTRUCTIONS

INSPECTION REQUEST INSTRUCTIONS USING THE **CFORMS** and/or new **Campus Building Permit Citizenserve Inspection Request Process**.

NOTE: The CForms Inspection Request Process is to be used only for Campus Building Permit numbers B21-510 and lower. The new Campus Building Permit Citizenserve Portal is required to be used for all Campus Building Permit numbers B21-511 and above.

1. **CForms**-For inspection requests using the older CForms Inspection Request System, log into <http://ucr.cforms.net>. Follow instructions.
2. **Citizenserve**-For newer Campus Permit Inspection Requests, Create an account and log into the new Campus Building Permit Citizenserve System. This can now be found on the PD&C website or "Copy and paste" <https://citizenserve.com/ucr> and then follow the instructions provided.
3. Complete Automated Inspection Request Form
4. Select your Permit # from the drop-down menu and request the inspection you need.
5. In either system, a notification will go out to the inspector on the project., advising them that there is an inspection request pending their review.
6. Once requested inspection is conducted, the IOR will input the disposition into Inspection Request system (approved, disapproved, corrections, etc.). There may be other attachments such as reports, photos, notes, etc., added to the inspection request disposition as well.
7. Results of the inspection is input fter the inspection in real-time and it can be viewed by all parties real-time. . Inspectors may also upload photos and other documents and attach them to the inspection file in the Inspection Request System
8. Completed "As-Built" plans of project shall be provided to Inspector of Record (IOR) prior to final inspection signature is allowed.
9. Once the work is completed, request a final inspection and a final inspection will be conducted. If approved, the permit will be signed as approved and complete., and a Certificate of Occupancy will be prepared for signature by the Campus Fire Marshal and Campus Building Official

NOTE: If you are not already associated with a permit, a request to be added to that specific permit must be completed prior to an inspection request being submitted. *Access to Specific Permits must be granted by the Building and Safety Division. Contact Lezlie Howard at the Building and Safety Division for authorization and assistance in gaining access to these specific permits.

NONCONFORMING WORK NOTICE
NUMBER: _____
DATE: _____

TO:

FROM:

SPEC. SEC. REF.: _____ PARA: _____ DWG REF: _____ DETAIL: _____

DESCRIPTION OF DEFECTIVE CONDITION (IOR): _____

REPORTED BY (IOR): _____

CORRECTIVE ACTION SHOULD BE TAKEN AS SOON AS POSSIBLE AND COORDINATED WITH THE INSPECTOR OF RECORD (IOR). IF FURTHER INFORMATION IS NEEDED, ADVISE THE UNIVERSITY'S REPRESENTATIVE IMMEDIATELY.

DESCRIPTION OF CORRECTIVE ACTION TAKEN (CONTRACTOR): _____

ACCEPTED BY (CONTRACTOR): _____ **DATE:** _____

UCR USE ONLY

ACCEPTANCE OF CORRECTED DEFECTIVE CONDITION (IOR): _____

ACCEPTED BY (IOR): _____ **DATE:** _____

COPIES: UNIVERSITY CONSULTANT CONTRACTOR

SECTION 01 4500 QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for quality-control services, without limitation, the following:
 - 1. Contractor's Responsibilities
 - 2. Tests and Inspections
 - 3. Test Reports
 - 4. Geotechnical Engineer and Other Special Inspection and Testing
 - 5. Repair and Protection
- B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by University's Representative.
- C. Special Inspection and testing services are required to verify compliance with requirements specified or indicated. They shall be coordinated with the Project IOR in order for the IOR to accompany the Special Inspector on these inspections and testing services. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements, and are in addition to the regular daily IOR inspections which are required by California Building Standards Codes, project documentation, contracts and the Authority Having Jurisdiction, UC Riverside DCFM, and UC Riverside CBO and project IOR (AHJ),
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified special inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services, required by University's Representative, are not limited by provisions of this Section.
- E. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Cutting and Patching" specifies requirements for repair and restoration of construction disturbed by special inspection and testing activities.

1.2 DEFINITIONS

- A. The term "University's Testing Laboratory" means a third-party independent testing laboratory retained and paid for by the University for the purpose of performing the testing services required by the Contract Documents except where specifically noted to be done by contractor, reviewing material and product reports, and performing other services as determined by University's Representative.
- B. The term "Contractor's Testing Laboratory" means a testing laboratory retained and paid for by Contractor to perform the testing services which are required by the Contract Documents to be performed by Contractor. Contractor's Testing Laboratory shall be an organization other than University's Testing Laboratory and shall be acceptable to University's Representative. It may be a commercial testing organization or the testing

laboratory of a trade association. Contractor's Testing Laboratory shall have performed testing of the type specified for at least five (5) years and shall maintain a separate General and Professional Liability Insurance, (Errors and Omissions,) in amount not less than one million dollars (\$1,000,000) each.

- C. Tests, special inspections, and acceptances of portions of the Work required by the Contract Documents or by Applicable Code Requirements shall be made at the appropriate times. Contractor shall give University's Representative timely notice of when and where tests and special inspections are to be made and/or required regardless whose Testing Laboratory will perform the tests and special inspections.
- D. If such procedures for testing, special inspection, or acceptance reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for University's Representative's services and expenses.
- E. If University's Representative is to observe tests, special inspections, or make acceptances required by the Contract Documents, University's Representative will do so promptly upon 3 days advance written notice and, where practicable, at the normal place of testing.
- F. Tests or special inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

1.3 CONTRACTOR'S RESPONSIBILITIES

- A. Secure and deliver to Contractor's Testing Laboratory adequate quantities of representative samples of materials proposed for use as specified.
- B. Submit to University's Testing Laboratory the preliminary design mixes proposed to be used for concrete and other materials which require review by University's Testing Laboratory.
- C. Submit copies of product test reports as specified.
- D. Furnish incidental labor and facilities, as required:
 - 1. To provide University's Testing Laboratory access to the Work to be tested.
 - 2. To obtain and handle samples at the Project site or at the source of the product to be tested.
 - 3. To facilitate special inspections and tests.
 - 4. For storage and curing of test samples.
- E. Provide written notice to University's Representative sufficiently in advance (a minimum of 3 days) of operations to allow for University's Testing Laboratory assignment of personnel and scheduling of tests.
- F. When tests or special inspections are not performed after such notice, Contractor shall reimburse University for University's Testing Laboratory personnel and travel expenses incurred.

1.4 TESTS AND SPECIAL INSPECTIONS

- A. Certain portions of the Work will be tested, inspected, or both, at various stages. Nothing in any prior acceptance or satisfactory test result shall govern, if at any subsequent time the Work, or portion thereof, is found not to conform to the requirements of the Contract Documents.
- B. If initial tests or special inspections made by University's Testing Laboratory's Geotechnical Engineer reveal that any portion of the Work does not comply with Contract Documents,

or if University's Representative determines that any portion of the Work requires additional testing or inspection, additional tests and inspections shall be made as directed.

- C. If such additional tests or inspections establish that such portion of the Work fails to comply with the Contract Documents, all costs of such additional tests and special inspections, and all other costs resulting from such failure, including compensation for University's Representative and University Representative's Consultants shall be deducted from the Contract Sum.
- D. Fixtures, equipment, materials, and other items removed, demolished, abandoned, or capped and left in place, shall be tested to verify that there is no damage caused after the items have been covered by construction.

1.5 TEST REPORTS

- A. University's Testing Laboratory and Contractor's Testing Laboratory shall submit five (5) copies of all reports to University's Representative, indicating observations and results of tests and indicating compliance or non-compliance with the Contract Documents.

1.6 GEOTECHNICAL ENGINEER AND OTHER SPECIAL INSPECTION AND TESTING

- A. The University shall retain and pay the expenses of a Geotechnical Engineer and materials testing, inspection and observation services consultant ("TIO Consultant") to perform inspection, testing, and observation functions specified by the University. Geotechnical Engineer and such other TIO Consultant shall communicate only with University and University's Representative. University's Representative shall then give notice to Contractor, with a copy to the University, of any action required of Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of special inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION

**SECTION 01 4516
CONTRACTOR'S QUALITY CONTROL PROGRAM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section includes, without limitation, the following:
 - 1. Quality Control Program
 - 2. Submittals
 - 3. Qualifications of Quality Control Manager
 - 4. Reporting Procedures
 - 5. Implementation

- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section describes the requirements for implementation of a Quality Control Program by the Contractor to assure performance of the Work in conformance with the provisions of the Contract Documents.

- B. Related Work Specified Elsewhere:
 - 1. Testing and Special Inspection Services of Quality Control are specified in Section 01 4500, "Quality Control."

1.3 QUALITY CONTROL PROGRAM

- A. The Contractor shall prepare and submit within thirty (30) days after the issuance of Notice to Proceed, the Quality Control Program (QCP) they intend to implement for the Work for approval by the University. This Program shall be tailored to the specific requirements of the Work and shall become an active part of the construction procedures. The Quality Control Program shall include the procedures, instructions, reports and forms to be used throughout the performance of the Work. The University reserves the right to review and reject all or part of the Quality Control Program as proposed by the Contractor. The Contractor shall revise and resubmit as appropriate until satisfactory to the University. The basic objectives of the Quality Control Program are as follows:
 - 1. To ensure that all Work adheres strictly to all provisions of the Contract Documents and governing agencies.
 - 2. To produce good quality workmanship.
 - 3. To prevent deficiencies through pre-construction quality control coordination.
 - 4. To detect and correct deficiencies in a timely manner.
 - 5. To provide an auditable record of all tests, inspections, procedures, non-compliance and corrections, and any other pertinent data as required by the University.

- B. The Contractor shall notify the University in writing of any proposed change to their Quality Control system and changes shall not be permitted if they would, in the opinion of the University, result in nonconformance with the Contract requirements.

- C. The Contractor may select either an outside "agency" or in-house personnel to administer the program. In either case, the Quality Control staff on-site shall be responsible only for Quality Control and the Quality Control Manager shall report directly to the Contractor's highest ranking

Corporate Officer involved in the Work. Quality Control staff members shall interface with the University, its Inspectors and Consultants, as required and appropriate.

1.4 SUBMITTALS

- A. The Quality Control Program submittal shall include, as a minimum, the following:
1. The Quality Control organization chart, beginning with the Quality Control Manager, shall include Quality Control personnel as may be necessary to accomplish complete and adequate inspection of the Work.
 2. Names and qualifications of personnel and firms selected to implement the Quality Control Program on-site and off-site.
 3. Authority and responsibility of the Quality Control Staff.
 4. Methods of Quality Control inspection including subcontractor's work and describing name of qualified testing laboratory to be used, if applicable.
 5. Documents to be used to record inspections and tests, including those specified in the Contract.
 6. Formats for documentation and reports.
 7. Model agenda for Quality Control Meetings
 8. A letter signed by the Responsible Managing Officer of the Contractor's firm outlining the authority of the Quality Control Manager to include, among other things, the authority as described herein. Clerical personnel sufficient to accomplish timely submittal of Quality Control Reports and other required documentation shall be provided.

1.5 QUALIFICATION OF QUALITY CONTROL MANAGER

- A. The minimum qualifications required of the Quality Control Manager are as follows:
1. Has recent construction experience in projects of similar size and nature.
 2. Has ten (10) years' experience performing construction-related work on Type I or II buildings.
 3. Has seven (7) years' experience performing Quality Control services on Type I or II multi story projects. At least 3 years must be on projects in California.
- OR
4. Has recent construction experience in projects of similar size and nature.
 5. Possess current certification issued by State of California OSHPD Class A level or DSA Class 1 level.
 6. Has seven (7) years' experience performing Quality Control work or inspection services on multi story Type I or II projects. At least 3 years must be on projects in California.
- OR
7. Possess an undergraduate degree in architecture, civil engineering or construction management.
 8. Has five years (5) performing Quality Control services or inspection experience on Type I or II multi story buildings. At least 3 years must be on projects in California.
 9. Possess at least four special inspector current certifications issued by ICC.
- B. Responsibilities and Duties of the Quality Control Staff:
1. The Quality Control Manager shall have the authority to stop work, reject work, order work removed, initiate remedial work, propose solutions, and reject material not in compliance with the Contract Documents.
 2. Responsibilities of the Quality Control Manager shall include, but are not limited to the following:
 - a. Present on-site during all working hours and assigned "full time" to this Project. Contractor shall designate alternate individual(s) to assume responsibilities in the temporary absence of the Quality Control Manager or when overtime work is being performed.
 - b. Have complete familiarity with the Drawings and Specifications.

- c. Establish and implement Quality Control Programs for the Contractor and with the various Subcontractors and monitor their conformance.
- d. Present samples, mock-ups and test panels to be used as standards of quality for review by the University and their Consultants.
- e. Inspect existing conditions prior to the start of new work segments.
- f. Perform in-progress and follow-up inspections on each work segment to ensure compliance with the Contract Documents. Accompany the University and their Consultants on such inspections.
- g. Coordinate required tests, inspections, and demonstrations with the University's IOR inspectors, consultants and any other authority having jurisdiction.
- h. Inspect all materials and equipment arriving at the job site to ensure conformance to the provisions of the Contract Documents. Prepare and submit to the University written reports as required by the Contract Documents.
- i. Identify, report and reject defective Work or Work not in conformance with the Contract Documents. Monitor the repair or reconstruction of rejected Work.
- j. Develop checklists to be used for the inspection of each Division of the Work.
- k. Retain specialists or outside firms for inspection of Work in areas where additional technical knowledge is required (mechanical, electrical, electronics, controls, communications, security, welding, structural, security hardware, etc.).
- l. Schedule additional site visits where appropriate.
- m. Verify and report that all materials and equipment manufactured off-site are in conformance with the Contract Documents.
- n. Prior to the start of each Division, Section and/or major item of Work required by the Contract Documents, conduct a preconstruction Quality Control meeting with responsible field and office representative and the University and their Consultants. Provide the University and their Consultants minutes of these meetings within forty-eight (48) hours.
- o. Work closely with the University to ensure optimum Quality Control. Attend Project meetings as required by the University.

1.6 REPORTING PROCEDURES

- A. As a minimum, develop forms, logs and reporting procedures consisting of the following:
 1. A Quality Control meeting shall be held at least monthly between the University, Consultants and the Quality Control Manager during which only Quality related topics will be reviewed.
 2. A monthly written report published at month end providing an overview of Quality Control activities, problems found and/or solved, status of remedial work, status of mock-ups, anticipated problems and planned activities for the coming month, etc.
 3. Deficiency reports: Plan of action by the Contractor for correcting any known contract deficiencies including delay in scheduled progress.
 4. Weekly reports (including reports from Contractor and Subcontractors) to the University describing:
 - a. Equipment and material received.
 - b. Tests and inspections performed with submittal information.
 - c. Deficiencies noted and/or corrected.
 - d. Quality Control concerns and problems.
 - e. Record keeping (as required).

1.7 IMPLEMENTATION

- A. The Contractor's Quality Control program shall be adequate to cover all operations, including both on-site and off-site and will be keyed to the proposed sequence of work and shall include as a minimum at least three (3) phases of inspection for all definable items or segments of work, as follows:
 1. Preparatory inspection shall be performed prior to beginning any work on any definable segment of the Work and shall include a review of Contract requirements; verification that

all materials and/or equipment have been tested, submitted, and accepted; verification that provisions have been made to provide required control testing; examination of the work area to ascertain that all preliminary work has been completed; and a physical examination of materials and equipment to assure that they conform to accepted shop drawings or submittal data and that all material and/or equipment are available. As a part of this preparatory work, Contractor's Quality Control organization will review and verify that all documents, including but not limited to; shop drawings, submittal data, method of Quality Control, product data sheets, test reports, affidavits, certification and manufacturer's instructions have been submitted and accepted by the University as required herein. Each submittal to the University shall bear the date and the signature of the Contractor's Quality Control Manager indicating that he has reviewed the submittal and certified it to be in compliance with Drawings and Specifications or showing the required changes.

2. Initial Inspection: To be performed as soon as a representative segment of the particular item of work has been accomplished and to include examination of the quality or workmanship and a review of control testing for compliance with Contract requirements, exclusion of defective or damaged materials, omissions, and dimensional requirements.
3. Follow-up Inspection: To be performed daily or as frequently as necessary to ensure continuing compliance with Contract requirements, including control testing, until completion.
4. The Contractor shall maintain daily current records with information as described above, in an appropriate format of all inspections and tests that the required inspection or tests have been performed. These records must cover both conforming and defective items and must include a statement that all supplies and materials, incorporated in the Work, are in full compliance with the terms of the Contract. Two legible copies must be furnished to the University. The report will cover all work performed or completed subsequent to the previous report.

END OF SECTION

SECTION 01 4520 CONCRETE MOISTURE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative Requirements
2. Information Submittals
3. Quality Assurance
4. Field Conditions
5. Materials for Test Procedures
6. Preparation
7. Testing: Testing for moisture vapor emission at concrete floors scheduled to receive applied floor coverings. Testing required at:
 - a. New concrete floor slabs on grade.
 - b. New elevated concrete floors where floor coverings are to be installed.
 - c. New wood flooring over concrete sub floor.
8. Installation Control Measures

1.2 ADMINISTRATIVE REQUIREMENTS

- ##### A. Submittal Procedures: In accordance with Section 01 3300, "Submittals."

1.3 INFORMATIONAL SUBMITTALS

A. Quality Control:

1. Qualifications of personnel or laboratory to perform testing.
2. Results of substrate moisture testing for each location and maximum allowable levels specified in respective Specification Sections for the intended floor finish.

1.4 QUALITY ASSURANCE

- ##### A. If areas of concrete are not within the floor covering manufacturer's maximum allowable emission rate and slab area fails the moisture test, do not proceed with installation and notify the University's Representative.

1.5 FIELD CONDITIONS

A. Ambient Conditions:

1. Area to be tested shall match that of the finished floor covering.
9. Doors, windows, and roofing shall be installed and the temperature of the building interior environment shall be controlled.
10. Interior temperature shall be 75 degrees F, plus or minus 10 degrees F (23.9 degrees C plus or minus 5.5 degrees C).
4. Relative humidity shall be 50 percent, plus or minus 10 percent.
5. Maintain the above conditions for 48 hours prior to and throughout the duration of the tests.

PART 2 - PRODUCTS

2.1 MATERIALS FOR TEST PROCEDURES

A. Acceptable MVER Tests:

1. Calcium chloride test kits shall be pre-packaged and of commercial consistency; American Moisture Test, Inc., Tustin, CA, or equal. Kit shall include sealed dish of anhydrous calcium chloride, a metering dome with gasket, and instructions.
2. Relative humidity (RH) probe that has been verified for accuracy within the past year.

B. Alkalinity Tests: Test kit by American Moisture Test, Inc., Tustin, CA, or equal pH meter.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Clean concrete surfaces of any residues resulting from pour of concrete which will affect the moisture vapor drive.
- B. Plastic dome of test kit shall be sealed airtight to prevent ambient humidity from influencing the test results.

3.2 TESTING

- A. Perform tests on concrete slabs to determine moisture vapor emission based on the Moisture Vapor Emission Rate (MVER) content in accordance with ASTM F1869 or F2170, and alkalinity in accordance with ASTM F710. No testing shall be performed during non-acclimated periods. Results of these tests will be used to determine suitability of substrate to receive flooring materials. Perform two sets of tests, at 60 days and again at 14 days before the start of flooring installation.
- B. Test Kit: Comply with ASTM F1869 and the following.
 1. Verify temperature of slab is up to service temperature.
 2. Duration of MVER test shall be 60 to 72 hours.
 3. Dish shall be measured one-hour before and one-hour after testing with weight calculated within 0.1 grams.
- C. RH Probe: Comply with ASTM F2170 and the following.
 1. Verify concrete slabs are up to service temperature at least 48 hours prior to testing.
 2. Depth of probes shall be 40 percent on slabs drying from the top only and 20 percent for slabs drying from both sides.
 3. Probe shall be allowed to acclimate and checked for drift less than 1 percent relative humidity over a 5 minute period.
 4. Elapsed time for test shall be 72 hours.
- D. Alkalinity Testing: Comply with ASTM F710 and the following.
 1. Verify that concrete surfaces are clean and that curing and sealing compounds have been removed.
 2. Place a 1 inch diameter amount of manufacturer's recommended liquid on concrete surface and allow to settle for 60 seconds.
 3. Insert meter into liquid and allow to calculate results.
- E. Unless otherwise approved in writing by University's Representative, tests shall be performed by an independent testing agency.
- F. Number of test kits shall be determined by the square footage of each flooring material. Provide minimum of three test kits for the first 1,000 square feet (93 square meters), and one test kit per each additional 1,000 square feet (93 square meters), with consideration to separation of test

areas. At slab on grade conditions test within 2 feet of toilet rough-in's to determine any piping penetration failures.

- G. Where calcium chloride test results are satisfactory but there is reason to suspect that unacceptable moisture levels below the upper two centimeters of the concrete may still exist, a relative humidity probe shall be used to test the full depth of the slab.

3.3 INSTALLATION OF CONTROL MATERIALS

- A. If areas of concrete are not within the floor covering manufacturer's maximum allowable emission rate and slab area fails the moisture test, comply with the requirements specified in Section 07 2620, "Concrete Vapor Emission Control".

END OF SECTION

**SECTION 01 5100
TEMPORARY UTILITIES**

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Installation
2. Temporary Electricity
3. Temporary Water
4. Temporary Lighting
5. Temporary Heating, Cooling, and Ventilating
6. ~~Temporary Telecommunications~~

1.2. INSTALLATION

A. Use qualified personnel for installation of temporary utilities. Locate utilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required. Coordinate temporary utilities with University Representative, IOR and Facilities Services.

B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Utility Service Connection: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.(Utilize the Utility Shut Down Forms whenever required)
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the University's easements cannot be used for that purpose.
4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the University or University's Representative. Neither the University nor University's Representative will accept cost or use charges as a basis of claims for Change Orders.

D. Submittals:

1. Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
2. Implementation and Termination Schedule: Within 15 days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility. Temporary Utilities: Prepare a schedule indicating dates for taking over the responsibility of the existing temporary utilities that the University already has in place from the first phase and termination of each temporary utility. At the earliest feasible time, when acceptable to the University, change over from use of temporary service to use of permanent service.

E. Quality Assurance:

1. Comply with industry standards and applicable laws and regulations of the University including, but not limited to, the following:
 - a. Potentially hazardous materials.
 - b. Health and safety regulations.
 - c. Utility company regulations.
 - d. Police, fire department, and rescue squad rules.
 - e. Environmental protection regulations.
2. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
 - a. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
3. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.
4. Construction Facilities and general construction activities shall comply with the energy use guidelines in Title 24 of the California Administrative Code.

1.3. TEMPORARY ELECTRICITY

- A. Temporary Electric Power Service: Electric power will be furnished by the University at cost of \$0.087/KWH. Provide weatherproof, grounded electric power service and distributions system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
1. Contractor Responsibilities:
 - a. The University is providing temporary power equipment for the Contractor's use at the management trailer compound. The equipment includes; power skid, meter, quad-plex wire, panel board and Nema enclosure. Install project site electric power service with a meter at the point of connection designated by the University's Representative. Refer to the diagram for locating temporary power connections at the end of this section.
 - b. Maintain connections and extensions in a safe manner and utilize so as to not constitute a hazard to persons or property.
 - c. Connections and extensions will be subject to OSHA regulatory requirements. Immediately remove or remedy connections and extensions that represent safety hazards or cause undue interruption of University's normal operations.

1.4. TEMPORARY WATER

- A. Water Service: Water for use in construction, testing, and irrigation will be furnished by the University at a cost of \$1.12/CCF (748 gallons).
1. Contractor Responsibilities:
 - a. Provide meter and all connections and extensions required.
 - b. Maintain connections and extensions in a safe manner and utilize so as to not constitute a hazard to persons or property.

- c. Connections and extensions will be subject to approval of the University. Immediately remove or remedy connections and extensions that represent safety hazards or cause undue interruption of University's normal operations.

1.5. TEMPORARY LIGHTING

- A. Temporary Lighting: Provide temporary lighting with local switching as required to supplement existing lighting.
- B. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

1.6. TEMPORARY HEATING, COOLING, AND VENTILATING

- A. Temporary Heat: Provide temporary heat required by construction activities. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- B. Maintain temperature at less than 60 degrees F (16 degrees C) in permanently enclosed portions of the building and areas where finished Work has been installed.
- C. Heating Facilities: Except where the University's Representative authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

~~1.7. TEMPORARY TELECOMMUNICATIONS~~

- ~~A. Temporary Telephones and Data Services: Provide temporary telephone and data service at the existing Construction Trailer site throughout the construction period for all personnel engaged in construction activities as described below.~~
 - ~~1. Provide Communications Work Order(s) (e.g. voice add and/or data add) for service through UCR Computing & Communications (UCR C&C), Communications Services, contact Sheri Morgan at (951) 827-3979. Contractor is responsible for providing Network Electronics, Telephone Sets and all installation and monthly recurring service charges.~~
 - ~~2. Install separate telephone lines (phone numbers) for each temporary trailer/office and first-aid station. At each telephone, post a list of important telephone numbers.~~
 - ~~3. Provide telephone lines and telephone sets for the following:
 - ~~a. Contractor's field trailer/office: Direct line telephones (telephone lines and telephone sets) as required.~~
 - ~~b. University's Representative's field trailer/office: Three (3) Direct line digital telephones and three (3) telephone sets.~~~~
 - ~~4. Provide data connections for the following:
 - ~~a. Contractor's field trailer/office: as required. NOTE: A signed and approved Memo of Understanding (MOU) between Contractor(s) and UCR C&C will be required for all data services that are to be provided to Contractor(s).~~
 - ~~b. University's Representative's field trailer/office: Provide four (4) data connections.~~~~

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

EXHIBIT A

Utility Shutdown-Protocol and Forms

University of California, Riverside-Facilities Manual

In order to provide clearer direction to the project Design Professional and also to the Contractor for the processes and procedures to request and obtain shutdowns using the Utility Shutdown Request (USR), as well as to assist Campus Staff members and faculty in coordination of this process, the following “Utility Shutdown Protocol and Procedures” is created. This shall be part of Division 1, of the project specification manual as part of the detailed submittals for any university projects requiring shutdown and turn-on of any utilities.

University of California, Riverside-Utility Shutdown Protocol and Procedures

The following **Utility Shutdown Protocol and Procedure** has been created in order to directly fulfill the requirements set out in the UCOP Facilities Manual. Additionally, it will ensure that design professionals, contractors and the campus community are provide with proper, timely and accurate utility shutdown information; ensures and maintains a documented, organized and orderly procedure for design professionals who prepare construction documents for projects at the University, as well as requiring all contractors who work on University construction projects, to follow a strict protocol and procedure, which will be a uniform standard for all utility shutdown events, during construction projects, at the University. The following is that protocol. This document shall be included in the project specifications manual for all projects, with all of the required attachments, forms and other related documents completed for each Utility Shutdown activity.

1. General

- a. The coordination of Utility Shutdowns has become increasingly complex at UCR due to the increase and complexity of construction activity and the effect utility shutdowns have on surrounding people, buildings and facilities. By nature, utility shutdowns affect a variety of stakeholders, including students, faculty, researchers, administration, pedestrians, security and law enforcement personnel, and various departments within UCR (Communications, Information Technology, Operations and Maintenance of Plant (OMP), Building Maintenance and Custodial Services, etc.), as well as the surrounding general public. Impacts to life safety and security systems, as well as automatically and mechanically controlled climate systems on campus, are particularly critical when considering utility shutdowns. To minimize negative impacts, UCR has developed procedures and guidelines for design professionals and contractors to use when planning for and requesting a utility shutdown on all construction projects.
- b. Contractor requested Utility shutdowns are discretionary on UCR’s part. Not until UCR has reviewed the utility shutdown request application, and has been fully apprised of the potential risks and impacts, and any necessary contingency plans, will the Utility Shutdown Request (USR) be granted. It shall be the sole responsibility of the design professional and contractor to provide the above information, in accordance with the provisions in this section. This procedure and protocol, as well as all associated forms and schedules, in addition to the information requested herein, shall be included in the Division 1 section of the project specifications manual for each project, so that preliminary approval can be obtained prior to project commencement. The final approved Utility Shutdown Plan shall be included in the 100% Construction documents, project specifications manual.
- c. The procedures and guidelines provided herein may be changed at any time by UCR for security, safety, and other operational reasons and needs.

2. Definitions

- a. **Contingency Plan:** Based upon the findings identified in the Impact Analysis, a Contingency Plan may be required by the university. This plan will identify those actions necessary to

mitigate and/or minimize disruptions in utility service and to maintain operational readiness during a utility shutdown. The General Contractor shall provide all necessary management, personnel and material resources needed to execute the plan at the time of the utility shutdown event, and such shall be included in this Contingency plan.

- b. **Contractor:** As used herein, the Contractor is the entity with overall responsibility for executing the scope of work necessitating the utility shutdown. This could be the General Contractor for a specific capital construction project, a tenant improvement contractor for a tenant improvement project, or any Operations and Maintenance of Plant (OMP) project or any other entity who is authorized by the university.
- c. **Impact Analysis:** The Impact Analysis identifies all systems, operations, and parties that will be affected by the proposed shutdown of the utility and specifically what that impact is. It shall include sufficient field forensic investigations to verify as-built conditions and that all systems and parties affected by the shutdown have been identified. Drawings and work plans shall be developed to convey actual field conditions and affected physical areas and infrastructure of the facility. This research shall also identify the affected stakeholders and the resulting impacts to their operations. This Impact Analysis will be used by UCR to determine the need for development of a **contingency plan**.
- d. **UCR Architects and Engineers (A&E):** is the authority requiring, and who is responsible for the review and approval process for all Capital Program project USR's and all construction documents at UCR.
- e. **Campus Building Official/Senior Construction Inspector Of Record (IOR):** Is the UCR field representative directly responsible for all construction inspections, general oversight and enforcement of all code requirements and approved construction documents, including all USR's, for the construction project. He/she will be instrumental in oversight of the Utility Shutdown event and will be present during the event.
- f. **Project Manager (PM):** Is the UCR representative directly responsible for the preparation and general oversight and coordination of the construction project, and who is involved with the overall review, scheduling and approval of the Utility Shutdown Request (USR).
- g. **Utility Shutdown:** A utility shutdown is any disruption or disconnects of continuity (including abandonment) of any and all utility systems for any length of time. This includes, but is not limited to: electrical, water, natural gas, fuel, fire alarm, security/automatic security cameras, sewer, communications, HVAC, automatic fire sprinkler system, etc.
- h. **Utility Shutdown Plan (USP):** The overall plan, which includes **Utility Shutdown Request Form, Impact Analysis, Shutdown Calendar**, and all other details relating to the shutdown of any utilities on a specific Capital Programs, Construction and Design Project. This **(USP)** shall be submitted and included in the Construction Documents and Project Specifications Manual for each specific project.
- i. **Utility Shutdown Request (USR):** The USR form identifies the time and date of the proposed shutdown, the type of shutdown, specific location, work area, affected buildings/systems, point of contact for the contractor, etc. It also includes a required Impact Analysis. A check list is attached to the form to assist the contractor in addressing the impact analysis.

3. Protocols

- a. Utility Shutdowns are defined as a singular event; one turn-off/one turn-on.
- b. Generally speaking, shutdowns should occur during a maximum of a four hour window on weekends and/or during the hours of 12 am and 5 am within a 24 hour period, unless otherwise approved by UCR.
- c. One USR is required for each 24 hour period, even if the preceding shutdown is being duplicated.
- d. Contractors shall follow UCR “Lockout/Tagout” procedures. An approved “Lock Out/Tag Out” program and confined space program, reviewed by UCR EHS, shall be detailed and included for all Electric Panels and circuitry, and/or any other utility service which is being worked on or any confined space and included in a project. This program information shall be included in all USR related documentation provided by the design professional and the contractor and it shall also be included in the contract documents submittal and project specification manual. All parties involved in the lockout/tagout process, such as, contractor, subcontractors, UCR Operations and Maintenance of Plant, should apply their own locks and tags. No share lock is allowed at all time.
- e. A single USR form is required for the physical shutdown of a single utility. If, by shutting down one utility, this causes loss of other systems or utilities, those other systems and utilities are identified and addressed in the Impact Analysis. For example; a shutdown of electrical may cause the loss of the Fire Alarm. The loss of the Fire Alarm is addressed as an impact.
- f. A USR is required for the physical shutdown of each utility even when occurring during the same time period. For example, if both electrical and water are proposed to be shut down during a given period, two URS Forms are required. Each utility shutdown will result in different impacts, likely independent of the other, and therefore will undergo independent evaluations and approvals.
- g. Utility Shutdown Request (USR) must be submitted 30 calendar days prior to the proposed utility shutdown, unless otherwise required or authorized by UCR. In the event that there is an “immediate” or “emergency” utility shutdown which must occur with less than a 30 day notice, then UCR Project Manager shall be notified with absolutely as much time as possible with all required details and impacts included in the request. UCR Staff will assist in this request as quickly as possible however no shutdown will be approved until all documents and review are completed.
- h. USR’s are submitted electronically or manually, including all required documentation, and they are to be included in the project specifications for each specific Capital Programs project.
- i. Status of each USR review is available from the Project Manager for each project.
- j. Only UCR Operations and Maintenance of Plant (OMP) personnel are permitted to disrupt or disconnect any utility system.
- k. Personnel required to be at all shutdowns include the Operations and Maintenance of Plant (OMP) personnel, who will be conducting the actual shutdown; the UCR Contractor of Record; as well as Architects & Engineers (A&E) inspectors. In addition, shutdowns may require other A&E Staff, UCR Environmental Health & Safety, UCR Police Department, and UCR subcontractors. All other resources necessary for the

successful shutdowns and restoration are provided by the Contractor at the time of the Shutdown and turn-on of utilities.

- l. Only one primary switchboard is to be shutdown at any given time.
- m. Electrical shutdowns may be required to be scheduled at a minimum of three days apart.
- n. A utility shutdown may be canceled the night of the shutdown for any of the following reasons:
 - i. All elements identified in contingency plan are not in place;
 - ii. Contractor is not ready within 30 minutes of scheduled shutdown;
 - iii. Security and operational readiness issues identified by UCR Staff;
- o. If a shutdown is canceled for any reason, the Project Manager (PM) and Construction Inspector of Record (CIOR) shall be contacted immediately. The Project Manager and Construction Inspector of Record will then notify all stakeholders of the cancelation.

4. UCR Roles and Responsibilities

- a. **UCR Operations and Maintenance of Plant (OMP) (performs ALL shutdowns):** (OMP) is a division within the Finance and Business Operations Research and Development unit (REDFBO) and is the ONLY party allowed to physically disrupt or disconnect any utility system. The role of (OMP) is to provide maintenance of the overall University facility. Utility shutdowns are therefore resource constrained, and will be scheduled based on availability of those resources, while recognizing that it will be necessary to schedule those required resources, and calculate all fees for the service as early as is possible.
- b. **UCR A&E, Construction Inspector of Record (CIOR) (participants on ALL shutdowns):** UCR Construction Inspectors will be present at the beginning, periodically during and at the end of all utility shutdowns and turn-on events. Inspections shall certify that the utility has been re-established satisfactorily and (CIOR) will document the same. UCR Inspector shall communicate UCR lockout/tagout procedure with the contractor.
- c. **UCR A&E, Project Manager (PM) (participant in ALL shutdowns):** The designated Project Manager is the single point of contact for the contractor for all utility shutdowns. The PM has the initial responsibility to approve and/or reject the USR and, with others, will review the Contractors implementation of the Contingency Plan and proposed execution of the utility shutdown and may be at the site at the time of shutdown and/or turn-on.

5. Design Professional Roles and Responsibilities

- a. Each project **Design Professional** shall submit, and include in the project documents and specifications manual, the detailed **Utility Shutdown Plan** which, upon a necessary shutdown of any utilities, shall identify all of the utilities affected, how the utility is to be isolated, maximum allowable duration of interruption (if applicable) and the affected facilities and systems, and lockout/tagout procedures for all shut downs. This plan will include the **Impact Analysis** which identifies all systems, operations, and

parties which will be affected by the proposed utility shutdown of the utility and specifically what that impact is. It shall also include sufficient field forensic investigations to verify as-built conditions and that all systems and parties affected by the shutdown have been identified, as well as all other required or requested data or information needed to substantiate, organize and schedule the proposed shut down of utilities.

- b. In communication with the Project Manager for the specific project, the Design Professional of Record shall meet with all **Shutdown Stakeholders** in order to address/mitigate fully, all comments or concerns raised by the utility shutdown activity. The Project Manager will coordinate this meeting.
- c. Once all comments and issues are discussed and addressed, and/or the initial Utility Shutdown Plan is approved, the Design Professional will correct and re-submit all Utility Shutdown Plan documents to the Project Manager and for inclusion in the Construction Documents and Project Specifications Manual.
- d. Design Professional shall prepare all Utility Shutdown forms for Contractor of Record (Unknown at this time).
- e. Design Professional shall ensure that all Construction Documents are updated so that final "As-Built" documents reflect all Utility Shutdown activity for this project.
- f. Design Professional of Record may be involved further at the time of the Utility Shutdown event.

6. Contractor Responsibilities

- a. The Contractor is responsible for submitting a **Utility Shutdown Request (USR)** for each and every proposed utility shutdown event, each with a minimum of 30 calendar days lead time prior to each requested shutdown event date. Emergency Shutdown events will be handled on a case by case basis, however as much prior notice as possible, shall be provided to the Project Manager. Immediately notify the Project Manager if/when this occurs. Only UCR A&E team members in conjunction with OMP shall decide if the event is an "emergency".
- b. Contractor is responsible for reviewing the Impact Analysis to be included with the USR. The Impact Analysis must include the specific location of the utility shutdown, documentation of field forensic investigations to verify as-built conditions and all systems and parties affected by the shutdown, lockout/tagout procedures, and the specific impact to each system and party affected. Documentation can include written narrative, diagrams, sketches, and photos as appropriate. The Impact Analysis shall include a specific work plan for providing contractor personnel and equipment to support the shutdown, including requirements generated by the impacts to other systems and parties. The Impact Analysis must also identify the need for support from other entities such as UCR Communication and Computer Systems Services, UCR OMP, UCR EH&S, UCR Police Department, UCR Subcontractors, and others. Early notice is imperative for proper coordination.
- c. Contractor is responsible for developing and implementing a contingency plan, if requested by UCR, to mitigate specific impacts during the shutdown. Any and all resources, including equipment, manpower and supervision required for the execution of the contingency plan are the responsibility of the contractor. This includes, but is not

limited to, temporary signage, temporary power, clean-up of collateral damage, operational workarounds, etc. This may include all areas and systems impacted by the shutdown.

- d. The Contractor is responsible for issuing a rolling 30 or 45 day look-ahead calendar that includes the identification of all projected USR's. The calendar shall be submitted weekly to the Project Manager and shall identify the contractor's utility shutdown identification/number (CUSR) and the date and type of the proposed shutdown. If modifications are needed the schedule shall be submitted to the Project Manager within 24 hours of identification of the change. Upon notification the Project Manager will immediately notify UCR OMP and UCR EH&S.
- e. The Contractor is responsible for implementation of the approved USR including all supporting elements and required contingencies within the designated schedule, as initially approved.
- f. During the utility shutdown, the Contractor is responsible for documenting previously unknown conditions found at the shutdown location, and for including them on the official project construction documents for permanent archiving with the Architects & Engineers Office.
- g. The Contractor is responsible for contacting the Project Manager, Physical Plant (OMP), EH&S and the Inspector (CIOR) at least 2 hours prior to the actual utility shutdown and prior to the utility restart. If there is any delay in the shutdown or restart from the approved schedule, the Contractor is responsible for notifying the (PM), (OMP) and (CIOR) as soon as that information is known.

7. Process and Procedures for Submitting USP and USR's

- a. The Design Professional shall submit, included in the project documents and specifications manual, the initial detailed Utility Shutdown Plan (USP), which includes and identifies all utilities affected, how the utility is to be isolated, maximum allowable duration of interruption (if applicable) and the affected facilities, and lockout/tagout procedures for all major shut downs. Design Professional shall also specify by-pass or temporary service if required to minimize disruption to the University. This plan, which includes the prepared Utility Shutdown Request (USR) will be included in the project specifications manual, once the request is approved.
- b. The Contractor submits the project USR, in electronic or hard copy format, including the Impact Analysis (mandatory), to the Office of Architects and Engineers, Project Manager. This shall be included in the project construction as built specifications manual. This starts the 30 calendar day period allowed for processing the USR. Any revisions or additions to the submitted USR, necessitating the re-submittal of the USR, will result in the restart of the 30 calendar day period.
- c. The PM will review the submitted USR for need, completeness of the USR (including the mandatory Impact Analysis), and compliance with the 30 day notification period. Any required changes to the USR or Impact Analysis along with any requirement for a contingency plan will be transmitted to the Contractor from the PM. The PM will provide the initial approval of the USR.

- d. Following the initial approval by the PM the USR, Impact Analysis, and Contingency Plan (if required) will be reviewed by Physical Plant (OMP), Environmental Health & Safety (EH&S) and other stakeholders. This review will include a technical review of the Impact Analysis, by impacted stakeholders, and coordination of schedule for the utility shutdown.
- e. Upon a satisfactory review of the USR, including the Impact Analysis and Contingency Plan, the PM will schedule a Stakeholder Coordination Meeting, if needed. This meeting is chaired by the PM and includes the Contractor and all applicable stakeholders identified in the USR or as part of the review process. The purpose of the meeting is to review all elements of the utility shutdown including the review of impacts and applicable contingencies to assure all known elements have been addressed. The USR and applicable Contingency Plan can be modified in this meeting provided all stakeholders are in agreement, the modification does not impact any additional stakeholder not in attendance, and the resulting shutdown in the field can be fully supported.
- f. Upon satisfactory completion of the Stakeholder Coordination Meeting, the PM will obtain final approval signatures.
- g. The PM will return the approved (USR) to the Contractor with copies to the (OMP, EH&S) and all stakeholders identified in the (USR) as well as other parties identified by the UCR Staff.
- h. Following approval of a (USR), if the (USR) is cancelled for any reason, the PM will immediately notify all stakeholders of the cancellation.

8. Sample Forms and Checklists

- a. Utility Shutdown Request Application (USR)
- b. USR Impact Analysis
- c. USR Impact Analysis Check List
- d. Utility Shutdown Request for Assistance
- e. Utility Shutdown Process Flow Diagram

UTILITY SHUTDOWN REQUEST (USR)

APPLICATION (USR) #2021USR-_____

PD&C Project Number: _____ Contractor USR Tracking Number: 2021USR-2021-950XXX

Construction Project Description: _____ Project Manager: _____

1. E-mail/submit one (1) form for each utility being requested for shutdown. You must fill out separate forms for each shutdown request.

2. Shutdown information times shall be in half-hour increments.
 3. E-mail completed form to the Services and PD&C Project Manager.
 4. Requests must be received a minimum of 30 days prior to the utility shutdown event time-NO EXCEPTIONS
 5. Utilities shall be shutdown and restored by Facility Services personnel ONLY.
 6. The shutdown will not occur unless the Contractor is present at the shutdown location and work area.
 7. Please complete the form in its entirety including attached Impact Analysis and Impact Analysis Checklist.
- INCOMPLETE FORMS WILL NOT BE PROCESSED.**
 NOTICE: All forms received on Saturday, Sunday or after 1:00 p.m. (Weekdays) will be marked as "RECEIVED" on the following business day.

SHUTDOWN TIMES MAY CHANGE WITHOUT NOTICE DUE TO UNIVERSITY OPERATIONAL PRIORITIES

(Select ONE utility per form)

- Water
 Electrical
 Gas
 Fire Alarm
 Security System
 HVAC
 Sewer
 Automatic Fire Sprinklers
 Communications
 HVAC
 Lab Vacuum
 Lab Air
 Other _____

LOCATION INFORMATION:

Specific Location: _____
 Work Areas Adjacent To: _____
 Affected Buildings/Systems: _____
 Purpose: _____
 Floor Level: _____ Landside Area: _____
 Building to Remain Occupied? Yes No
 Is this a Laboratory? Yes No

Contractors Signature: _____

CONTACT INFORMATION:

Subcontractor: _____ Contact Name: _____
 Phone Number: () _____ - _____ FAX: () _____ - _____ E-MAIL: _____

SHUTDOWN INFORMATION:

Day: _____ Date: _____ Time: _____
 Contractor Requestor's Name: _____
 Phone: () _____

RESTORE INFORMATION:

Day: _____ Date: _____ Time: _____
 Position/Title: _____
 CONTACT E-MAIL: _____

DO NOT WRITE BELOW THIS LINE FOR UNIVERSITY OF CALIFORNIA, RIVERSIDE USE ONLY

Date (USR) Received: _____ Time: APPROVED DENIED (NOT APPROVED)
 Comments: _____
 Director-Signature: _____ Date: _____ Project Manager-Signature: _____ Date: _____



UTILITY SHUTDOWN REQUEST(USR)

APPLICATION (USR) #2021USR-_____

IMPACT ANALYSIS (1 of 3)

Project No. _____ PD&C Project Manager: _____

Construction Project Description: _____

Detailed Description of Utility to be Shutdown:

Specific Location:

Lockout/Tagout :

Lock Out/Tag Out Plan:

Affected Systems/Equipment:

Impact of Work on Systems/Equipment/Stakeholders:

Plan to Mitigate Impacts:

Proposed Work Plan for Implementing the Shutdown:

Affected Systems/Equipment:

Impact of Work on Systems/Equipment/Stakeholders

Plan to Mitigate Impacts:

Proposed Work Plan for Implementing the Shutdown:

ATTACH DOCUMENTATION FO FIELD FORENSIC INVESTIGATION, SKETCHES, DIAGRAMS, PHOTOS, AND ADDITIONAL NARRATIVE EXPLANATION AS APPROPRIATE. PROVIDE NAME OF SPECIFIC STAKEHOLDERS IMPACTED



UTILITY SHUTDOWN REQUEST(USR)

APPLICATION (USR) #2021USR-_____
 IMPACT ANALYSIS (2 of 3)

UCR Project Number: _____ PD&C Project Manager: _____
 Construction Project Description: _____
 Utilities to be shut down: _____ Locations: _____
 Field Forensics Investigations and Documentation Complete Date of Completion: ____/____/____

NOTE: CONTRACTOR IS REQUIRED TO COMPLETE AND DOCUMENT FIELD FORENSIC INVESTIGATIONS TO VERIFY AS-BUILT CONDITIONS

Impacted Facilities	Yes	No	Description
Parking Structure-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Sports Field-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Student Recreation Center-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Laboratory-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Administration Building -----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Class Rooms-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Streets-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Facility Services-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Central Plant/Steam Plant-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Sports Facility-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other-----	<input type="checkbox"/>	<input type="checkbox"/>	_____

Impacted Parties (Stakeholders)	Yes	No	Description
Students-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Faculty -----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Administration-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Vendors-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other Contractors/Projects-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
UCR Department-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
IT/Communications-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fire and Life Safety-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Police/Security-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Facility Services-----	<input type="checkbox"/>	<input type="checkbox"/>	_____

Impacted Systems	Yes	No	Description
Water-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Sewer-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Electrical-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fire Sprinklers-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fire Alarms-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Gas-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Landscape/Water-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Security-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
HVAC-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
IT/Communications-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other -----	<input type="checkbox"/>	<input type="checkbox"/>	_____



UTILITY SHUTDOWN REQUEST(USR)

APPLICATION (USR) #2021USR-_____
IMPACT ANALYSIS (3 of 3)

Project Number: _____ PD&C Project Manager: _____
 Construction Project Description: _____
 Utility to be shut down: _____ Locations: _____
 Field Forensics Investigations and Documentation Complete Date of Completion: ____ / ____ / ____

NOTE: *CONTRACTOR IS REQUIRED TO COMPLETE AND DOCUMENT FIELD FORENSIC INVESTIGATIONS TO VERIFY AS-BUILT CONDITIONS*

<u>Work Plan Requirements</u>	<u>Yes</u>	<u>No</u>	<u>Description</u>
Parking Structure-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Sports Field-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Student Recreation Center----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Laboratory-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Administration Building -----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Class Rooms-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Streets-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Facility Services-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Central Plant/Steam Plant-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Sports Facility-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other-----	<input type="checkbox"/>	<input type="checkbox"/>	_____

<u>Work Plan Reviewers</u>	<u>Yes</u>	<u>No</u>	<u>Description-(Specific Persons who will review this Work Plan)</u>
Students-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Faculty -----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Administration-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Vendors-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other Contractors/Projects--	<input type="checkbox"/>	<input type="checkbox"/>	_____
UCR Departments-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
IT/Communications-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fire and Life Safety-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Police/Security-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Facility Services/Central Plant	<input type="checkbox"/>	<input type="checkbox"/>	_____

<u>Impacted Systems</u>	<u>Yes</u>	<u>No</u>	<u>Description</u>
Water-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Sewer-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Electrical-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fire Sprinklers-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fire Alarms-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Gas-----	<input type="checkbox"/>	<input type="checkbox"/>	_____
Landscape/Water-----	<input type="checkbox"/>	<input type="checkbox"/>	_____

**SECTION 01 5200
CONSTRUCTION FACILITIES**

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Supervision and Security
2. Maintenance
3. Field Offices and Sheds
4. First Aid Facilities
5. Sanitary Facilities
6. Storage
7. Termination and Removal

1.2. SUPERVISION AND SECURITY

- A. Staff Names:** Within 15 days of commencement of construction operations, post a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.
- B. Supervision:** Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- C. Security:**

1. Protection and security measures required by the University are considered minimum requirements. Provide additional measures as necessary and appropriate to the hazards of this Project. Employ all measures necessary to ensure the security of the Project site. Security measures provided by the University do not relieve the Contractor from responsibility for site security and protection of the work as required by the Contract Documents.
2. Watchman: The University will not be providing security services for the Project. During all hours that Work is not being prosecuted, including weekends and holidays, furnish such watchman's services as Contractor may consider necessary to safeguard materials and equipment in storage on the Project site, including Work in place or in process of fabrication, against theft, acts of malicious mischief, vandalism, and other losses or damages. The University will not be liable for any loss or damage.
3. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
 - a. Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
4. The contractor shall provide a security camera system for the Project site as follows:
 - a. Twelve (12) cameras shall be outdoor rated powered over Ethernet (POE) with zoom capability.
 - b. Wireless or hardwired within 300' form POE switch provided by Contractor.
 - c. Streaming video
 - d. Web based
 - e. Security camera system shall also include four (4) DVRs with computer and electronic related equipment to be used onsite during construction. Contractor to provide proper power, CAT 6 cabling for the IP camera and twelve (12) 20' pole, properly braced, for the mounting of each IP camera. The Contractor shall provide system access to University and training to University Representatives and designees.

1.3. MAINTENANCE

- A. Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities if required, as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.
- B. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

- C. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

1.4. FIELD OFFICES AND SHEDS

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access, and as approved by the University's Representative, within the area of the site designated as "Limits of Work".
- B. The University is providing the existing 12' x 60' Field Office for UCR use in the area of Work which the Contractor shall maintain until final acceptance of the Project. The Contractor shall be responsible for providing a cleaning/maintenance service to maintain and clean the offices 2x a week for the duration of the project.

- 1. University's Representative's field office shall contain at a minimum the following furnishings:

- a. Three (3) standard size desks with drawers.
- b. Twenty four (24) Lineal ft. of bookshelves.
- c. Seven (7) two drawer legal size filing cabinets.
- d. Two (2) drawing racks with minimum five (5) sticks each.
- e. Three (3) swivel base desk chairs.
- f. Six (6) visitor chairs.
- g. One (1) drafting stools.
- h. Three (3) waste baskets.
- i. One (1) bottled water dispensing station (hot & cold), with bottled water supplied by contractor.
- j. Four (4) 4' X 8' folding tables and twelve (12) chairs.

- 2. University Representative's field office shall contain at a minimum the following equipment:

- a. One multi-function photocopy machine (Xerox, Canon or equal) with self-feed, enlargement and reduction capabilities. Capable of copying in color to and from 8-1/2 x 11, 8-1/2 x 14 and 11 x 17 paper with paper Supplied by Contractor.
- b. Photocopier equipment to also include plain paper fax capabilities and flat plate digital scanning function for scanning documents into PDF files to use as attachments to email..
- c. Ten (10) construction hard hats (Fibre-Metal 3-Action-Gear). These hard hats shall remain the property of the Regents.
- d. One (1) complete set of all code books and references applicable to this project. These code books and references shall remain the property of the University.
- e. Items c and d will become the property of the Regents.

- C. Field Offices: The University is providing the Contractor with an insulated, weather tight, temporary office of sufficient size (triple wide) to accommodate the required office personnel at the Project Site with adequate lighting, power, heating, and cooling. Contractor to keep the office clean and orderly for use for large progress meetings and shall be responsible for providing a cleaning/maintenance service to maintain and clean 2x a week for the duration of the project. Furnish and equip offices as follows:

- 1. Furnish with desks and chairs for Contractor's on-site staff, 4-drawer file cabinets, plan rack, and a 6-shelf bookcase. Furnish a conference table of sufficient size to comfortably accommodate a minimum of 14 people.
- 2. Equip with a water cooler.

- D. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service.

1. Maintain secure storage for tools (including personal tools of individual workers), equipment, and materials. The University will not be responsible for loss or damage to tools, equipment, or materials.

E. Materials

1. General: Provide new materials. If acceptable to the University's Representative, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
2. Lumber and Plywood:
 - a. For job-built temporary offices, partitions, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
 - b. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thickness indicated.
 - c. For vision barriers, provide minimum 3/8-inch-(9.5-mm-) thick exterior plywood.
 - d. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-(16-mm-) thick exterior plywood.
3. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary offices, shops, and sheds.
4. Paint:
 - a. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
 - b. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
5. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
6. Water: Provide potable water approved by local health authorities.
7. Open-Mesh Fencing: The University has temporary construction fencing already in place around the entire Glen Mor 2 site. The ~~contractor~~University shall transfer over the lease ~~from the University to the Contractor~~ at the start of construction and Contractor shall maintain the fencing in good order for the duration of the project until Substantial Completion. Contact American Fence at (951) 443-3550 for rental terms and conditions.

F. Equipment

1. General: Provide new equipment. If acceptable to the University's Representative, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
2. Water Hoses: Provide 3/4-inch (19-mm), heavy -duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
3. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle

outlets equipped with ground fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

4. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
5. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
6. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
7. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - a. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
 - b. Comply with requirements of authorities having jurisdiction.

1.5. FIRST AID FACILITIES

- A. First Aid Supplies: Provide types and quantities required by referenced standards, the University's Representative, and as prudent for the conditions existing for the Work.

1.6. SANITARY FACILITIES

- A. Maintenance of Septic Tanks: Septic tanks are required to serve both the Contractor's management offices and the University's site offices. The contractor shall provide maintenance services to remove effluent on a regularly scheduled basis.
 1. Maintain temporary toilets and septic tanks in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
- B. Temporary Toilet Units: Provide self-contained, single-occupancy toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Use of existing University sanitary facilities will not be permitted.

1.7. STORAGE

- A. Contractor's use of the Project site for the Work and storage is restricted to the areas designated on the Drawings or as approved by University's Representative. Use of mechanical and electrical rooms for storage of materials or furniture is prohibited.
- B. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
 - a. Concrete slabs on grade and suspended floors have not been designed for heavy loading.
 - b. Slabs on Grade: Do not subject slabs on grade to excessive loading by shoring, storage of materials, or operation of construction equipment unless adequately protected by planking designed to safely distribute loads. Maintain slabs and repair or replace damaged slabs at no additional cost to the University.
 - c. Suspended Floors: Do not subject suspended slabs to construction loads greater than 40 psf unless adequate shoring and protection is provided. Retain a civil or structural engineer experienced in shoring design and registered in the State of California to design necessary temporary support systems.
 7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
 8. Immediately remove from the site materials and equipment that are damaged or do not comply with requirements of the Contract Documents.
 9. When handling and moving materials and equipment, protect all finished surfaces.
- C. Keep copies of manufacturer's specifications and instructions on site and available for reference.

1.8. TERMINATION AND REMOVAL

- A. Remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
- B. Materials and facilities that constitute temporary facilities are the Contractor's property. The University reserves the right to take possession of project identification signs.
- C. Repair or replace street paving, curbs, and sidewalks damaged by construction traffic.
- D. At Substantial Completion, clean and renovate any permanent facilities used during the construction period.
- E. After removal of temporary facilities at the management compound in Lot 14 i.e. office trailers, wood patio decks, ramps, fencing, anchorage, electrical equipment, etc. which were placed on portions of the existing site not scheduled for new Work, Contractor shall repair all damage, holes, etc., to the pavement and apply a seal coat to the pavement (see Section 32 1300) and restripe all of the stalls in the three rows of parking (approximately 42 spaces) adjacent to the

management compound. A parking stall layout shall be provided by the University Representative.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 5300 TEMPORARY CONSTRUCTION

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Temporary Stairs, Scaffold, and Runways
2. Trenching and Shoring
3. Temporary Bridges
4. Temporary Decking
5. Temporary Overpasses
6. Temporary Ramps
7. Temporary Runarounds

1.2. TEMPORARY STAIRS, SCAFFOLD, AND RUNWAYS

- A. Provide all scaffolds, stairs, hoist plant, runways, platforms, and similar temporary construction as may be necessary for the performance of the Contract. Such facilities shall be of the type and arrangement as required for their specific use, substantially constructed throughout and strongly supported, well secured and complying with all applicable rules and regulations of the Industrial Accident Commission of the State of California and all applicable laws and ordinances. Refer to Section 01 41002, Regulatory Requirements.
- B. Arrange for construction equipment access to areas which may be partly blocked by existing obstructions.

1.3. TRENCHING AND SHORING

- A. All Work shall be in full accordance, but not necessarily limited to the following codes and regulations: Titles 8, 19, 21, 22 and 24, State of California, California Code of Regulations (CCR), California Occupational Safety and Health Administration (OSHA).
- B. Protection. Pursuant to Labor Code Sections 6705 and 6707, Contractor shall include in its base bid all costs incident to the provision of adequate sheeting, shoring, bracing or equivalent method for the protection of Life and Limb which shall conform to the applicable Federal and State Safety Orders.
- C. Before beginning excavation five feet or more in depth, Contractor shall submit to University's Representative a detailed plan showing the design or shoring, bracing, sloping, or other provisions to be made for worker protection from the hazards of caving ground during the excavation. The proposed plan shall comply with the State of California Construction Safety Orders, Title 8 and Title 24 of the California Code of Regulations (CCR). If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer registered in the State of California, University's Representative's determination of the matter shall be final and conclusive on Contractor. The cost of required engineering services shall be borne by Contractor and shall be deemed to have been included in the amount bid for the Work as stated in the Agreement.
- D. Neither the review nor approval of any plan showing the design of shoring, bracing, sloping, or other provisions for worker protection, shall relieve Contractor from its obligation to comply with Construction Safety Orders Standards and Title 24 CCR for the design and construction of such protective Work, and Contractor shall indemnify University and University's Representative from any and all claims, liability, costs, action and causes of action arising out of or related to the failure of such protective systems.

Contractor shall defend University, its officers, employees, and agents and

University's Representative in any litigation of proceeding brought with respect to the failure of such protective systems.

- E. Comply with State of California Construction Safety Orders, Article 6 - Excavations, Trenches, Earthwork - whether or not the excavation, trench, or earthwork is five feet or more in depth.

1.4. ~~TEMPORARY BRIDGES~~

A. _____

1.5. ~~TEMPORARY DECKING~~

A. _____

1.6. ~~TEMPORARY OVERPASSES~~

A. _____

1.7. ~~TEMPORARY RAMPS~~

A. _____

1.8. ~~TEMPORARY RUNAROUNDS~~

A. _____

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

**SECTION 01 5400
CONSTRUCTION AIDS**

PART 1 – GENERAL

1.1. SUMMARY

A. This Section Includes:

1. Temporary Lifts and Hoists
2. Temporary Cranes

~~1.2. TEMPORARY ELEVATORS~~

A.

1.3. TEMPORARY LIFTS AND HOISTS

A. Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

1.4. TEMPORARY CRANES

A. Provide crane services for hoisting and installing materials. Cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities. If crane services are used, a lift plan must be provided and approved prior to work being performed

~~1.5. TEMPORARY SWING STAGING~~

A.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 5500 VEHICULAR ACCESS AND PARKING

PART 1 – GENERAL

1.1. SUMMARY

A. Section includes:

1. Temporary Access Roads
2. Haul Routes
3. Temporary Parking Areas
4. Temporary Roads
5. Traffic Control
6. Staging Areas

B. Submittals:

1. Submittals shall be submitted in accordance with Section 01 3300, "Submittals."
 - a. Submit Traffic Control Plan for Project Construction prior to the start of construction activities for approval by University's Representative.
 - b. Submit Pedestrian Access Plan for Project Construction prior to the start of construction activities for approval by University's Representative.

~~1.2. TEMPORARY ACCESS ROADS~~

~~1.3. HAUL ROUTES~~

1.4. TEMPORARY PARKING AREAS

A. Parking: Limited parking for workers employed on the Work may be provided on the Project Site to the extent that space for that purpose is available without interference with activities of University or activities related to performance of the Work. Refer to Section 01 3540 "Environmental Mitigation".

1. All vehicles are required to display a parking permit while parked on campus. Transportation and Parking Services will sell parking permits to contractors, their employees and sub-contractors in parking lots where spaces are currently available for purchase. 2014-15 monthly permit rates are \$40/Gold, \$47/Blue and \$64/Red. All rates are subject to change. Monthly permits are available at the Parking Service Building located at 683 Linden Street. Daily permits can be purchased in the Parking Service Building, at information kiosks at campus entrances, and in posted visitor parking lots. Parking permits are lot specific. All vehicles entering the campus are required to adhere to the University's parking policies and the California Vehicle Code. .
2. Contractor may use available space within its Project Site fence limits for parking without a permit.
3. Provide 3 parking spaces within Contractor's Project Site fence limits for University's Representative and its Consultants use.

~~1.5. TEMPORARY ROADS~~

1.6. TRAFFIC CONTROL

A. Prior to the start of construction activities, determine the routing of construction vehicles and the measures necessary to control traffic during construction. Provide measures including, but not limited to, the following:

1. Contractor is responsible for controlling construction traffic on and adjacent to the site, including public right-of-ways. Comply with requirements of authorities having jurisdiction for traffic controls in public right-of-ways.
 - a. Provide necessary measures including, but not limited to, flag personnel, barricades, sufficient lights, reflectors, warning signals, warning signs indicating closures, directional, and detour instructions.
 2. Route construction equipment, trucks, and similar vehicles through the campus to Big Springs Road and existing public streets to and from the site as approved by the University's Representative and as specified in Section 01 3540 Environmental Mitigation.
 3. Schedule deliveries to minimize disruption of University traffic and duration of on-site storage.
- B. Traffic Control Plan for Project Construction.
1. Contractor and all subcontractors shall ensure that the construction site and access road speed limits are established and enforced during the Contract Time until Substantial Completion. Post and enforce traffic speed limits of 15 miles per hour or less on all unpaved roads.
 2. Contractor and all subcontractors shall comply with the Traffic Control Plan for project construction prepared by Contractor and approved by University's Representative prior to the commencement of construction activities.
 3. To the extent reasonable, Contractor and all subcontractors shall maintain at least one unobstructed lane in both directions on campus roadways. At any time only a single lane is available, Contractor and all subcontractors shall provide a temporary traffic signal, signal carriers (i.e., flag persons), or other appropriate traffic controls, as approved by University's Representative, to allow travel in both directions. If construction activities require the complete closure of a roadway segment, contractor and all subcontractors shall provide appropriate signage indicating alternative routes as approved by University's Representative.
 4. To maintain adequate access for emergency vehicles when construction activities would result in roadway closures, Contractor shall give 14-days notice to the University's Representative, so that the University's Representative can consult with the UCPD, EH&S, and Riverside Fire Dept. as appropriate to disclose closures and identify alternative travel routes.
 5. The hauling and disposal of any excess clean soil excavated from or already stockpiled on the site will be the responsibility of the contractor to transport and stockpile it at the UCR Ag Ops area located near Lot 13 as directed by the University Representative. Refer to Section 31 2000 Earth Moving for additional information regarding the collection and disposal of unsatisfactory material and debris.
 6. All construction traffic will access the Project Site from the west and through the campus. Construction traffic will avoid using Valencia Hill Drive, Watkins Drive and Big Springs Road. There are two existing, posted construction traffic warning signs at the corner of Watkins Drive and Valencia Hill Drive which shall remain in place and maintained by the Contractor for the duration of the Project and will be the Contractor's responsibility to remove and dispose of the signs at the completion of the Work.
- C. Pedestrian Access Plan for Project Construction.
1. Contractor and all subcontractors shall comply with the Pedestrian Access Plan for project construction prepared by the Contractor and approved by University's Representative, prior to the commencement of construction activities.

1.7. STAGING AREAS

- A. Staging Area is the Loading Dock for the School of Medicine Education Building 1. This staging area must be coordinated with School of Medicine Education Building 2 project and contractor. Access may be limited because concurrent construction projects.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 5600 TEMPORARY BARRIERS AND ENCLOSURES

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes:

1. General Cleaning and Protection
2. Temporary Fire Protection
3. Temporary Barricades, Warning Signs, Signals and Lights
4. Temporary Fencing
5. Temporary Protective Walkways

1.2. GENERAL CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.

26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

1.3. TEMPORARY FIRE PROTECTION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the University's Representative.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," and requirements of the University.
 1. Locate fire extinguishers where convenient and effective for their intended purpose.
 2. Store combustible materials in containers in fire-safe locations.
 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in all buildings and anywhere on site.
 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

1.4. TEMPORARY BARRICADES, WARNING SIGNS, SIGNALS AND LIGHTS

- A. Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
 1. Enclose excavations and openings with proper barricades.
 2. Clearly identify hazards on and adjacent to the Project site. Maintain clearly visible and, if applicable, audible identification on a continuous 24-hour-per-day basis.
 3. Illuminate barricades, warning signs, obstructions, and other hazards at night. Provide adequate light for clear visibility from sunset to sunrise.
 4. Where appropriate, provide audible warning signals.

1.5. TEMPORARY FENCING

- A. Control of pedestrian and vehicular traffic through and adjacent to areas of exterior work that may require temporary fencing, is the Contractor's responsibility. The installation of such temporary controls shall be submitted in advance to the University authorities of installation, and shall be maintained by the Contractor at all times.

1.6. TEMPORARY PROTECTIVE WALKWAYS

- A. Protection of finish floor coverings inside building and adjacent areas to project may require temporary covering and is Contractor's responsibility. Such areas shall be maintained by the Contractor at all times.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 5700 TEMPORARY CONTROLS

PART 1 – GENERAL

1.1. SUMMARY

A. This Section Includes:

1. Control of Construction Water
2. Dust Control, Air Pollution, and Odor Control
3. Noise Control
4. Temporary Erosion and Sediment Control (SWPPP)
5. Temporary Environmental Controls
6. Temporary Pest Control
7. Biological Resources
8. Cultural Resources
9. Aesthetics
10. Air Quality

1.2. CONTROL OF CONSTRUCTION WATER

- ##### A. Provide impermeable floor coverings and suitable dams to prevent damage by water used for the Work. Immediately clean up and remove all surplus water and water spilled in non-working areas. Do not allow water to overflow gutters, flood streets or parking lots.

1.3. DUST CONTROL, AIR POLLUTION, AND ODOR CONTROL

A. The Contractor shall employ measures to prevent the creation of dust, air pollution and odors.

1. Unpaved areas where vehicles are operated shall be periodically wetted down or given an equivalent form of treatment as defined in South Coast Air Quality Management District (SCAQMD) Rule 403 to eliminate dust formation.
2. All volatile liquids including fuels or solvents shall be stored in closed containers.
3. No open burning of debris, lumber or other scrap will be permitted.
4. Equipment shall be maintained in a manner to reduce gaseous emission.
5. Low sulfur fuel shall be used for construction equipment.
6. Stockpiles of excavated materials shall be covered with material approved by University's Representative.
7. Contractor shall provide street sweeping whenever silt from construction site is carried over to adjacent streets.

B. Provide measures, including regular watering, necessary to minimize air-borne dust.

1. Exposed surfaces should be watered twice daily.
2. Stockpiles of excavated materials should be covered.
3. A berm shall be erected on the downslope of the project site to prevent silt-laden water from running off site.
4. Trucks carrying excavated materials from the site shall be covered and shall have their tires and undercarriages washed prior to exiting the site as required to remove material that may fall or blow off later.
5. Paving of exposed dirt surfaces should be done as quickly as is reasonably possible.

6. Streets affected by fugitive dust shall be swept regularly.
 7. The Contractor shall assign a person to be responsible for monitoring dust levels, reviewing conditions with the University's Representative, and suggesting appropriate additional control measures when required.
 8. Uncovered soil shall be bound by grass or similar ground cover as soon as is reasonably possible.
 9. Excavation should not be conducted when surface winds exceed 11 miles per hour.
 10. Unnecessary idling of construction vehicles and equipment shall be avoided.
- C. All contractors, and overseen by the General Contractor, shall implement dust control measures consistent with South Coast Air management District (SCAQMD) Rule 403 – Fugitive Dust during the construction phases on the project development.
1. Apply water and/or non-toxic chemical soil stabilizers according to manufacturer's specifications to all inactive construction areas (previously graded areas that have been inactive for 10 or more days).
 2. Replace ground cover in disturbed areas as quickly as possible.
 3. Enclose, cover, water twice daily, or apply approved chemical soil binders to exposed piles with 5 percent or greater silt content.
 4. Water active grading sites at least twice daily.
 5. Suspend all excavating and grading operations when wind speeds (as instantaneous gusts) exceed over 25 mile per hour over a 30-minute period.
 6. All trucks hauling dirt, sand, soil, or other loose material are to be covered or should maintain at least two feet of freeboard (i.e., minimum vertical distance between top of the load and top of the trailer) in accordance with section 23114 of the California Vehicle Code.
 7. Sweep streets at the end of the day if visible soil material is carried over to adjacent roads.
 8. Install wheel washers where vehicles enter and exit unpaved roads onto paved roads, or wash off trucks and any equipment leaving project site for each trip.
 9. Apply water three times daily of chemical soil stabilizers according to manufacturer's specifications to all unpaved parking or staging areas or unpaved road surfaces.

1.4. NOISE CONTROL

~~A. Noise control shall be maintained by the contractor in all areas of construction, guarding against any undue noise which may impair proper use of existing facilities. Activities with the highest noise potential shall be scheduled for the times when background ambient noise levels are highest (i.e., during peak commute hours). Contractor shall use noise suppressed equipment available and/or shall muffle/control noise on equipment to the maximum extent possible. Noisy construction related operations (e.g. mixing concrete) shall be accomplished on-site to the extent feasible. Those noisy, construction related operations shall be performed on those areas of the site furthest from noise sensitive receptors i.e. residence halls, off-site community, etc."~~

OR

Noise control shall be maintained by the contractor in all areas of construction, guarding against any undue noise, which may impair proper use of existing facilities. Contractor shall use noise suppressed equipment available and control noise on equipment to the maximum extent possible.

B. The following noise control procedures shall be employed:

- ~~1. Maximum Noise: The Contractor shall use equipment and methods during the course of this work that are least disruptive to adjacent offices or residences. Noise levels for trenchers, graders, trucks and pile drivers shall not exceed 90 dBA at 50 feet as measured under the noisiest operating conditions. For all other equipment, noise levels shall not exceed 85 dBA at 50 feet.~~

OR

Noise control shall be maintained by the contractor in all areas of construction, guarding against any undue noise, which may impair proper use of existing facilities. Contractor shall use noise suppressed equipment available and control noise on equipment to the maximum extent possible.

- ~~2. Equipment: Jack hammers shall be equipped with exhaust mufflers and steel muffling sleeves. All diesel equipment shall have exhaust muffled. Air compressors shall be of a quiet type such as a "whisperized" compressor.~~

OR

Equipment: Jack hammers shall be equipped with exhaust mufflers and steel muffling sleeves. All diesel equipment shall have exhaust muffled. Air compressors shall be of a quiet type such as a "whisperized" compressor. Require contractors to use the quietest among alternative equipment or to muffle/control noise from available equipment to the maximum extent possible.

AND/OR

~~Require Mufflers and Other Noise Attenuators on Project Construction Equipment: All contractors, and overseen by the General Contractor, shall ensure that noise producing construction equipment and vehicles using internal combustion engines will be equipped with mufflers; air inlet silencers where appropriate; and any other shrouds, shields, or other noise-reducing features in good operating condition that meet or exceed original factory specification. Mobile or fixed "package" equipment (e.g., arc welders, air compressors) will be equipped with shrouds and noise control features that are readily available for that type of equipment. Stationary construction equipment, material and vehicle staging shall be placed to direct noise away from sensitive receptors.~~

AND OR

Require Use of Electrically Powered Equipment: All contractors, and overseen by the General Contractor, shall ensure that work use electrically powered equipment instead of pneumatic or internal combustion-powered equipment, where feasible.

- ~~3. Operations: Machines shall not be left idling. Electric power shall be used in lieu of internal combustion engine power wherever possible. Equipment shall be maintained to reduce noise from vibration, faulty mufflers, or other sources.~~

OR

Operations: Machines shall not be left idling. Electric power shall be used in lieu of internal combustion engine power wherever possible. Equipment shall be maintained to reduce noise from vibration, faulty mufflers, or other sources.

- ~~4. Scheduling: Noisy operations shall be scheduled so as to minimize the disturbance and duration to adjacent neighborhoods and nearby student Housing complexes.~~

OR

Scheduling: Noisy operations shall be scheduled so as to minimum their disturbance to occupied adjacent areas and duration at any given location. Schedule activities with highest noise potential for times when background ambient noise levels are highest.

5. Location: Consider noise sensitive areas around the site when planning locations of operations which cause higher levels of noise, and perform those tasks in less sensitive areas when possible. Schedule work that will generate vibrations, uncontrolled dust, noise levels in excess of 65 dBA, interior- 85 dBA, exterior and potentially hazardous conditions for time periods that are the least disruptive to the University and the surrounding residential neighborhood.

6. ~~Use of High Vibration Construction Equipment near Lothian Residence Hall~~

~~a. All contractors, and overseen by the General Contractor, shall schedule construction activity entailing use of high vibration generating equipment within 75 feet of Residence Halls during periods when students are not in residence, to the extent feasible.~~

~~Prohibit Noise producing Signals: All contractors, and overseen by the General Contractor, shall prohibit the use of noise producing signals, including horns, whistles, alarms, and bells, except for safety purposes only. Public address or music systems will also be prohibited.~~

1.5. TEMPORARY EROSION AND SEDIMENT CONTROL

A. Exposed earth surfaces shall be watered to minimize dust generation as necessary according to weather conditions.

B. During winter construction, an erosion and sediment-transport control plan incorporating standard erosion control practices shall be implemented prior to the first day of earth moving activities.

1. Erosion control shall include retaining sediments within project site by the use of catch basins; using interceptor ditches and benches to prevent gulying of slopes; and preparing and implementing erosion control plans.

C. Storm Water Pollution Prevention Plan (SWPPP):

1. This project has an active SWPPP permit and the university has retained a SWPPP management consultant for this project. The contractor shall take over the contract of the SWPPP consultant for the SWPPP management of the project for the duration of the schedule until substantial completion. Contact David Beckwith, President, David Beckwith & Associates at (714) 349-7007. The details of the SWPPP for Glen Mor 2 and its implementation can be viewed online at the California State Water Resources Board's SMARTS website (type "University of California, Riverside").

2. Refer to Section 01 2100 Allowances for the description of the SWPPP allowance.

3. For additional information see Section 31 1000 "Site Clearing".

4. Protection Against Inclement Weather: Brace, secure, and cover all parts of the Work to prevent damage by inclement weather. Refer to Section 3.9 Storm Water Control for SWPPP information.

5. Protect the Work from damage due to nuisance water such as rainwater, surface runoff, and irrigation water. Comply with requirements of the University's Representative regarding routing and disposal of nuisance water.

- D. Storm Water Control
1. This project already has an open SWPPP permit on file. Refer to Section 01 1400 “Contractor’s Use of the Project Site” for more detailed SWPPP information.
 - a. Provide engineering, drawings, etc., to meet the requirements.
 2. Erect berm and other appropriate measures to prevent water from running off site and staging area.
 3. Erect berm and other appropriate measures to prevent water from entering the site and staging area.
 4. Temporary Storm Water Pollution Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.
- 1.6. TEMPORARY ENVIRONMENTAL CONTROLS
- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce levels of harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.
 - B. See also Section 01 3543, Environmental Procedures.
- 1.7. TEMPORARY PEST CONTROL
- A. N/A
- 1.8. BIOLOGICAL RESOURCES
- A. Pre-Construction Surveys for Burrowing Owls will be conducted (by University representatives) **not more than 30 days prior to ground disturbance and/or construction related activities**. No ground disturbance and/or construction related activities shall begin until survey complete and any avoidance measures identified and implemented.
 - B. Pre-Construction Nesting Bird Surveys will be conducted (by University representatives) **within a maximum of 7 days prior to initiation of ground disturbance activities** when vegetation removal will occur between February 15 and September 15. No ground disturbance activities shall occur until survey complete and any avoidance measures identified and implemented.
 1. Prior to initiation of ground disturbance activities, disturbance limits adjacent to or within the Arroyo shall be clearly staked by University representatives, including disturbance limits associated with Arroyo improvements. Access to the Arroyo shall be limited to existing roads and shall be fenced to ensure unnecessary encroachment to the Arroyo does not occur.
 - C. Minimize Temporary Impacts
 1. Biological Resources to be avoided during construction, include identified California Dept. of Fish and Game (CDFG) jurisdictional streambeds and riparian habitats, and shall be

avoided if practicable. No impacts on the Arroyo shall occur outside of staked disturbance limits.

2. At a minimum, the following areas shall be avoided:
 - a. Riparian vegetation adjacent to the path/culvert removal.
 - b. Riparian vegetation located at the northwest side of the south abutment temporary work area for Bridge 2.
 - c. CDFG jurisdictional streambed located on the south side of the bank re-contouring area.
 - d. The mature cottonwood tree near the Valencia Hill culvert extension work limit.
 - (1) The following measures will be implemented to minimize disturbance to the cottonwood tree at the Valencia Hill culvert work area:
 - (2) Establishment and demarcation of a tree protection zone. This should be accomplished under the guidance of an International Society of Arboriculture (ISA) certified arborist and employ a protective barrier consisting of 3-foot- high orange construction fencing. The preferred protection zone shall encompass a buffer of 5 feet beyond the drip line, or 15 feet from trunks, whichever is greater. Where the proposed improvements extend into the preferred protection zone, placement of the protective barrier shall minimize encroachment into the preferred protection zone to the maximum extent practical.
 - (3) Pruning of tree roots, limbs and canopy prior to start of construction, under the guidance of an ISA certified arborist and in accordance with ISA pruning standards (for instance, cuts made clean and to the bark collar of the closest joint on the branch). Pruning should occur during the dormant period (approximately November to March).
 - (4) Construction of the Valencia Hill culvert extension shall be monitored by an ISA certified arborist. The arborist may require implementation of best management practices to minimize disturbance within the work limits, including but not limited to padding of vehicles, minimizing soil removal or addition, and use of protective matting.
 - (5) Upon completion of construction, the tree shall be evaluated by an ISA certified arborist. Evaluations shall occur quarterly for one full year to monitor for signs of failure (including canopy dieback, reduced size or number of leaves, premature fall color). If in the opinion of the arborist, the tree is not showing signs of failure, it shall be determined that the avoidance measures have been successful and no further action shall be required.
 - (6) If post-construction monitoring indicates the tree has failed, the measures provided for below shall be implemented to replace the lost functions and values:
 - (7) In the event the mature cottonwood tree at the Valencia Hill culvert extension is determined to have failed the re-vegetation plan shall include the following measures to replace the lost functions and values:

- (8) Replacement planting of three coast live oaks on the upper bank within the removed canopy area. Replacement trees shall be at least 6 inch caliper and 10 feet in height.
 - (9) Replacement planting of Fremont's cottonwood (15 gallon minimum) along the stream channel within the area immediately downstream of the extended culvert. The total number of replacement trees (live oak and cottonwood) shall provide a minimum 1:1 replacement ratio based on the 85-inch diameter at breast height (DBH) measurement of the existing cottonwood tree. It is expected compliance with this measure would require planting of approximately 25 to 30 cottonwood trees.
- e. To reduce disturbance of Natural and Naturalistic Open Space areas:
- (1) Unnecessary driving in sensitive or otherwise undisturbed areas shall be avoided. New roads or construction access roads would not be created where adequate access already exists.
 - (2) Removal of native shrub or brush shall be avoided, except where necessary.
 - (3) Drainages shall be avoided, except where required for construction. Limit activity to crossing drainages rather than using the lengths of drainage courses for access.
 - (4) Excess fill or construction waste shall not be dumped in washes.
 - (5) Vehicles or other equipment shall not be parked in washes or other drainages.
 - (6) Overwatering shall be avoided in washes and other drainages.
 - (7) Wildlife including species such as fox, coyote, snakes, etc. shall not be harassed. Harassment includes shooting, throwing rocks, etc.
- D. Worker Education Program
1. All contractors, and overseen by the General Contractor, shall participate in a worker education program for all construction personnel prior to personnel initiating ground disturbance activities, which will include a discussion of the importance of the Arroyo and areas within the Arroyo to be avoided (including parking and staging of equipment), a discussion of native wildlife with the potential to occur, and education on not harassing native wildlife.
- E. Biological Monitoring During Construction
1. All contractors, and overseen by the General Contractor, shall cooperate with and follow required direction from the qualified biologist who shall monitor the project for compliance with best management practices.
- F. Exotic species

1. Any exotic species removed shall be properly handled to prevent sprouting or re-growth. Construction equipment shall be cleaned of mud or other debris that may contain invasive plants and/or seeds and inspected to reduce the potential of spreading noxious weeds before mobilizing to the work of construction. Cleaning of any equipment shall occur at least 300 feet from the Arroyo area and before leaving the work area during the course of construction.

1.9. CULTURAL RESOURCES

A. Protection and Recovery of Buried Artifacts

1. If an archaeological resource is discovered during construction, all soil-disturbing work within 100 feet of the find shall cease and the University Representative shall be notified and shall contact a qualified archaeologist within 24 hours of discovery to inspect the site. If a resource within the project area of potential effect is determined to qualify as a unique archaeological resource (as defined by CEQA), the University shall devote adequate time and funding to salvage the material. Any archaeologically important artifacts recovered during monitoring shall be cleaned, catalogued, and analyzed, with the results presented in a report of finding that meets professional standards.
2. In the event of the discovery of a burial, human bone, or suspected human bone, all excavation or grading in the vicinity of the find shall halt immediately and the area of the find shall be protected and the University immediately shall notify the Riverside County Coroner of the find and comply with the provisions of P.R.C. Section 5097 with respect to Native American involvement, burial treatment, and re-burial, if necessary.

1.10. AESTHETICS

- A. Strict adherence to the approved Detailed Planting Plans to Maintain Existing View Corridors.

1.11. AIR QUALITY

- A. All construction vehicles and equipment containing an internal combustion engine and operating on the project site shall meet EPA-certified Tier 2 emission standards or higher. Contractor shall maintain on-going verification records of equipment certification as new equipment is delivered to the site for University Representatives to review for compliance.
- B. Low NOx diesel fuel and construction equipment shall be used to the extent that is readily available at the time of construction. Contractor shall maintain on-going, updated records for University Representatives to review for compliance.
- C. The following Air Quality reduction procedures shall be implemented throughout the construction process:
 - a. Compliance with all SCAQMD rules and regulations.
 - b. Maintenance programs to assure vehicles remain in good operating condition.
 - c. Avoid unnecessary idling of construction vehicles and equipment.
 - d. Use of alternative fuel vehicles.
 - e. Provision of electrical power to site to eliminate the need for on-site generators.
- D. All off-road equipment operating on project site, as well as on-road heavy-duty vehicles (including hauling and material delivery trucks) traveling to and from the project site will be fitted

with an oxides catalyst. Contractor shall maintain on-going verification records of equipment certification as equipment is delivered to the site for University Representatives to review for compliance.

- E. Limited on-campus parking outside the project site boundaries will be made available for construction workers. The University will provide contractors' workers with limited, free, on-campus parking in a designated portion of Lot 13 across Big Springs Rd from the project site.
1. Confine parking to the construction site or specifically designated areas of Lot 13. Vehicles parked elsewhere are subject to Campus parking fees or fines. Campus parking permits are available through Parking Services of **\$56.00** per month (check with Parking Services for daily and weekly rates) per vehicle. Rate is subject to change.
 2. Contractor may use available space within its Project fence limits for parking without a permit.
 3. Provide 3 parking spaces within the staging area for University's Representative and its Consultants use.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 5800 TEMPORARY SIGNAGE

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes:

1. Temporary Project Signage.
2. Temporary Interior Signage.

1.2. TEMPORARY PROJECT SIGNAGE

- A. Project Identification: Two (2) 8' x 4' post mounted temporary project identification signs are already in place at two locations on the site. The Contractor shall make minor text revisions of the name of the UCR Vice Chancellor, the project's construction firm and the time of occupancy. Verify the actual copy with University Representative.
- B. Contractor shall make minor changes to the required text on the (2) Project identification signs. The text shall match the existing (black times Roman) font and dimensions on the sign. **All Stars Signs of Escondido** is a pre-approved supplier to UC Riverside project signs although any vendor can be used. Contractor to change the name of the Vice Chancellor, change the name of the project construction firm and change the time of occupancy. Verify the actual copy with University Representative.
- C. Provide signs for traffic direction and warnings such as "Construction Project" and "Keep Out" to facilitate control of personnel and vehicles. Use only the minimum number necessary, to 2' x 4' maximum size.
- D. ~~Provide 3 signs along the construction fence facing south and 3 signs along the west side with the telephone number for the Neighbor Complaint HotLine.~~
- E. After text changes have been made, reinstall signs securely on existing wood posts. Maintain in good condition throughout the construction period and remove upon completion, including concrete footings, if any.
- F. Contractor shall submit all name and title changes on the existing signs to University's Representative for approval prior to installation. Contractor shall review completed project sign with University Representative, prior to installation.

1.3. TEMPORARY INTERIOR SIGNAGE

- A. A. When and if there are construction activities within the shell of the building, and as and when such activities may affect ingress and/or egress, or normal business operations, the Contractor shall provide cautionary and directional signage to aid the public, and to maintain public safety.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 6000 PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project:
1. Quality Assurance
 2. Product Delivery, Storage, and Handling
 3. Product Selection
 4. Product Installation
- B. Definitions: The Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.
 - b. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.
 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.2. QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
1. Each prime contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate contractors.
 2. If a dispute arises between prime contractors over concurrently selectable, but incompatible products, the University's Representative will determine which products shall be retained and which are incompatible and must be replaced.

- C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
 - 1. No available domestic product complies with the Contract Documents.
 - 2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.
- D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
 - 3. UL Label: Provide products bearing appropriate UL label as indicated.

1.3. PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 5200, Paragraph 1.5.

PART 2 – PRODUCTS

2.1. PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation, except where salvaged materials are indicated.
 - 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
 - 1. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract

- Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
2. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
 3. Visual Matching: Where Specifications require matching an established Sample, the University Representative's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
 4. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The University's Representative will select the color, pattern, and texture from the product line selected.

PART 3 – EXECUTION

3.1 PRODUCT INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01 7100 EXAMINATION AND PREPARATION

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes:

1. Mobilization
2. Acceptance of Conditions
3. Construction Layout
4. Construction Surveying
5. Protection of Adjacent Construction
6. Non-Destructive Concrete Examination

1.2. MOBILIZATION

A. Mobilization shall be identified on the project schedule and shall be accompanied with all necessary Campus notifications and approvals in-place. Various day-to-day activities shall be notified to the Campus and any building occupants in advance of mobilization.

1.3. ACCEPTANCE OF CONDITIONS

1. Prior to commencing the Work, the Contractor and University's Representative shall tour together the Project site (and areas immediately surrounding the site) to examine and record damage to existing buildings and improvements constructed under a prior contract. As such the Contractor accepts the work constructed on site "as-is" and must finish what is installed into a complete and functional system.
2. This record shall serve as a basis for determination of subsequent damage due to Contractor's operations and shall be signed by all parties making the tour. Any cracks, sags, or damage to the adjacent buildings, improvements and landscaping elements not noted in the original survey, but subsequently discovered, shall be reported to University's Representative within 15 days from Notice to Proceed.
3. The Contractor shall prepare a report of the survey, including:
 - a. DVD recording of existing conditions.
 - b. 8" x 10" glossy photographs of significant features requested by University's Representative.
 - c. Key plan with references to video/photographs
4. The Contractor and University Representative shall periodically monitor conditions of existing buildings and installations for signs of movement, settlement, or other damage related to construction.
5. Contractor is solely responsible for repairing damage to existing construction and finishes and for replacing damaged components, which cannot be repaired.
6. Contractor is solely responsible for maintaining and watering existing landscaping within the Project site and for replacing landscaping elements, which are damaged or destroyed during the course of the Work.

1.4. CONSTRUCTION LAYOUT

1.5. CONSTRUCTION SURVEYING

1.6. PROTECTION OF ADJACENT CONSTRUCTION

1.7. NON-DESTRUCTIVE CONCRETE EXAMINATION

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 7123 FIELD ENGINEERING

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section specifies administrative and procedural requirements for field-engineering services including, but not limited to, the following:
1. Surveys, Lines, and Levels Examination.
 2. Surveys, Lines, and Levels Performance.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Identification: The University's Design Professional or its designee will identify existing control points including horizontal and vertical control points.
- B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost and destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
 2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.
- C. Establish and maintain a minimum of 2 permanent benchmarks on the site, referenced to data established by survey control points.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work Contractor shall employ and pay for underground utilities service company to investigate and verify the existence and location of all underground utilities and other construction.
1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.
 2. The Drawings show, if applicable, existing above and below grade structures, drainage lines, storm drains, sewers, water, gas, electrical, hot water and other utilities, which are known to the University.
 3. Existing installations shall be kept in service where possible and damage to them shall be repaired with no adjustment of Contract Sum.
 4. If any other structures or utilities are encountered, request University's Representative to provide direction on how to proceed with the Work.

5. If any structure or utility is damaged, take appropriate action to ensure the safety of persons and property. Repair damage and restore utility to service at no cost to the University.
6. Obtain University Representative approval at least 30 days prior to any service shutdown or cutover. All utility shut downs shall be kept to a minimum. Contractor shall coordinate for all shut downs to occur during weekend hours without change to the contract sum. Identify date, time and expected duration (no more than 8 hours duration) of all utility shutdowns. There will be no shut downs for sewer services, must do bypass.

3.2 PERFORMANCE

- A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
 1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
 2. As construction proceeds, check every major element for line, level, plumb, movement, settlement, or other damage.
- B. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.
- C. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with, and obtain required approvals from University's Representative.

END OF SECTION

SECTION 01 7329 CUTTING AND PATCHING

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes general administrative and procedural requirements for cutting and patching, including without limitation, the following:
 - 1. Submittals
 - 2. Quality Assurance
 - 3. Warranty
 - 4. Materials
 - 5. Inspection
 - 6. Preparation
 - 7. Performance
 - 8. Cleaning
- B. Requirements of this Section apply to mechanical and electrical installations. Refer to Specification Divisions 20-28 for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.
- C. Refer to other applicable Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
- D. Cutting and Patching, in addition to requirements of the General Conditions, includes removing, altering, and repairing portions of the Work as required to accomplish the following:
 - 1. Make several parts fit properly.
 - 2. Uncover work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove samples of installed work as specified or requested by the University's Representative for testing.
 - 5. Install new construction penetrations of or connections to existing construction.

1.2. SUBMITTALS

- A. Cutting and Patching Proposal: Submit written notice to the University's Representative requesting permission to proceed with cutting which could affect structural safety of the project 10 days in advance of starting cutting. Request approval to proceed. Include the following information, as applicable, in the proposal:
 - 1. Describe the extent of cutting and patching required. Show how it will be performed and indicate why it cannot be avoided.
 - 2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 - 3. List products to be used and firms or entities that will perform Work.
 - 4. Indicate dates when cutting and patching will be performed.
 - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out-of-service. All utility shut downs shall be kept to a minimum. Contractor shall coordinate for all shut downs to occur during weekend hours without change to the contract sum. Identify date, time and expected duration (no more than 8 hours duration) of all utility shutdowns. There will be no shut downs for sewer services, must do bypass.

6. Approval by the University's Representative to proceed with cutting and patching does not waive the University's Representative right to later require complete removal and replacement of unsatisfactory work.

B. Changed Conditions Notice: Submit written recommendations to the University's Representative should conditions of work or schedule indicate change of materials or methods, including the following:

1. Conditions indicating change.
2. Recommendations for alternative materials and methods.
3. Information required for substitution.

1.3. QUALITY ASSURANCE

A. Requirements for Structural Work:

1. Obtain approval of the cutting and patching proposal before cutting and patching structural elements including, but not limited to, the following:

- a. Foundation construction.
- b. Structural concrete.
- c. Miscellaneous structural metals.
- d. Piping and equipment.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems

- a. Primary operational systems and equipment.
- b. Fire protection systems.
- c. Communication systems.
- d. Electrical wiring systems.
- e. Security systems

C. Visual Requirements: Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patch in a visually unsatisfactory manner.

1.4. WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 – PRODUCTS

2.1. MATERIALS

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action and notify University's Representative before proceeding.
 - 1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
 - 2. Provide drawings and calculations signed by a licensed California Structural Engineer for shoring, bracing and support to maintain structural integrity.
 - 3. Protect other portions of the Project.
 - 4. Protect Project from the element.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.
 - 1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
 - 4. Comply with requirements applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
 - 5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 3. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.4 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01 7400 CLEANING AND WASTE MANAGEMENT

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes:
 - 1. Progress Cleaning and Site Maintenance
 - 2. Construction Waste Management and Disposal
 - 3. Final Cleaning
 - 4. Contractor C&D Waste Monitoring Form and Green Waste Monitoring Form, copies of which are attached at the end of this Section.
- B. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
- C. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and antipollution regulations.
 - 1. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in streams, storm or sanitary drains.
 - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.
 - 3. Comply with requirements of Southern California Air Quality Management District in effect at the time of construction.
 - 4. Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.
- D. Submittal: Prior to requesting inspection for Substantial Completion and Final Completion, submit written certification to the University's Representative that final cleaning has been performed in accordance with the Contract Documents.

1.2. PROGRESS CLEANING AND SITE MAINTENANCE

- A. Collection and Disposal of Waste: Contractor shall furnish all labor, equipment, containers, transportation, materials, supplies and related expenses to provide the University with comprehensive waste collection and waste recycling services for the Project. Contractor shall collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 degrees F (27 degrees C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly.
 - 1. Do not burn waste materials. Do not bury debris or excess materials on the University's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems or streams. Remove waste materials from the site and dispose of lawfully.
 - 2. Where extra materials of value remain after completion of associated Work, they become the University's property. Dispose of these materials as directed by the University's Representative.

3. Provide on-site containers for collection of waste materials, debris, and rubbish, and empty at least weekly. Maintain containers in such condition so as to ensure they are clean and sanitary, to prevent odor and insect infestation, and ensure no unsightly presentation. Perform maintenance on the containers as required to ensure proper function for the intended purpose.
4. Handle waste materials in a controlled manner. Do not drop or throw materials from heights.
5. Remove combustible debris from the building daily and store in covered, non-combustible containers located not less than 40 feet from any building.

B. Cleaning During Construction Period: Comply with regulations of the University and safety standards for cleaning.

1. Schedule cleaning operations so that dust and other contaminants resulting from cleaning operations will not settle on wet paint, or other coatings or finishes during their cure period.
2. Comply with manufacturer's instructions for cleaning the surfaces and parts of finishes and equipment. Use only those cleaning materials and procedures recommended by the manufacturer of the item to be cleaned.
3. Provide cleaning during construction as necessary to ensure operations can proceed on schedule and that finish materials can be installed properly and viewed for determination of aesthetic characteristics.

1.3. CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. The University has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible shall be employed to enable the University to meet a minimum 95% percent diversion of construction and demolition (C&D) waste (including green waste) from the landfill.

B. Contractor shall be responsible for monitoring and maintaining a written log using the C&D Waste Monitoring Form and Green Waste Monitoring Form, copies of which are attached at the end of this Section, to report when actual container deliveries and waste pickups occur, the types of C&D waste material included, weight of each type (in Tons) diverted or landfilled and total percentage of waste diverted from landfill, and any other data required to be reported on the respective forms. Contractor shall submit completed forms with the required data to University's Representative, or designee, **with each Application for Payment**. Such written information shall be used as backup to support payment of Contractor's scheduled value for Division 1, General Requirements.

C. C&D waste is a combination of concrete, lumber, plaster, cardboard, glass, various metals, paper, PVC, ABS, HDPE, PP, PDPE, PET, white foam, paint buckets, carpet, green waste, and dirt.

1. C&D waste accepted for recycling:

- a. Card Board.
- b. Mixed metals.
- c. PVC Pipe.
- d. ABS Pipe.
- e. H.D.P.E. Pipe.
- f. Carpet.
- g. Carpet Pad.
- h. Mixed Plastics.
- i. Glass.

- j. Bottles & Cans – CRV.
- k. H.D.P.E Plastics.
- l. H.D.P.E Pipe.
- m. Foam – White.
- n. Paper – Mixed.
- o. Plastic Buckets – Paint (empty) & Landscapers.
- p. Drywall.
- q. Wood.
- r. Particle Board.
- s. Green Waste:
 - (1) Green Waste refers to waste resulting from removal of vegetation; it is a combination of brush, branches, leaves, flowers, shrubs and small trees and other items listed on the Green Waste Monitoring Form.
 - (2) Green Waste accepted for recycling and/or compost:
 - (a) Grass Clippings.
 - (b) Trees – Tree trunks shall be cut into 4' and 10" pieces.
 - (c) Branches – Branches shall be cut into 4' and 10" pieces.
 - (d) Tree Trimmings – All other material other than trunks, branches, and leaves.
 - (e) Wood.
 - (f) Mulch.
 - (g) Brush.
 - (h) Leaves.
 - (i) Flowers.
 - (j) Shrubs.
 - (k) Palm Fronds.
- t. Inert Material – Soil, Asphalt, Brick, Concrete

1.4. FINAL CLEANING

- A. This Section includes the administrative and procedural requirements for final cleaning at Substantial Completion and Final Inspection.
- B. Provide final-cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial cleaning and maintenance program. Comply with manufacturer's instructions.
- C. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.
 - 1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.
 - 2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - 3. Remove petrochemical spills, stains, and other foreign deposits.
 - 4. Remove tools, construction equipment, machinery, and surplus material from the site.
 - 5. Remove snow and ice, if any, to provide safe access to the building.
 - 6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural

- weathering of exterior surfaces. Restore reflective surfaces to their original condition.
7. Remove debris and surface dust from limited access spaces, including trenches, equipment vaults, manholes and similar spaces.
 8. Broom clean concrete floors in unoccupied spaces.
 9. Remove labels that are not permanent labels.
 10. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 11. Wipe surfaces of electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 12. Remove grease, dust, dirt, stains, and other marks from surfaces exposed-to-view.
 13. Leave the Project clean.
- D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.
- E. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- F. Where extra materials of value remain after completion of associated Work, they become the University's property. Dispose of these materials as directed by the University's Representative at no additional cost to the University.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 7700 CONTRACT CLOSEOUT

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
 - 1. Substantial Completion
 - 2. Final Inspection Acceptance
 - 3. Closeout Procedures
 - 4. Instruction and Evaluation of University's Personnel
 - 5. Training Tools and Materials
 - 6. Qualifications of Instructors
 - 7. Operation and Maintenance Manuals and Instructions
 - 8. Spare Parts and Extra Stock Materials
 - 9. Warranties
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 33.

1.2. SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise the University of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance and service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases enabling the University unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Submit record drawings, operation and maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra stock, and similar items.
 - 7. Make final changeover of permanent locks and transmit keys and key schedule to the University. Advise the University's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems and instruction of the University's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleanup requirements, including touchup painting.
 - 10. Touch up and otherwise repair and restore marred, exposed finishes.
 - 11. Adjust and balance all systems and adjust all valves.
 - 12. Check fluid and gas carrying pipe systems, roofs, flashings, gutters, and downspouts for leaks. Repair or replace as necessary.

13. Lubricate all moving parts of machinery and equipment as recommended by the manufacturers of the machinery and equipment.
14. Submit certification required in Section 01 7400 for "Final Cleaning."

B. Inspection Procedures: On receipt of a request for inspection, the University's Representative will either proceed with inspection or advise the Contractor of incomplete or incorrect work. The University's Representative will prepare the Punchlist following inspection or advise the Contractor of what must be completed or corrected before the certificate will be issued.

1. The University's Representative will repeat inspection when requested and assured that the Work is substantially complete.
2. Results of the completed inspection will form the basis of requirements for final acceptance.
3. Allow 3 weeks for the University's Representative to prepare the list of items to be corrected.

1.3. FINAL INSPECTION ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the University Representative's final inspection list of items to be completed or corrected, endorsed and dated by the University's Representative. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the University's Representative.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the University took possession of and assumed responsibility for corresponding elements of the Work.
5. Submit consent of surety to final payment.
6. Submit a final liquidated damages settlement statement.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
8. Completed Punchlist.

B. Reinspection Procedure: The University's Representative will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the University's Representative.

1. Upon completion of reinspection, the University's Representative will prepare a certificate of final acceptance. If the Work is incomplete, the University's Representative will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated and related costs of University's Representative and University Representative's Consultants will be deducted from final retention payment.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the University's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Operation and Maintenance manuals.
 2. As-Built documents.
 3. Spare parts and materials.
 4. Tools.
 5. Lubricants.
 6. Fuels.
 7. Identification systems.
 8. Control sequences.
 9. Hazards.
 10. Cleaning.
 11. Warranties and bonds.
 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Startup.
 2. Shutdown.
 3. Emergency operations.
 4. Noise and vibration adjustments.
 5. Safety procedures.
 6. Economy and efficiency adjustments.
 7. Effective energy utilization.

3.2 INSTRUCTION AND EVALUATION OF UNIVERSITY'S PERSONNEL

- A. Perform hands-on demonstrations and instruction for University's designated personnel in the operation, adjustment and maintenance of products, equipment, and systems, as required and at agreed upon times.
- B. Instruction Before Final Inspection: Before Final Inspection, and after work under this contract is completed, tested and prior to acceptance by the University; and not less than five (5) days after submittal of the Operation and Maintenance Data, operate all the systems for a period of three (3) 8-hour periods during which time a qualified factory trained representative familiar with the items installed shall instruct and supervise the University's Personnel in the operation and maintenance of the equipment and systems. This instruction period is in addition and subsequent to any period of operation, testing and adjustment called for elsewhere in these specifications.
- C. Instruction by Manufacturer's Representatives: Any instructions from manufacturer's representatives required under other sections of this specification shall be conducted during this period. This instruction period shall be conducted after completion of all piping and equipment labeling required by the Contract.
- D. Time of Instructions: Make all arrangements and notices for operation and instruction periods through the University's Representative.
- E. Seasonal Operation: For equipment requiring seasonal operation, perform demonstrations and instructions for each required season and at agreed upon times.
- F. Evaluation: During and after demonstrations and instructions for University's designated personnel, evaluate their ability to perform the necessary maintenance and operation functions required to properly operate and maintain each piece of equipment. Make sure

that at the end of the training session, the University's designated personnel are reasonably proficient in the operations and maintenance of products, systems, and equipment.

3.3 TRAINING TOOLS AND MATERIALS

- A. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance. For all systems requiring operation and maintenance training from factory representative, written authorization from the University is required. All systems of more than one manufacturer, a factory representative from each will be required.
- B. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

3.4 QUALIFICATIONS OF INSTRUCTORS

- A. Instructions for the University's Personnel. For instruction of the University's operating and maintenance personnel, use experienced instructors thoroughly trained and experienced in the operation and maintenance of the building equipment or system involved.

3.5 OPERATION AND MAINTENANCE MANUALS AND INSTRUCTIONS

- A. Assemble and furnish a minimum of 3 complete sets (unless otherwise indicated in a specific section) of all mechanical and electrical systems data, except that noted to be mounted in frames, in three-ring loose-leaf binders, complete with index, with indexed dividers permanently attached and exterior labels on cover and back of binders.
- B. Data Required:
 - 1. Manufacturers' Manuals: Provide complete installation, operation, maintenance, and service manuals and printed instructions and parts lists for all materials and equipment, where such printed matter is regularly available from the manufacturer. This includes but is not limited to such service manuals as may be sold by the manufacturer covering the operation and maintenance of items, and complete replacement parts lists sufficiently detailed for parts replacement ordering to manufacturer. Bound publications need not be assembled in binders.
 - 2. Equipment Nameplate Data: A typewritten list of all mechanical and electrical equipment showing all equipment nameplate data exactly. Identify equipment by means of names, symbols, and numbers used in the Contract Documents.
 - 3. System Operating Instructions: Typewritten instructions covering operation of the entire system as installed (not duplicating manufacturers' instructions for operating individual components). Include schematic flow and control diagrams as appropriate and show, locate, or list system valves, control-elements, and equipment components using identification symbols and numbers. List rooms, area of equipment served, and show proper settings for valves, controls, and switches.
 - 4. System Maintenance Instructions: Typewritten instructions covering routine maintenance of systems. List each item of equipment requiring inspection, lubrication, or service and briefly describe such maintenance, including types of lubricants and frequency of service. It is not intended that these instructions duplicate manufacturers' detailed instructions. Give name, address, and phone number of nearest firm authorized or qualified to service equipment or provide parts.
 - 5. Warranty, Bonds, and Service Contracts: Provide a copy of each warranty, bond, and service contract issued. These should be accompanied by a sheet which outlines procedures to take in the event of failure and the circumstances which might affect the validity of warranties or bonds.
 - 6. Wall Mounted Data: Frame one set of typewritten system instructions and diagrams as required under Paragraphs 3. and 4. above, covered with plexiglass and mount in locations as directed by the University's Representative.

3.6 SPARE PARTS AND EXTRA STOCK MATERIALS

- A. A. Contractor shall in advance of delivering any such materials notify the University's Representative for approval to receive materials.

3.7 WARRANTIES

A. General Provisions:

1. This subsection includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.
 - a. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
 - b. Refer to Divisions 2 through 33 for specific requirements for warranties on products and installations specified to be warranted.
 - c. Certifications and other commitments and agreements for continuing services to University are specified elsewhere in the Contract Documents.
2. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
3. Effective Date: Warranties shall begin on the date of Final Acceptance unless specifically designated differently or a different date is mutually agreed upon in writing by the parties involved.
4. General Conditions require all items to be under warranty for a period of one (1) year from date of final completion (Notice of Completion) unless otherwise indicated. Warranties for more than one year required by individual Sections require a written warranty by Contractor and Subcontractor. Refer to individual Section of the Specifications to verify if longer warranties are required.

B. Definitions:

1. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the University.
2. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the University.

C. Warranty Requirements

1. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
2. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement.

The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

3. **Replacement Cost:** Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Regents have benefited from use of the Work through a portion of its anticipated useful service life.
4. **Regents' Recourse:** Expressed warranties made to the Regents are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Regents can enforce such other duties, obligations, rights, or remedies.
 - a. **Rejection of Warranties:** The Regents reserve the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - b. The Regents reserve the right to refuse to accept Work for the Project where a special guarantee, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented so that entities required to countersign such commitments are willing to do so.
5. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the University reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.
6. **Disclaimers and Limitations:** Manufacturer's disclaimers and limitations on standard product warranties shall not relieve the Contractor of the Contractor's warranty on the Work that incorporates the products, and shall also not relieve suppliers, manufacturers, and subcontractors required to counter-sign special warranties with the Contractor.

D. Warranty Submittals

1. Submit written warranties to the University's Representative prior to the date certified for Substantial Completion. If the University Representative's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion, or a designated portion of the Work, submit written warranties upon request of the University's Representative.
 - a. When a designated portion of the Work is completed and occupied or used by the University, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the University's Representative within 10 days of completion of that designated portion of the Work.
2. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the University, through the University's Representative, for approval prior to final execution.
 - a. Refer to Divisions 2 through 33 for specific content requirements and particular requirements for submitting special warranties.
3. **Form of Submittal:** At Final Completion compile 3 copies of each required warranty, in the form included at the end of this Section, properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

4. Assemble required guarantees, bonds, and service and maintenance contracts.
5. Number of original signed copies required: Three (3) sets, each on 8-1/2 inch x 11 inch sheets, 3-hole punched in 3-ring binders. Fold larger sheets to fit into binders. Submit in commercial quality, 3-ring binders, with durable, cleanable plastic covers. Each set of binders shall include:
 - a. Cover: Identify each binder on the cover with typed or printed title, "WARRANTIES", University's Project Name and Number, Name of General Contractor, and binder number, such as "Set 1, Volume 1 of 2", etc.
 - b. Table of Contents: in a spreadsheet/table format, neatly typed and in orderly sequence by CSI number, based on Specifications Table of Contents in the Bidding-Contract Documents, with the following information:
 - (1) CSI Number.
 - (2) Name of Product or Work item.
 - (3) Brief Scope Description.
 - (4) Firm name, address, telephone number, and name of principal with email address.
 - (5) Date of beginning of guarantee, bond, or service and maintenance contract.
 - (6) Duration and expiration date of warranty or service and maintenance contract.
 - c. When warranted, construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
 - d. Except when a special warranty is required by the provisions of a specific Section of these Specifications, or a standard warranty is not offered as a matter of record by the manufacturer of a specified product, submit the manufacturer's standard warranty for each product incorporated in the Work.
 - e. When a manufacturer does not offer a standard warranty, provide a written form listing the product and indicating "Standard Product Warranty Not Available."
6. Special Warranty Forms: Attached at the end of this Section.

END OF SECTION

GUARANTEE

Project Name: _____ Date: _____

Project Location: _____

Project Number: _____

GUARANTEE FOR _____ (the "Contract"), between
The (Specification SECTION and Contract No.)

The Regents of the University of California ("University") and

("Contractor")

(Name of Contractor or Subcontractor)

hereby guarantees to University that the portion of the Work described as follows:

which it has provided for the above referenced Project, is of good quality; free from defects; free from any liens, claims, and security interests; and has been completed in accordance with Specification SECTION and the other requirements of the Contract.

The undersigned further agrees that, if at any time within _____ months after the date of the guarantee the undersigned receives notice from University that the aforesaid portion of the Work is unsatisfactory, faulty, deficient, incomplete, or not in conformance with the requirements of the Contract, the undersigned will, within 10 days after receipt of such notice, correct, repair, or replace such portion of the Work, together with any other parts of the Work and any other property which is damaged or destroyed as a result of such defective portion of the Work or the correction, repair, or replacement thereof; and that it shall diligently and continuously prosecute such correction, repair, or replacement to completion.

In the event the undersigned fails to commence such correction, repair, or replacement within 10 days after such notice, or to diligently and continuously prosecute the same to completion, the undersigned, collectively and separately, do hereby authorize University to undertake such correction, repair, or replacement at the expense of the undersigned; and Contractor will pay to University promptly upon demand all costs and expenses incurred by University in connection therewith.

SUBCONTRACTOR

Signed: _____ Title: _____
Typed Name: _____
Name of Firm: _____
Contractor License Classification and Number: _____
Address: _____
Telephone Number: _____

CONTRACTOR

Signed: _____ Title: _____
Typed Name: _____
Name of Firm: _____

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INTENTIONALLY

SPECIAL WARRANTY FORM

When required in Sections of the Specifications, Special Warranties shall be in the following form and written on Contractor's own letterhead:

"Warrant _____
(portion of work warranted)

Project: _____

Address: _____

Date: _____

We, the undersigned hereby warrant to the Regents of the University of California ("Regents") that the portion of the work identified, which we have installed in the above-named Project has been performed in accordance with the Contract Documents and that the work, as installed, will fulfill the requirements of the warranty included in this Specification. We agree to repair or replace any or all of our work, together with any other work which may be damaged or displaced by so doing, that may prove to be defective in its workmanship, materials, operation, or failure to conform to Contract provisions and requirements within a period of year(s) from date of Substantial Completion of the stipulated below for the above-named Project, without any expense whatever to the said Regents, ordinary wear and tear and unusual abuse or neglect excepted. In the event of our failure to comply with the above-mentioned conditions within ten (10) calendar days after being notified in writing by the Regents, we collectively or separately do hereby authorize the Regents to proceed to have said defects repaired and made good at our expense, including all collection cost and reasonable attorney fees, and we will honor and pay the costs and charges therefore upon demand."

WARRANTY PERIOD: _____ STARTING: _____ TERMINATING _____

Name of General Contractor

Name of Subcontractor

Signature of General Contractor

Signature of Subcontractor

Address

Address

Phone Number

Phone Number

State License Number

State License Number

Name of Manufacturer

Manufacturer Phone Number

Signature of Manufacturer

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**SECTION 01 7839
AS-BUILT DOCUMENTS****PART 1 – GENERAL****1.1. SUMMARY**

- A. This Section includes administrative and procedural requirements for As-Built Documents, including without limitation, the following:
1. As-Built Drawings
 2. As-Built Specifications
 3. As-Built Product Data
 4. As-Built Sample Submittal
 5. Miscellaneous As-Built Submittals
 6. Recording
- B. As-Built Documents required include the following:
1. Marked-up copies of Drawings.
 2. Marked-up copies of Shop Drawings.
 3. Newly prepared drawings.
 4. Marked-up copies of Specifications, Addenda, and Change Orders.
 5. Marked-up Product Data submittals.
 6. Samples.
 7. Field records for variable and concealed conditions.
 8. Record information on Work that is recorded only schematically.
 9. Operation and Maintenance Data submittals.
 10. Miscellaneous submittals.
- C. Maintenance of Documents and Samples: Store As-Built Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use As-Built Documents for construction purposes. Maintain As-Built Documents in good order, legible condition, and in a clean, dry, secure, fire-safe location. Make As-Built Documents and Samples available at all times for the University's Representative's inspections.
1. Maintain 1 set of all As-Built Documents at the Project site for the entire duration of construction.
 2. Clearly label each document or item "AS-BUILT DRAWING," "AS-BUILT SAMPLE," "AS-BUILT SPECIFICATION," or similarly as appropriate and applicable.
- D. Do not conceal Work requiring verification for As-Built Documents until such information has been verified and recorded.

1.2. AS-BUILT DRAWINGS

- A. Markup Procedure: During construction, maintain a clean, undamaged set of blue- or black-line white prints of Contract Drawings and Shop Drawings for As-Built Document purposes.
1. Mark these Drawings to show the actual installation where the installation varies from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to, the following:
 - a. Dimensional changes to the Drawings.
 - b. Revisions to details shown on the Drawings.
 - c. Depths of foundations below the first floor. Indicate foundation elevations relative to first floor elevation.
 - d. Horizontal locations and vertical depths of underground utilities and appurtenances, including both site utilities and those under buildings and structures, referenced to permanent surface improvements.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Changes made by change order or field order.
 - h. Changes made following the University Representative's written orders and pertinent graphic and written responses to RFI's.
 - i. Details not on original Contract Drawings.
 2. Mark As-Built prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
 3. Mark As-Built sets with red erasable colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 4. Mark important additional information that was either shown schematically or omitted from original Drawings. Mark new information that is important to the University but was not shown on Contract Drawings or Shop Drawings.
 5. Note field order numbers, alternate numbers, change order numbers, RFI numbers, ASI numbers, and similar identification.
 6. Identify and date each drawing; include the printed designation "AS-BUILT DRAWING" in a prominent location on each drawing
- B. Responsibility for Markup: The individual or entity who obtained As-Built data, whether the individual or entity is the installer, subcontractor, or similar entity, shall prepare the markup on As-Built drawings.
1. Accurately information in an understandable drawing technique.
 2. Record data as soon as possible after obtaining it, but within 24 hours maximum. Record and check the markup prior to enclosing concealed installations.
 3. At time of Substantial Completion, submit As-Built drawings to the University's Representative for the University's records. Organize into sets and bind and label sets for the University's continued use. Bind each set with durable-paper cover sheets. Include appropriate identification, including titles, dates, and other information on the cover sheets.
- C. Newly Prepared As-Built Drawings: Prepare new drawings instead of following procedures specified for preparing As-Built drawings where new drawings are required, and the University's

Representative determines that neither original Contract Drawings nor Shop Drawings are suitable to show the actual installation.

- D. Consult with the University's Representative for the proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. When completed and accepted, integrate newly prepared Drawings with procedures specified for organizing, copying, binding and submittal of As-Built drawings.

1.3. AS-BUILT SPECIFICATIONS

- A. During the construction period, maintain 3 copies of the Specifications, including addenda and modifications issued, for As-Built Document purposes.
 - 1. Mark the Specifications to indicate the actual installation where the installation varies from that indicated in Specifications and modifications issued. Note related project record drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later.
 - a. In each Specification Section where products, materials, or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.
 - b. Record the name of the manufacturer, supplier, installer, and other information necessary to provide a record of selections made and to document coordination with As-Built Product Data submittals and maintenance manuals.
 - c. Note related As-Built Product Data, where applicable. For each principal product specified, indicate whether As-Built Product Data has been submitted in maintenance manual instead of submitted as As-Built Product Data.
 - d. Use pen and black ink so marks will reproduce clearly.
 - 2. Upon completion of markup, submit As-Built Specifications to the University's Representative for the University's records.

1.4. AS-BUILT PRODUCT DATA

- A. During the construction period, maintain one copy of each Product Data submittal for As-Built Document purposes.
 - 1. Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation.
 - 2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 3. Note related change orders and markup of As-Built Drawings, where applicable.
 - 4. Upon completion of markup, submit a complete set of As-Built Product Data to the University's Representative for the University's records.
 - 5. Where As-Built Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as As-Built Product Data.

1.5. AS-BUILT SAMPLE SUBMITTAL

- A. Immediately prior to date of Substantial Completion meet with the University's Representative and the University's personnel at the site to determine which of the Samples maintained during the construction period shall be transmitted to the University for record purposes. Comply with the University Representative's instructions for packaging, identification marking, and delivery to the University's Sample storage space. Dispose of other Samples in a manner specified for disposing surplus and waste materials.

1.6. MISCELLANEOUS AS-BUILT SUBMITTALS

- A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous As-Built records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the University's Representative for the University's records.

- 1. Categories of requirements resulting in miscellaneous As-Built Documents include, but are not limited to, the following:
 - a. Field records on excavations and foundations.
 - b. Field records on underground construction and similar work.
 - c. Survey showing locations and elevations of underground lines.
 - d. Invert elevations of drainage piping.
 - e. Surveys establishing building lines and levels.
 - f. Authorized measurements utilizing unit prices or allowances.
 - g. Records of plant treatment.
 - h. Ambient and substrate condition tests.
 - i. Certifications received in lieu of labels on bulk products.
 - j. Batch mixing and bulk delivery records.
 - k. Testing and qualification of tradesmen.
 - l. Documented qualification of installation firms.
 - m. Load and performance testing.
 - n. Inspections and certifications by governing authorities.
 - o. Leakage and water-penetration tests.
 - p. Final inspection and correction procedures.
 - q. Field test reports.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

3.1 RECORDING

- A. Post changes and modifications to the As-Built Documents as they occur. Do not wait until the end of the Project. The University's Representative and IOR will periodically review As-Built Documents to determine compliance with this requirement.
- B. Current updated As-Built Documents shall be made available to the University's Representative and IOR for review at the time of submitting applications for payment.
- C. Per the General Conditions, the University has the right to withhold payment until As-Built Documents are completed and current to date as of the latest application for payment

END OF SECTION

LEED CONCRETE TRACKING FORM

PROJECT NAME: _____

CONTRACTOR: _____

SPEC SECTION: _____

CONTACT NAME: _____

Tel. no: _____ SUBMITTAL NO: _____

A. Mix Number	B. Supplier	C. Total Materials Cost of Concrete (\$)	D. Mass of recycled SCMs (lbs.)	E. Mass of total cementitious materials only (lbs.) ¹	F. SCMs as a percentage of total cementitious materials only (%) [D/E]	G. Dollar value of all cementitious materials only (\$) [from concrete supplier]	H. Recycled content value per yard (\$) [(F/2) x G]	I. Distances from both harvesting AND manufacturing point to project site (miles) ²
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

¹ This column includes Portland cement, recycled SCM's and any other cementitious ingredients that are not recycled (not total lbs. of concrete).

² Materials can travel more than 500 miles, provided materials always remain within 500 mile radius of project site.

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SECTION 01 8113 SUSTAINABLE DESIGN REQUIREMENTS

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section includes: Requirements and procedures for compliance with certain U.S. Green Building Council's (USGBC) LEED (Leadership in Energy and Environment Design) New Construction (NC) Version 3 (v3) prerequisites and credits needed for the Project to obtain at minimum LEED Silver certification with the goal being LEED Gold including:
1. Prerequisites and credits which the Owner intends to achieve.
 2. Requirements for LEED documentation and submittals.
 3. A copy of the LEED Project Checklist, attached at the end of this Section for information only.
- B. Definitions:
1. **Agrifiber Product:** Products consisting of fibrous material derived from the agricultural industry and typically characterized by rapidly renewable characteristics. Such products may consist of wheat straw, sugar cane, and other agricultural crops.
 2. **Chain-of-Custody Certificates:** Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 3. **Chain of Custody:** A tracking procedure to document the status of a product from the point of harvest, extraction, or recovery to the point of ultimate end use.
 4. **Chemical Waste:** Includes paints, adhesives, sealants, coatings, petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 5. **Chlorofluorocarbons (CFCs):** Any of various halocarbon compounds consisting of carbon, hydrogen, chlorine, and fluorine, once used widely as aerosol propellants and refrigerants. Chlorofluorocarbons have been identified to cause depletion of the atmospheric ozone layer.
 6. **Construction and Demolition Waste:** Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
 7. **Construction IAQ Management Plan:** A document that outlines measures to minimize contamination in a building during construction and to flush the building of contaminants prior to occupancy.
 8. **Cost Basis:** A basis of calculation wherein the input values are in terms of monetary cost (US Dollar).

9. **Hazardous Materials:** Includes pesticides, biocides, carcinogens, and “wet products” as listed by recognized authorities, such as the Environmental Protection Agency (EPA), International Agency for Research on Cancer (IARC), the State of California, and any special local requirements.
10. **Heat Island Effect:** A condition wherein elevated temperatures are experienced in urban landscapes as a result of solar energy retention within constructed bodies. Principal bodies that contribute to the heat island effect include streets, sidewalks, parking lots, and buildings.
11. **Interior Final Finishes:** Materials and products that will be exposed at interior occupied spaces, including flooring, wall covering finish carpentry, and ceilings.
12. **LEED v3 NC:** Leadership in Energy & Environmental Design, version 3 for New Construction. The LEED Green Building Rating System represents the US Green Building Council’s effort to provide a national standard for what constitutes a green building.
13. **Point of Extraction, Harvest, or Recovery:** The geographic location where the material was extracted, harvested, or recovered.
14. **Point of Final Assembly:** The geographic location where individual components are assembled into the product that is furnished and installed by the tradesmen.
15. **Post-Consumer Material:** Recycled material from consumer waste.
16. **Post-Consumer Recycled Content:** The percentage of material in a product (by weight) that was consumer waste. The recycled material was generated by household, commercial, industrial, or institutional end-users and can no longer be used for its intended purpose. It includes returns of materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking), and landscaping waste (e.g., leaves, grass clippings, tree trimmings). (ISO 14021)
17. **Pre-Consumer (Post-Industrial) Material:** Material diverted from the waste stream during the manufacturing process (can also be considered post-industrial). Excluded is reutilization of materials such as rework, re-grind or scrape generated in a process and capable of being reclaimed within the same process that generated it.
18. **Rapidly Renewable Materials:** Materials made from plants that are typically harvested within a 10-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils or wool.
19. **Recycled Content:** The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).
 - a. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
 - b. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

20. Regionally Extracted, Harvested, or Recovered Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.
21. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
22. Volatile Organic Compounds (VOCs): Carbon compounds emitted by materials that participate in atmospheric photochemical reactions. VOC's are common in building products and are emitted over time through outgassing. Sources of VOC's may include solvents in paints and other coatings; wood preservatives; strippers and household cleaners; adhesives in particleboard, fiberboard, and some plywoods; and foam insulation. When released, VOC can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, and damage to the liver, kidneys, and central nervous system, and possibly cancer.
23. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material being landfilled.
24. Weight Basis: A basis of calculation wherein the input values are in terms of weight (US Pound).

1.2. GENERAL REQUIREMENTS

- A. Work must be completed in accordance with the requirements of the U.S. Green Building Council's LEED Rating System for achieving the credits shown in the attached Checklist. Changes to the LEED Checklist shall be approved by the LEED Project Administrator.
- B. LEED credits needed to obtain LEED Gold certification are dependent on material selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits will be used as one criterion to evaluate substitution requests.
- C. Additional LEED prerequisites and credits needed to obtain the specified LEED certification are dependent on the design and other aspects of the Project that are not part of the Work under this Contract.
- D. LEED rating system applicable to the work shall be USGBC's LEED Rating System for New Construction and Major Renovations (LEED-NC), Version 3.
- E. LEED Registration: The LEED Project Administrator has registered the Project with the internet based LEED Tracking System "LEED-Online".
- F. The General Contractor shall provide a LEED Representative to provide and coordinate Contractor related services for LEED. The General Contractor's LEED Representative shall be a LEED Accredited Professional.
- G. Contractor's LEED® Representative shall be an individual responsible for implementation, coordination, and documentation of LEED® Credit Requirements specified herein. General Contractor's LEED® Representative shall attend LEED® Certification meetings and put together a LEED Action Plan critical showing how LEED prerequisites and credits requirements will be met. General Contractor's LEED® Representative shall be present on site at all times necessary when work is in progress to insure that the LEED Action Plan is being met.

- H. Other Sections in Divisions 02 through 33: Specific information related to sustainable design and in reference to LEED credits.
- 1.3. REFERENCE STANDARDS
- A. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE).
 - B. Carpet and Rug Institute (CRI): Indoor Air Quality Green Label Plus Testing Program.
 - C. CARB - California Air Resources Board Suggested Control Measures for Architectural Coatings
 - D. Environmental Protection Agency (EPA): Energy Star - Program Requirements for Roof Products
 - E. Energy Policy Act (EPACT) of 2005.
 - F. Forest Stewardship Council (FSC) "Principles and Criteria." G. Green Seal (GS) Environmental Standards.
 - G. LEED Reference Guide for New Construction and Major Renovations, Version 3 (LEED-Cv3).
 - H. South Coast Air Quality Management District (SCAQMD).
 - I. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- 1.4. LEED PROJECT GOALS
- A. This project shall incorporate campus-wide credits that were to be approved by the USGBC in March of 2012. The General Contractor shall be required to provide full credit documentation and back-up for each Credit, as required, as part of their Construction Submittal. The Contractor shall refer to the Project Checklist for LEED credits having bearing on the Contractor's scope of work. Any credit documentation required from a listed subcontractor who is unable to provide the required documentation shall then become the General Contractor's responsibility as part of their Construction Submittal.
 - B. Contractor shall appoint a LEED Representative to be present on-site to coordinate and insure LEED project goals/credits are achieved. The Contractor's LEED Representative will coordinate with the University's LEED Representative.
 - 1. The University's Representative will designate trades where the Contractor shall designate a LEED[®] Representative. Contractor's LEED[®] Representative shall be responsible for implementation, coordination, and documentation of relevant LEED[®] Credit Requirements specified herein. Contractor's LEED[®] Representative shall provide the General Contractor with all necessary documentation to insure LEED[®] prerequisites and credits requirements are met.
 - 2. General Contractor's LEED[®] Representative shall coordinate of all Contractors and shall insure Contractors not designated by the University to have a LEED[®] Representative, meet LEED[®] prerequisites and credits requirements, and provide sufficient documentation for LEED[®] compliance.
 - C. Contractor shall refer to the LEED-NC v3 "Reference Guide" for more detailed information and exact language of the requirements and the exact nature of the submittals, referred to as "credit templates and supporting documentation." The University's LEED Representative shall provide further details as needed.

- D. Contractor shall maintain a copy of the LEED-NC v3 “Reference Guide” on site. Additional information on LEED® and how to purchase copies of the LEED®-NC v3.0 reference guide and how to use LEED®-Letter Templates can be found at www.usgbcv.org and <https://leedonline.usgbc.org>.
- E. The following table summarizes the credits that need full documentation from the Contractor as noted in this LEED specification.

LEED® Certification	
LEED® REFERENCE	Point Description
SSp1: PTC	Construction Activity Pollution Prevention
MR 4.1 – 4.2: PTC	Recycled Content Material
MR 5.1 – 5.2: PTC	Local/Regional Materials
MR 6.0: PTC	Rapidly Renewable Materials
MR 7.0: PTC	Certified Wood
EQ 3.1 – 3.2: PTC	Construction IAQ Management Plan
EQ 4.1 – 4.4: PTC	Low-Emitting Materials

1.5. SUBMITTALS

- A. Sustainable Design and LEED submittals are in addition to other submittals. If submittal item is identical to that submitted to comply with other requirements, submit duplicate electronic copies as a separate submittal to verify compliance. Any discrepancies shall be referred to the Universities Representative for clarification.
- B. LEED Documentation Submittals shall be prepared and submitted using the LEED-Online credit website.
 - 1. The Contractor is responsible to obtain project access to LEED-Online and join the project using the project’s 15 digit project access code.
 - a. Contractor shall assign one representative to coordinate the LEED-Online PDF credit templates and submittal documents assigned to the Contractor.
 - b. Access to the credit templates requires installation of the current version of Adobe software as required by LEED-Online.
 - c. Additional instructions on how to access the project can be provided by the LEED Project LEED Administrator.
 - 2. Once the Contractor has joined the project through LEED-Online, the LEED Project Administrator will assign the LEED credits that the Contractor is responsible for completing.
 - a. Each credit template is an editable Adobe PDF document.
 - b. Each credit template may be completed or updated at any time prior to the LEED Construction Submittal.
 - c. After completion of documentation for each credit, use the “Save Template to LEED- Online” button at the lower right hand corner of the last page of the template to save the data.
 - d. Additional submittal documentation and back-up requirements should be uploaded to the LEED-Online website following the instructions for each credit.

3. LEED-Online submittals require calculations for items such as recycled content materials to be inserted into an online form called a template. Costs and materials need to be broken down and the calculations carried out on the templates.
 4. The Contractor is responsible for providing the information, downloading and completing the templates and uploading them on the LEED-Online website. Certain types of backup information such as the material safety data sheets (MSDS) for low-emitting materials, need to be submitted by the Contractor. The LEED-NC v3 "Reference Guide" provides detailed documentation requirements.
 - a. All Sub-Contractors shall provide the Contractor with the necessary cutsheets and MSDS data sheets for the materials used on site.
 5. The Contractor is responsible for providing resubmission of any requested information or documentation on the LEED-Online website in response to USGBC review comments to LEED credits previously submitted.
- C. LEED Materials Cost Analysis Sheet: Provide updates and maintain materials' cost data for recycled content, regional content and certified wood excluding mechanical, electrical, and plumbing components, and specialty items such as elevators and equipment, concurrent with each Application for Payment. The Project Administrator shall provide a template for use by the Contractor.
1. Provide actual material costs which can include shipping costs. Material costs should account for all taxes and transportation costs incurred by the contractor but, exclude labor and equipment costs once the material has been delivered to the site. For each material supplied for Divisions 3-11 specific material cost data for individual components and materials (not including labor) will be required to be provided as part of some LEED® pre-requisite and credit requirements submittals.
 2. For assemblies formulated from multiple materials (e.g., a composite wood panel) or a product made up of subcomponents (e.g., a window system), determine the percentage of applicable material content (percentage of weight for recycled content and for FSC wood as a percentage of total weight, volume or cost).
 3. Consistent numbers must be applied to various LEED® credits submittals requiring similar material cost data.
- D. LEED Data Sheet: Submit LEED Data Sheets with each submittal and with each change order. Sample form is attached at the end of this Section.
- E. LEED Action Plans: Provide the following plans within 14 days of date established in the Notice to Proceed:
1. Credit SS Prerequisite 1: Erosion and sedimentation control plan. See Sections 01 1400, 01 3540, and 31 1000 for requirements.
 2. Prerequisite EA 1.0: Plan for fundamental commissioning complying with the requirements in Section 01 9113.
 3. Credit MR 2.1 and 2.2: Construction and Demolition Debris Recycling (Waste Management) Plan in order to meet 95% construction waste diversion. See Section 01 7419 Construction Waste Management for requirements.
 4. Credit MR 4.1: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content. Use materials with recycled content such that the sum of postconsumer recycled content

plus ½ of the preconsumer content constitutes at least 10% based on cost of the total value of the materials in the project.

- b. Indicate cost of all products and materials used regardless of recycled content for the purpose of comparison so as to ultimately derive a cost-based percentage of recycled content.
5. Credit MR 5.1: List of proposed regional materials.
 - a. Identify each regionally extracted, processed, and manufactured material, its source, and cost.
 6. Credit MR 7.0: List of proposed certified wood products.
 - a. Include statement indicating costs for each product containing certified wood. In the case of manufactured products containing non-wood materials, only the new wood portion can contribute to this credit.
 - b. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
 7. Credit IEQ 3.1: Provide an Indoor Air Quality Plan for activities during construction following the SMACNA 2007 guidelines.
 8. Credit IEQ 3.2: Create a plan and schedule for building flush-outs to be performed in accordance with credit requirements after all finishes have been installed and the building has been completely cleaned before occupancy.
 9. Credit EQ 4.1, 4.2, 4.3 & 4.4: Low Emitting Materials
- F. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
1. Prerequisite SSp1 Construction Activity Pollution Prevention.
 2. Credit MR 2.1 and 2.2: Waste reduction progress reports.
 3. Credit MR 4.1 and 4.2: Recycled content.
 4. Credit MR 5.1 and 5.2: Regional material.
 5. Credit MR 7.0: Certified wood.
 6. Credit IEQ 3.1 and 3.2: Construction IAQ Management Plan: During Construction and Before Occupancy
- G. Within 21 calendar days of Project Substantial Completion, General Contractor shall provide to University's Representative an electronic copy of all LEED required documentation demonstrating compliance with LEED Certification requirements, including but not limited to, documentation provided during the submittal process. This shall be submitted through the Universities LEED Management Software.

1.6. SUBSTITUTIONS

- A. Requests for substitutions shall comply with the provisions of Section 01 2500 Product Options and Substitutions and the following additional requirements specified in this Article for LEED certification related materials and requirements and environmental products and procedures identified in this Section. Submit a description of the differences

of the proposed substitution from specified product related to LEED requirements. Include description of environmental advantages of proposed substitution over specified product.

1. No substitutions shall be submitted without the full projected LEED® impact documented.
2. Where LEED® material emission limits are specified, the University shall reject proposed substitutions where:
 - a. Data for VOC's is not provided.
 - b. Emissions of VOC's exceed the material's specified VOC limit.
 - c. There is negative impact on overall system efficiency.
 - d. The total number of LEED® credits will be compromised.
 - e. The intent of the LEED® credits are compromised.
- B. The Contractor is responsible for re-submittal of calculations and documentation of products or material substitutions that affect LEED prerequisites and credits referenced in this Section, and which apply to any credits previously submitted as part of the LEED Design Application Submittal, and credits included in the LEED Construction Submittal Products that do not meet these requirements shall not be submitted for substitution.

1.7. CREDIT REQUIREMENTS

- A. The following is a list of Credit Requirements for which the General Contractor shall contribute LEED® certification documentation demonstrating compliance with the corresponding LEED® Credit Requirements. The LEED BD&C v2009 Reference Guide shall be used along with following requirements.
- B. All Contractors shall provide the General Contractor with their trade's relevant documentation contributing to LEED® certification.
- C. The following Credit Requirements for LEED® compliance are in addition to those requirements specified elsewhere in the Specifications.
- D. Construction Activity Pollution Prevention (SSp1):
 1. Contractor shall comply with the Universities Erosion Control Plan.
 2. Keep an inspection report or photos to demonstrate compliance.
- E. Building Systems Commissioning: Contractor shall comply with the following requirements of LEED® Energy and Atmosphere Prerequisite 1 – Fundamental Building Systems Commissioning.
 1. Refer to Section 01 9113 General Commissioning Requirements.
- F. Construction Waste Management (MRc2): Contractor shall divert at minimum 95% of construction waste from the landfill by weight.
- G. Recycled Content (MRc4): Contractor shall use materials with recycled-content so that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10 percent of the total value of the materials in the project. (Mechanical and electrical components shall not be included in this calculation). Documentation includes:

1. Cost of each material or product, excluding cost of labor and equipment for installation.
 2. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product.
 3. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost.
- H. Local Regional Material (MRc5): Contractor shall provide a minimum of 10 percent (cost basis) of project materials that are extracted, processed, and manufactured within a radius of 500 miles of the project. Documentation Includes:
1. Cost of each material or product, excluding cost of labor and equipment for installation.
 2. Location of product manufacture and distance from point of manufacture to the Project Site.
 3. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site.
 4. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material.
 5. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product.
 6. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost.
- I. Certified Wood (MRc6): Contractor shall provide a minimum of 50% (cost basis) of all new non-salvaged wood-based materials that are certified in accordance with the Forest Stewardship Council (FSC) guidelines for wood building components.
1. Track certified wood purchases and retain associated COC (Chain of Custody) documentation. Collect copies of vendor invoices for each certified wood product. Maintain a list that identifies the percentage of certified wood in each purchase. In the case of manufactured products that combine wood and non-wood materials, only the new wood portion can be applied toward the credit.
 2. You will need a letter, cut sheet, or statement from the vendor indicating the type of FSC certification.
 - a. FSC Pure: valued at 100% of product cost.
 - b. FSC Mixed Credit: valued at 100% of product cost.
 - c. FSC Mixed (XX)%: A percentage of FSC content is indicated, and you can claim that percentage of the product's cost.

- d. FSC Recycled and FSC Recycled Credit: do not count toward this credit at all and can be left out of the baseline wood budget. FSC Recycled can count towards MRc4 Recycled Content.
- 3. If FSC wood is part of an assembly, **Request that manufacturers provide assembly information** broken down by weight, volume, or cost.
 - a. If in an assembly, only the portion of FSC certified wood can count towards this credit.
- J. Construction Indoor Air Quality Management Plan During Construction (IEQc3.1): Contractor shall develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and preoccupancy phases of Project buildings.
 - 1. General Contractor shall submit to University's Representative an electric copy of a Construction IAQ Management Plan within 14 calendar days of Notice to Proceed. Plan shall include, but not be limited to, the following:
 - a. Provision to meet the five requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008.
 - b. Provision to protect stored on-site or installed absorptive materials from moisture damage. This shall include a description of:
 - (1) Storage of materials on elevated platforms, under cover, and in a dry location.
 - (2) Secure coverage of the tops and sides of material with waterproof sheeting if materials are not stored in an enclosed location.
 - c. Provision to protect HVAC equipment during construction. This shall include a description and commitment to:
 - (1) Shut down the return side of the HVAC system during heavy construction or demolition and cover return air openings air tight to prevent introduction of contaminants.
 - (2) Provide temporary filters that shall be replaced with new media prior to occupancy if the HVAC system is operated during heavy construction.
 - d. Provision to take Construction Photographs demonstrating conformance with the approved Construction Indoor Air Quality Management Plan measures to insure protection of materials and air-handling equipment from moisture while stored on site.
 - (1) A minimum of 6 Construction Photographs shall be taken on three different occasions during Construction for a total minimum of 18. Construction photographs shall be time stamped and shall be taken during those periods' absorptive materials and HVAC equipment is stored on site. Construction Photographs shall include identification of the SMACNA approach featured by each photograph.
 - (2) Contractor shall submit Construction Photographs to the University's Representative for approval.
 - (3) If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.

Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

- K. Construction Indoor Air Quality Management Plan Before Occupancy (IEQc3.2): After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60 degrees F and a relative humidity no higher than 60%.
- L. If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,5000 cubic feet of outdoor air per square foot of floor area. Once the space is occupied, it must be ventilated at a rate of 0.30 cubic feet per minute (cfm) per square foot of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot of outside air has been delivered to the space. Provide a written narrative describing the building flush out procedures implemented. Provide Flushout Start Date and End Date for each building.

OR

Conduct baseline IAQ testing after construction ends and prior to occupancy using testing protocols consistent with the EPA Compendium of Methods for Determination of Air Pollutants in Indoor Air "or the ISO method listed in the table below. Testing must be done in accordance with one standard; project teams may not mix requirements from the EPA Compendium of Methods with ISO.

- M. Low-Emitting Materials:
 - 1. Credit EQc4.1: Adhesives, Sealants and Sealant Primers must comply with the South Coast Air Quality Management District (SCAQMD) Rule #1168. Volatile organic compound (VOC) limits listed in the table below correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.
 - a. Wood Glues: 30 g/L.
 - b. Metal to Metal Adhesives: 30 g/L.
 - c. Adhesives for Porous Materials (Except Wood): 50 g/L.
 - d. Subfloor Adhesives: 50 g/L.
 - e. Plastic Foam Adhesives: 50 g/L.
 - f. Carpet Adhesives: 50 g/L.
 - g. Carpet Pad Adhesives: 50 g/L.
 - h. VCT and Asphalt Tile Adhesives: 50 g/L.
 - i. Cove Base Adhesives: 50 g/L.
 - j. Gypsum Board and Panel Adhesives: 50 g/L.
 - k. Rubber Floor Adhesives: 60 g/L.
 - l. Ceramic Tile Adhesives: 65 g/L.
 - m. Multipurpose Construction Adhesives: 70 g/L.
 - n. Fiberglass Adhesives: 80 g/L.
 - o. Structural Glazing Adhesives: 100 g/L.
 - p. Wood Flooring Adhesive: 100 g/L.

 - q. Contact Adhesive: 80 g/L.
 - r. Special Purpose Contact Adhesive: 250 g/L.
 - s. Structural Wood Member Adhesive: 140 g/L.
 - t. Sheet Applied Rubber Lining Operations: 850g/L.
 - u. Plastic Cement Welding Compounds: 50 g/L.
 - v. ABS Welding Compounds: 4325 g/L.

- w. CPVC Welding Compounds: 490 g/L.
 - x. PVC Welding Compounds: 510 g/L.
 - y. Adhesive Primer for Plastic: 550 g/L.
 - z. Architectural Sealants: 250 g/L.
 - aa. Non-membrane Roof Sealants: 300 g/L.
 - bb. Roadway Sealants: 250 g/L.
 - cc. Single-ply Roof Membrane Sealants: 450 g/L.
 - dd. Other Sealants: 420 g/L.
 - ee. Sealant Primers for Nonporous Substrates: 250 g/L.
 - ff. Sealant Primers for Porous Substrates: 775 g/L.
 - gg. Other Sealants Primers: 750 g/L.
2. Credit EQ 4.2: Paints and coatings used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following criteria as applicable to the project scope.
- a. Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
 - b. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti- Corrosive Paints, 2nd Edition, January 7, 1997.
 - c. Clear wood finishes, floor coatings, stains, primers, sealers and shellacs applied to interior elements must not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
 - d. Flat Paints and Coatings: VOC not more than 250 g/L.
 - e. Non-Flat Paints and Coatings: VOC not more than 250 g/L.
 - f. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - g. Restricted Components: Paints and coatings shall not contain any of the following:
 - (1) Acrolein.
 - (2) Acrylonitrile.
 - (3) Antimony.
 - (4) Benzene.
 - (5) Butyl benzyl phthalate.
 - (6) Cadmium.
 - (7) Di (2-ethylhexyl) phthalate.
 - (8) Di-n-butyl phthalate.
 - (9) Di-n-octyl phthalate.
 - (10) 1,2-dichlorobenzene.
 - (11) Diethyl phthalate.
 - (12) Dimethyl phthalate.
 - (13) Ethylbenzene.
 - (14) Formaldehyde.
 - (15) Hexavalent chromium.
 - (16) Isophorone.

- (17) Lead.
- (18) Mercury.
- (19) Methyl ethyl ketone.
- (20) Methyl isobutyl ketone.
- (21) Methylene chloride.
- (22) Naphthalene.
- (23) Toluene (methylbenzene).
- (24) 1,1,1-trichloroethane.
- (25) Vinyl chloride.

Product Type	Referenced Standard	VOC Limit (g/L minus water)
Interior Flat Coating or Primer	Green Seal GS-11, 1993	50
Interior Non-Flat Coating or Primer	Green Seal GS-11, 1993	150
Anti-Corrosive/ Anti-Rust Paint	Green Seal GC-03, 2nd Edition, 1997	250
Clear Wood Finish: Lacquer	SCAQMD Rule 1113, 2004	550
Clear Wood Finish: Sanding Sealer	SCAQMD Rule 1113, 2004	350
Clear Wood Finish: Varnish	SCAQMD Rule 1113, 2004	350
Clear Brushing Lacquer	SCAQMD Rule 1113, 2004	680
Floor Coatings	SCAQMD Rule 1113, 2004	100
Sealers and Under coaters	SCAQMD Rule 1113, 2004	200
Shellac: Clear	SCAQMD Rule 1113, 2004	730
Shellac: Pigmented	SCAQMD Rule 1113, 2004	550
Stain	SCAQMD Rule 1113, 2004	250
Concrete Curing Compounds	SCAQMD Rule 1113, 2004	350
Japans/ Faux Finishing Coatings	SCAQMD Rule 1113, 2004	350
Magnesite Cement Coatings	SCAQMD Rule 1113, 2004	450
Pigmented Lacquer	SCAQMD Rule 1113, 2004	550
Waterproofing Sealers	SCAQMD Rule 1113, 2004	250
Waterproofing Concrete/ Masonry Sealers	SCAQMD Rule 1113, 2004	400
Wood Preservatives	SCAQMD Rule 1113, 2004	350
Low-Solids Coatings	SCAQMD Rule 1113, 2004	120*

*Note: VOC levels for Low-Solids Coatings are measured in grams of VOC per liter of material.

3. Credit EQ 4.3: All carpet installed in the building interior must meet the testing and product requirements of the Carpet and Rug Institute Green Label Plus program. All carpet cushion installed in the building interior must meet the requirements of the Carpet and Rug Institute Green Label1 program. All hard surface flooring must be certified as compliant with the FloorScore 2 standard (current as of the date of this rating system, or more stringent version) by an independent third-party. Flooring products covered by FloorScore include vinyl, linoleum, laminate flooring, wood flooring, ceramic flooring, rubber flooring and wall base.

IEQc4.3: LOW-EMITTING MATERIALS—FLOORING SYSTEMS REQUIREMENTS	
Option 1	
Carpet	Meet testing and product requirements of the Carpet and Rug Institute’s Green Label Plus program.
Carpet cushion	Meet requirements of the Carpet and Rug Institute Green Label program.
Carpet adhesives	Meet VOC limit of 50 g/L (Same as for EQc4.1).
Hard surface flooring (see exceptions below)	Meet the testing and product requirements of FloorScore certification.
Floor finishes	Meet the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004 (Same as for IEQc4.2).
Tile setting adhesives and grout	Meet the South Coast Air Quality Management District (SCAQMD) Rule 1168. VOC limits correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005. (Same as for IEQc4.1).
Tile, masonry, terrazzo, cut stone, and solid-wood flooring without coatings or sealants	Qualifies for credit without testing.
Option 2	
All flooring elements installed in the building interior	Meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.
Tile, masonry, terrazzo, cut stone, and solid-wood flooring without coatings or sealants	Qualifies for credit without testing.

4. Credit EQ 4.4: Composite wood and agrifiber products used on the interior of the building (i.e., inside the weatherproofing system) must contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde resins.

IEQc4.4: LOW-EMITTING MATERIALS—COMPOSITE WOOD AND AGRIFIBER PRODUCTS REQUIREMENTS	
Composite wood and agrifiber products: <ul style="list-style-type: none"> • Particleboard • Medium density fiberboard (MDF) • Plywood • Wheatboard • Strawboard • Panel substrates • Door cores • Plywood sections of I-beams 	No added urea-formaldehyde resins
Laminating adhesives used for assemblies	No added urea-formaldehyde resins

PART 2 – PRODUCTS

2.1. LEED ACTION PLANS

- A. See list of required plans.

2.2. LEED PROGRESS REPORTS

- A. See list of required progress reports.

2.3. LEED CREDIT DOCUMENTATION

- A. See LEED Data Sheet.

PART 3 – EXECUTION

3.1 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

- A. Product Data:

1. MERV ratings for all air filter media used should be provided in compliance with the requirements for Credit IEQ Pr1, Credits IEQ 3.1-3.2, and Credit IEQ 5.
2. Product emissions data and material safety data sheets (MSDS) showing compliance with the requirements for the following materials and credits:
 - a. Adhesives and sealants used on the interior of the building (Credit IEQ 4.1).
 - (1) Interior adhesives and sealants shall comply with the VOC limits of SCAQMD Rule #1168.

- (2) Aerosol Adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.
 - b. Paints and coatings used on the interior of the building. Indicate VOC content in grams per liter (g/l) calculated according to 40 CFR 59, Subpart D (EPA method 24) and chemical components (Credit IEQ 4.2).
 - (1) Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
 - (2) Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
 - (3) Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed the VOC content limits established for those coating types in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
 - c. Flooring products and materials (Credit IEQ 4.3).
 - (1) All Carpet and carpet cushion installed in the building must meet the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
 - (2) All hard surface flooring must meet the requirements of the FloorScore standards as shown with testing by an independent third-party.
 - (3) All flooring adhesives and finishes meeting IEQc4.1 and 4.2 requirements.
 - d. Composite wood materials (Credit IEQ 4.4).
 - (1) Composite wood and agrifiber products including laminating adhesives used on the interior of the building (i.e., inside the weatherproofing system) must contain no added urea-formaldehyde resins.
- B. Construction Indoor Air Quality Management Plan. During construction Contractor shall meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition 2007, ANSI/ SMACNA 008-2008 (Chapter 3). Submit a plan that addresses how SMACNA Guidelines will be met in each of the following five areas:
1. Material and equipment protection.
 2. Source control and materials emissions.
 3. Pathway interruption.
 4. Housekeeping.
 5. Material scheduling.

- C. Temporary Construction Ventilation-HVAC use and protection during construction: If used during construction, HVAC systems will either run 100 percent outside air or have MERV 8 air filters in place during construction. After construction MERV 13 filters shall be put in place. Contractor shall maintain sufficient temporary ventilation of areas where materials are being used that emit VOC's, and maintain ventilation continuously during installation, and until emissions dissipate after installation. If continuous ventilation is not possible via the building's HVAC system(s) then ventilation shall be supplied via open windows and temporary fans, sufficient to provide no less than three air changes per hour. Contractor shall submit a Pre-Occupancy Indoor Air Quality Management Plan that addresses the following:
1. The period after installation shall be sufficient to dissipate odors and elevated concentrations of VOCs. Where no specific period is stated in these Specifications, a time period of 72 hours shall be used.
 2. All areas shall be vented directly to outside. Areas shall not be vented to other enclosed areas.
 3. Estimated start and end dates of a building flush-out supplying a total air volume of 14,000 cubic feet of outdoor air per square foot of floor area.
 4. Use of MERV 13 filters prior to and after the building flush-out.
 5. Use of 100% outside air for the duration of the flush-out period.
- D. During dust producing activities (e.g. drywall installation and finishing) ventilation system shall be off, and openings in supply and return HVAC system shall be protected from dust infiltration. Provide temporary ventilation as required.
- E. Preconditioning: Prior to installation, Contractor shall allow products which have odors and VOC emissions to off-gas in dry, well-ventilated space outside of building for 14 calendar days, in order to allow for reasonable dissipation of odors and emissions.
- F. Signed LEED letters indicating proper completion of work for IEQ 3.1 and 3.2 Construction IAQ Management Plan, during construction and pre-occupancy.
- G. Photographs: Document the implementation of the SMACNA Guidelines during construction with six photographs at three different occasions (total of 18 photographs). Include a brief description of the measures in each photograph, location in the building, and the date the photograph was taken.

3.2 SEQUENCING

- A. Environmental Issues: Contractor shall complete all interior finish material installation no less than 14 days prior to Substantial Completion to allow for building flush out. Submit notification to General Contractor's LEED Representative when all interior finish material installation is complete, highlighting the date of completion.

3.3 FIELD QUALITY CONTROL

- A. Building Flush Out: Prior to Substantial Completion, Contractor shall flush out building continuously (i.e. 24 hours per day, 7 days per week) using 100 percent outside air at standard operational set-point temperatures for at least 14 calendar days. Conduct flush-out with new MERV 13 filtration media, and after flush-out, replace with new MERV 13 filtration media, except the filters solely processing outside air. For air handlers, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill, as determined by ASHRAE 52.2-1999. If interruptions of more than 4 hours are required for testing and balancing purposes, extend flush out period by a minimum of 1 day.

1. When touch-up work is performed, Contractor shall provide temporary construction ventilation during installation and extend building flush out by a minimum of 4 days after touch-up installation is complete.
 2. Return ventilation system to normal operation following flush-out period to minimize energy consumption.
 3. Replace all outside air filtration media prior to occupancy. Filtration media shall have a MERV of 13 as determined by ASHRAE 52.2-1999.
- B. IAQ Testing: If Building Flush Out is not undertaken, Contractor shall conduct a baseline indoor air quality testing procedure consistent with current EPA protocol for Environmental Requirements, Baseline IAQ and Materials.

3.4 PROTECTION

- A. Protect stored on-site and installed absorptive materials from moisture damage. Where absorptive materials not intended for wet applications are exposed to moisture, immediately remove from site and dispose of properly.
- B. Protect installed materials using methods that do not support growth of molds and mildews.
1. Immediately remove from site and properly dispose of materials showing signs of mold and signs of mildew, including materials with moisture stains.
 2. Replace materials showing signs of mold and mildew with new, undamaged materials.
 3. Ducts: Seal ducts during transportation, delivery, and construction to prevent accumulation of construction dust and construction debris inside ducts.
- C. Ducts: Seal ducts during transportation, delivery, and construction to prevent accumulation of construction dust and construction debris inside ducts.

END OF SECTION

LEED CREDIT CHECKLIST

Contractor Certification:

I, _____, a duly authorized representative of _____ (Contractor), hereby certify that the material information contained herein is an accurate representation of the material qualifications to be provided by Contractor, as components of the final building construction. Furthermore, I understand that any change in such qualifications during the purchasing period will require prior written approval from the University's Representative.

SIGNATURE OF CONTRACTOR'S AUTHORIZED REPRESENTATIVE: _____ Date: _____

P. ____ OF ____

Example:

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LEED DATA SHEET

Shall be submitted with each submittal along with cut sheets supporting the data below:

ENVIRONMENTAL MATERIALS REPORTING FORM (provide cut sheets for the data below)



PROJECT NAME: _____ CONTRACTOR: _____

SPEC SECTION: _____

CONTACT NAME: _____ TEL. NO: _____ SUBMITTAL NO: _____

Product Name	Vendor or Manufacturer	REQUIRED for ALL products identified in Specs <small>CSI 2004 Divisions 3-10, 31.00 Foundations, 32.10 Paving, 32.30 Site Improvements, and 32.90 Planning. MEP excluded.</small>	Percentage of the product salvaged, refurbished or reused ¹	Recycled Content ² (for concrete, use separate form)		Location and distances from manufacturing point to project site AND raw material harvesting point to project site (miles) ³	Percentage of product that is rapidly renewable ⁴	For all wood-based products ⁵			
				% post-consumer	% pre-consumer			% New wood	% Certified Wood	FSC Tracking COC #	Urea formaldehyde in composites (Y/N)
1.		Total Material Cost (excl. labor & equipment)				Harvest: Manufacture:					
2.						Harvest: Manufacture:					
3.						Harvest: Manufacture:					
4.						Harvest: Manufacture:					

CONTRACTOR CERTIFICATION:

I, _____ a duly authorized representative of _____ hereby certify that the material information contained herein is an accurate representation of the material qualifications to be provided by us, as components of the final building construction. Furthermore, I understand that any change in such qualifications during the purchasing period will require prior written approval from the Construction Manager and Owner.

SIGNATURE OF AUTHORIZED REPRESENTATIVE: _____ DATE: _____

D. _____ of _____

¹ **Salvaged:** Material or product which has been recovered from existing buildings or construction sites and reused in other buildings (e.g., structural beams, doors, brick).
² **Post-Consumer Recycled Content:** Portion of material or product which derives from discarded consumer waste that has been recovered for use as a raw material (e.g., plastic bottles, newspaper).
³ **Regional Materials:** Materials are considered regional if harvested AND manufactured within 500 miles of the project site. Materials can travel more than 500 miles, provided materials always remain within a 500 mile radius of project site. For salvaged/recycled materials such as steel, you do not need to provide the original harvesting location, but rather the location the steel was sourced from. Distances are as the crow flies, not actual miles traveled via surface transport.
⁴ **Rapidly Renewable:** Materials and products made from raw materials that are harvested within a 10-year cycle (e.g., bamboo, cork, linoleum, fast-growing poplar, wheatboard, wool carpet)
⁵ **FSC Certified:** Wood-based products which are certified by the Forest Stewardship Council and carry a Chain-of-Custody certificate number from the vendor or manufacturing.
Composite Wood & Agrifiber Products: Any wood based products must not contain added urea-formaldehyde.

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VOC REPORTING FORM

CONTRACTOR: _____

SECTION: _____

CONTACT NAME: _____

TEL. NO: _____

PROJECT NAME:

SPEC

SUBMITTAL NO:

Product type or application	Product name	Vendor or Manufacturer	Greenguard or SCS Certified (Y/N) (provide certificate): Systems Furniture and Seating Only	REQUIRED for ALL field-applied adhesives, sealants, paints & coatings identified in Specs (including those related to MEP work)		
				VOC content ¹ (grams per liter)	Corresponding LEED VOC limit	Backup documentation ²
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						

1. VOC: Volatile organic compound which vaporizes into a gas at normal room temperatures and is emitted during the use, application, curing, or drying of an adhesive, sealant, paint, or coating product (excludes methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, and other exempt compounds).
2. Submit backup documentation from manufacturer indicating VOC content of the product, defined in either grams per liter, or lbs. per gallon (e.g., MSDS sheet, Product Data Sheet)
3. Refer to the Sustainable Design Requirements Spec. for applicable VOC limits and chemical component limitations for adhesives, sealants, paints and architectural coatings.

CONTRACTOR CERTIFICATION:

I, _____ a duly authorized representative of _____ hereby certify that the material information contained herein is an accurate representation of the material qualifications to be provided by us, as components of the final building construction. Furthermore, I understand that any change in such qualifications during the purchasing period will require prior written approval from the Construction Manager and Owner.

SIGNATURE OF AUTHORIZED REPRESENTATIVE: _____

DATE: _____

p. _____ of _____

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SECTION 01 9113 GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned:

1. Commissioning Team
2. University's Responsibilities
3. Contractor's Responsibilities
4. CxA's Responsibilities
5. Commissioning Documentation
6. Submittals
7. Quality Assurance
8. Title 24 Acceptance Testing
9. Start-up, Pre-Functional Checklists and Initial Checkout
10. Functional Performance Testing
11. Operation and Maintenance Training Requirements
12. Costs of Commissioning Work
13. Equipment and System Schedule

B. Related Sections:

- a. Division 1 Section "Sustainable Design Requirements" for LEED Documentation related to commissioning.
- b. Audio visual equipment
- c. Fire suppression systems
- d. Plumbing systems
- e. HVAC systems, including Controls or Integrated Automation.
- f. Lighting and other electrical systems.
- g. Communications and Data systems.
- h. Safety and security systems.

C. Basis of Design (BOD) and Owner's Project Requirements (OPR) documentation prepared by University contains requirements that apply to this Section. This information is available to Bidders upon request.

D. Comply with the Acceptance Testing requirements of Title 24 Energy Code and ACM (Alternative Calculation Method) Approval Manual. Additional requirements are given in Part 3 of this Section.

1.2 DEFINITIONS

A. Commissioning Process: The basic purpose of building commissioning is to provide documented confirmation that building systems function in compliance with criteria set forth in the Project Documents to satisfy the owner's operational needs.

B. Basis of Design (BOD) document: A document that records concepts, calculations, decisions, product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

C. CxA: Commissioning Authority.

- D. University Project Requirements (OPR): A written document, prepared by the University, that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.
- E. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.
- F. TAB: Testing, Adjusting, and Balancing.
- G. Title 24: California Code of Regulations, Title 24, Part 1 - Building Energy Efficiency Standards (latest edition).

1.3 COMMISSIONING TEAM

- A. Members Appointed by Contractor: Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- B. Members Appointed by University:
 - 1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner may engage the independent CxA under a separate contract.
 - 2. Representatives of the facility user and operation and maintenance personnel.
 - 3. Architect and engineering design professionals.

1.4 UNIVERSITY'S RESPONSIBILITIES

- A. Provide the OPR documentation to the CxA and Contractor for use in developing the commissioning plan; systems manual; operation and maintenance training plan; and testing plans and checklists.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to the following:
 - 1. Coordination meetings.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Testing meetings.
 - 14. Demonstration of operation of systems, subsystems, and equipment.
- B. Provide the BOD documents, prepared by University or its consultants, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.5 CONTRACTOR'S RESPONSIBILITIES

- A. Provide utility services required for the commissioning process.
- B. Contractor is responsible for construction means, methods, job safety, and/or management function related to commissioning on the job site.
- C. Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
 - 1. Participate in construction-phase coordination meetings.

2. Participate in maintenance orientation and inspection.
 3. Participate in operation and maintenance training sessions.
 4. Participate in final review at acceptance meeting.
 5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
 6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 7. Review and comment on final commissioning documentation.
- D. Contractor shall integrate all commissioning activities into Contractor's master construction schedule.
- E. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
1. Participate in construction-phase coordination meetings.
 2. Participate in maintenance orientation and inspection.
 3. Participate in procedures meeting for testing.
 4. Participate in final review at acceptance meeting.
 5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.
 6. Provide information to the CxA for developing construction-phase commissioning plan.
 7. Participate in training sessions for University's operation and maintenance personnel.
 8. Provide updated Project Record Documents to the CxA on a daily basis.
 9. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Division 01 Section "Operation and Maintenance Data."
 10. Provide technicians who are familiar with the construction and operation of installed systems, who shall execute the test procedures developed by the CxA, and who shall participate in testing of installed systems, subsystems, and equipment.

1.6 CxA'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Conduct a commissioning design review of the OPR, BOD, and design documents prior to mid-construction documents phase and back-check the review comments in the subsequent design submissions, in accordance with LEED credit EA3 "Enhanced Commissioning".
- C. Prepare a construction-phase commissioning plan. Collaborate with design team, University, Contractor and with subcontractors to develop test and inspection procedures. Include design changes and scheduled commissioning activities coordinated with overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.
- D. Work with the University to schedule commissioning activities. All parties will address scheduling issues in a timely manner in order to expedite the commissioning process.
- E. Review and comment on submittals from Contractor for compliance with the OPR, BOD, Contract Documents, and construction-phase commissioning plan. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the OPR and BOD.

- F. Convene commissioning team meetings on a monthly basis for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The CxA shall prepare and distribute minutes to commissioning team members and attendees within five (5) workdays of the commissioning meeting.
- G. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.
- F. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the OPR, BOD, and Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.
- G. Prepare Project-specific test and inspection procedures and checklists.
- H. Schedule, direct, witness, and document tests, inspections, and systems startup.
- I. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- J. Certify date of acceptance and startup for each item of equipment for start of warranty periods.
- K. Review Project Record Documents for accuracy. Request revisions from Contractor to achieve accuracy. Project Record Documents requirements are specified in Division 01 Section "Project Record Documents."
- L. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the OPR, BoD, and Contract Documents. Operation and maintenance documentation requirements are specified in Division 01 Section "Operation and Maintenance Data."
- M. Review Contractor's operation and maintenance training program. Operation and maintenance training is specified in Division 01 Section "Demonstration and Training."
- N. Obtain the services of a professional agency to video the training sessions where required by individual Specification Sections.
- O. Video construction progress including hidden shafts.
- P. Prepare commissioning reports.
- Q. Assemble the final commissioning documentation, including the commissioning report and Project Record Documents.

1.7 COMMISSIONING DOCUMENTATION

- A. Index of Commissioning Documents: CxA shall prepare an index to include storage location of each document.
- B. Commissioning Plan: A document, prepared by CxA, that outlines the schedule, allocation of resources, documentation requirements of the commissioning process, and shall include, but is not limited to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
 2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
 3. Identification of systems and equipment to be commissioned.
 4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
 5. Identification of items that must be completed before the next operation can proceed.
 6. Description of responsibilities of commissioning team members.
 7. Description of observations to be made.
 8. Description of requirements for operation and maintenance training, including required training materials.
 9. Description of expected performance for systems, subsystems, equipment, and controls.
 10. Schedule for commissioning activities with specific dates coordinated with overall construction schedule.
 11. Identification of installed systems, subsystems, and equipment, including design changes that occurred during the construction phase.
 12. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
 13. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
 14. Step-by-step procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.
- C. Pre-Functional Checklists: CxA shall develop pre-functional checklists for all equipment to be commissioned. Further requirements are specified in Part 3 of this Section.
- D. Functional Performance Testing: CxA shall develop functional performance test procedures for all equipment and systems to be commissioned. Further requirements are specified in Part 3 of this Section.
- E. Certificate of Readiness: Certificate of Readiness shall be signed by Contractor, Subcontractor(s), and installer(s) certifying that systems, subsystems, equipment, and associated controls are ready for testing. Completed test checklists signed by the responsible parties shall accompany this certificate.
- F. Test and Inspection Reports: CxA shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- G. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.
- H. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BoD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

1. Creating an Issues Log Entry:
 - a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
 - b. Assign a descriptive title of the issue.
 - c. Identify date and time of the issue.
 - d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
 - e. Identify system, subsystem, and equipment to which the issue applies.
 - f. Identify location of system, subsystem, and equipment.
 - g. Include information that may be helpful in diagnosing or evaluating the issue.
 - h. Note recommended corrective action.
 - i. Identify commissioning team member responsible for corrective action.
 - j. Identify expected date of correction.
 - k. Identify person documenting the issue.

2. Documenting Issue Resolution:
 - a. Log date correction is completed or the issue is resolved.
 - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
 - c. Identify changes to the OPR, BOD, or Contract Documents that may require action.
 - d. State that correction was completed and system, subsystem, and equipment is ready for retest, if applicable.
 - e. Identify person(s) who corrected or resolved the issue.
 - f. Identify person(s) documenting the issue resolution.

- I. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the OPR, BOD, and Contract Documents. The commissioning report shall include, but is not limited to, the following:
 1. Lists and explanations of substitutions; compromises; variances in the OPR, BOD, and Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during University occupancy and operation. It shall describe components and performance that exceed requirements of the OPR, BOD, and Contract Documents and those that do not meet requirements of the OPR, BOD, and Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
 2. OPR and BOD documentation.
 3. Commissioning plan.
 4. Testing plans and reports.
 5. Corrective modification documentation.
 6. Issues log.
 7. Completed test checklists.
 8. Listing of off-season test(s) not performed and a schedule for their completion.

- J. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:
 1. OPR and BOD, including system narratives, schematics, and changes made throughout the Project.
 2. Project Record Documents as specified in Division 01 Section "Project Record Documents."

3. Final commissioning plan.
4. Commissioning report.
5. Operation and maintenance data as specified in Division 01 Section "Operation and Maintenance Data."

1.8 SUBMITTALS

The CxA shall submit the following:

- A. Commissioning Plan Prefinal Submittal: Submit three (3) hard copies of pre-final commissioning plan. Deliver one copy to Contractor, one to Owner, and one to University Consultant. Present submittal in sufficient detail to evaluate data collection and arrangement process. One copy, with review comments, will be returned to the CxA for preparation of the final construction-phase commissioning plan.
- B. Commissioning Plan Final Submittal: Submit three (3) hard copies and two sets of electronically formatted information of final commissioning plan. Deliver one hard copy and one set of discs to University, and one copy to University Consultant. The final submittal must address previous review comments. The final submittal shall include a copy of the pre-final submittal review comments along with a response to each item.
- C. Test Checklists and Report Forms: Submit sample checklists and forms to Contractor quality-control manager and subcontractors for review and comment. Submit three (3) copies of each checklist and report form.
- D. Certificates of Readiness.
- E. Test and Inspection Reports.
- F. Corrective Action Documents.
- G. Pre-final Commissioning Report Submittal: Submit three (3) hard copies of the pre-final commissioning report. Include a copy of the preliminary submittal review comments along with CxA's response to each item. CxA shall deliver one copy to University and one copy to University Consultant. One copy, with review comments, will be returned to the CxA for preparation of final submittal.
- H. Final Commissioning Report Submittal and LEED™ Documentation: Submit three (3) hard copies and three (3) sets of electronically formatted information of the final commissioning report. The final submittal must address previous review comments and shall include a copy of the pre-final submittal review comments along with a response to each item.
- I. Recommissioning Management Manual: Develop an indexed Recommissioning Management Manual to be delivered to the Owner with the final commissioning report. Include all components listed in the LEED Reference Guide.
- J. LEED™ Documentation. Compile LEED™ Documentation. Format as required by USGBC for submittal under LEED™ rating system.

1.9 QUALITY ASSURANCE

- A. Training Instructor Qualifications: Contractor shall provide factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments (per NIST requirements if applicable) immediately whenever instruments have been repaired following damage or

dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

CxA shall coordinate the following:

- A. **Coordinating Meetings:** Conduct regular coordination meetings of the commissioning team at least monthly to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- B. **Pretesting Meetings:** Conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.
- C. **Testing Coordination:** Coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

1.2 TITLE 24 ACCEPTANCE TESTING

- A. Comply with the requirements of Title 24, and Appendix NJ of the Nonresidential Alternative Calculation Method (ACM) Approval Manual.
 - 1. The installing Contractor shall be responsible for reviewing the plans and specifications to assure they conform to the Acceptance Requirements. This is typically done prior to signing a Certificate of Compliance.
 - 2. The installing Contractor shall be responsible for providing all necessary instrumentation, measurement and monitoring, and undertaking all required acceptance requirement procedures. They shall be responsible for correcting all performance deficiencies and again implementing the acceptance requirement procedures until all specified systems and equipment are performing in accordance with the Standards.
 - 3. The installing Contractor shall be responsible for documenting the results of the acceptance requirement procedures including paper and electronic copies of all measurement and monitoring results. They shall be responsible for performing data analysis, calculation of performance indices and crosschecking results with the requirements of the Standard. They shall be responsible for issuing a Certificate of Acceptance. The University shall not release a final Certificate of Occupancy until a Certificate of Acceptance is submitted that demonstrates that the specified systems and equipment have been shown to be performing in accordance with the Standards.
 - 4. The installing Contractor upon completion of undertaking all required acceptance requirement procedures shall record their State of California Contractor's License number or their State of California Professional Registration License Number on each Certificate of Acceptance that they issue.

1.3 START-UP, PRE-FUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned.
- B. **General.** Pre-functional Checklists are developed and completed for all major equipment and systems being commissioned. The checklist captures equipment nameplate and

characteristics data, confirming the as-built status of the equipment or system. These checklists also ensure that the systems are complete and operational, so that the functional performance testing can be scheduled. The checklists are created by the CxA and completed (filled out) by the installing Contractor.

- C. Start-up and Initial Checkout Plan. The CxA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed.
- D. Pre-functional Checklists. The CxA shall create pre-functional checklists, based primarily on the manufacturer's startup and initial checkout procedures are created. Each checkout item shall have a place to document that proper installation has occurred. Once the pre-functional checklist is completed by the installing Contractor, this signifies that the equipment is properly installed per manufacturer's procedures, and the controls and TAB are complete and the equipment is ready for final functional performance testing. The Contractor determines which Sub-contractor is responsible for executing and documenting each of the line item tasks.
- E. Sensor Calibration. Calibration of all sensors shall be included as part of the pre-functional checklists performed by the Contractors.
- F. Execution of Pre-functional Checklists and Startup.
 - 1. Sub-contractors and vendors schedule startup and checkout with the University, Contractor, and CxA.
 - 2. The CxA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are repetitive multiple units, (in which case a sampling strategy may be used as approved by the University).
 - 3. For lower-level components of equipment in non-sensitive areas of the Project, (e.g., VAV boxes, reheat coils), the CxA shall observe a sampling of the pre-functional and start-up procedures.
 - 4. The Contractor and vendors shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and pre-functional checklists.
 - 5. Only individuals that have direct knowledge and witnessed that a line item task on the pre-functional checklist was actually performed shall initial or check that item off.
- G. Deficiencies, Non-Conformance and Approval in Checklists and Startup.
 - 1. The Contractor shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA within two days of test completion.
 - 2. The CxA reviews the report and recommends approval to the University. The CxA shall work with the Contractor and vendors to correct and retest deficiencies or uncompleted items. The CxA will involve the University and others as necessary.

1.4 FUNCTIONAL PERFORMANCE TESTING

- A. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

- B. **Development of Test Procedures.** Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Prior to execution, the CxA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection. The CxA shall review University-contracted or factory testing which the CxA is not responsible to oversee and shall determine what further testing may be required to comply with the Contract Documents. Redundancy of testing shall be minimized.

The test procedure forms developed by the CxA shall include the following information:

1. System and equipment or component name(s).
2. Equipment location and ID number.
3. Date.
4. Project name and University Project Number.
5. Participating parties.
6. Reference to the specification section describing the test requirements.
7. A copy of the specific sequence of operations.
8. Instructions for setting up the test.
9. Special cautions, alarm limits, etc.
10. Specific step-by-step procedures to execute the test.
11. Acceptance criteria of proper performance with a Yes / No check box.
12. A section for comments.
13. Signatures and date block for the CxA.

- C. **Test Methods.**

1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The CxA will determine which method is most appropriate.
2. Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Contractor executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
3. Sampling. Multiple identical pieces of non-life-safety or non-critical equipment may be functionally tested using a sampling strategy. The sampling strategy will be developed by the CxA and approved by the University. If, after three attempts at testing the specified sample percentage, failures are still present, then all remaining units are tested at the Contractor's expense.

- D. **Coordination and Scheduling.** The Contractor shall provide sufficient notice to the CxA regarding their completion schedule for the pre-functional checklists and startup of all equipment and systems. The CxA will schedule functional tests through the University Representative and Contractor. The CxA shall direct, witness and document the functional testing of all equipment and systems. The Contractor shall execute the tests.

- E. **Problem Solving.** The CxA will recommend solutions to problems found; however the burden of responsibility to solve, correct and retest problems is with the Contractor and University consultants.

1.5 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, CxA shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. In addition to requirements specified in Division 01 Section "Demonstration and Training," perform the following:
 1. Review the OPR and BoD.
 2. Review installed systems, subsystems, and equipment.
 3. Review instructor qualifications.
 4. Review instructional methods and procedures.
 5. Review training module outlines and contents.
 6. Review course materials (including operation and maintenance manuals).
 7. Inspect and discuss locations and other facilities required for instruction.
 8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
 9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- B. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 01 Section "Demonstration and Training."

1.6 COSTS OF COMMISSIONING WORK

- A. The cost of the CxA shall be borne by the University.
- B. The cost to the Contractor and Subcontractors to comply with the specified requirements and to support the work of the CxA shall be included in the Contractor's and Subcontractor's bid price.
- C. If a device, piece of equipment, sequence, or system fails a test, corrections shall be made and a second test shall be performed. If the second test is not successful, then the CxA's cost for a third test or subsequent tests shall be reimbursed to the CxA by the Contractor.

1.7 EQUIPMENT & SYSTEM SCHEDULE

- A. The following equipment shall be commissioned in this Project.

System	Equipment	Note	Req'd by LEED
HVAC System	Chillers		X
	Boilers		X
	Pumps		X
	Cooling towers		X
	Variable frequency drives		X
	Air handlers		X
	Packaged AC units		X
	Terminal units for Court Rooms and other high occupancy rooms		X
	Terminal units for Office areas	2	X
System	Equipment	Note	Req'd by LEED
HVAC System	Unit heaters		X
	Heat exchangers		X
	Exhaust fans		X
	Supply fans		X
	Return fans		X
	Chilled beams		X

Building Energy Management System (EMS)	Sequences of Operation, Monitored Points, Control Points, and Alarms		X
	Metering/Monitoring Devices and Equipment		X
	Software Commissioning, GUI presentation commissioning, system access performance criteria, software tools/source code commissioning, instrument data sheets, middleware commissioning, Internet Protocol commissioning		
Lighting and Shade Control System	Sequences of Operation, Monitored points, control points, user controls		X
Electrical System	Sweep or scheduled lighting controls	2	X
	Daylight dimming controls		X
	Lighting occupancy sensors		X
	Electrical grounding		
Plumbing System	Domestic water heaters		X
Security Alarm Systems	Security cameras and monitoring system personal duress alarm system; Intercom system; Paging System.		
Security Electronics	Security plumbing fixture water management system.		
Seminar/Conference Rooms	Door Controls.		
	Fire alarm system.		
	Distributed radio antenna system.		
	Access control system.		
	Room acoustics.		
Fire/Life Safety Systems	Sound masking system.		
	Assisted listening.		
	Video projection.		
	Audio system.		
	Lighting and lighting controls.		X
	All devices		
Communication System	Alarm drivers		
	HVAC/Fire System Integration		
	Event Notifying and Reporting Systems		

Notes:

1. Centralized equipment should be fully commissioned.

PART 2 - Items which represent multiple, identical repetitive equipment may be tested on a "sampling" or "spot-check" basis, 20% of total.

END OF SECTION

DIVISION 09 - FINISHES

099000 Painting

DIVISION 10 - SPECIALTIES

102213 Wire Mesh Partitions

DIVISION 13 – SPECIAL CONSTRUCTION

133423 Aisle Containment

DIVISION 22 – PLUMBING

220500 Common Work Results for Plumbing
220523 General Duty Valves for Plumbing Piping
220529 Hangers and Supports for Plumbing Piping and Equipment
220553 Identification for Plumbing Piping and Equipment
221116 Domestic Water Piping and Fittings
221119 Domestic Water Piping Specialties
221316 Sanitary Waste and Vent Piping
221319 Sanitary Waste Piping Specialties

DIVISION 23 – MECHANICAL

230000 General Mechanical Requirements
230519 Meters and Gauges for HVAC Piping
230523 General Duty Valves for HVAC
230529 Hangers and Supports for HVAC Piping and Equipment
230593 Testing, Adjusting and Balancing for HVAC
230713 Duct Insulation
230719 HVAC Piping Insulation
230900 Direct Digital Control System
230993 Sequence of Operations for HVAC Controls
232113 Hydronic Piping
232116 Hydronic Piping Specialties
233113 Metal Ducts
233300 Air Duct Accessories
233713 Diffusers Registers and Grilles
238123.12 Computer Room Air Conditioners
238413 Ultrasonic Humidifiers

DIVISION 26 – ELECTRICAL

260000 General Electrical Requirements
260060 Electrical Demolition
260519 LV Power Conductors & Cables
260526 Grounding & Bonding
260529 Hangers & Supports
260533 Raceways and Boxes for Electrical Systems
260548 Vibration and Seismic Controls for Electrical Systems
260553 Identification for Electrical Systems
262600 Power Distribution Units
262726 Wiring Devices



DIVISION 27 – COMMUNICATIONS

270500	Requirements for Communications Installations
270526	Grounding Bonding for Communications Systems
270529	Hangers and Supports for Communications Systems
270533	Conduit and Boxes for Communications Systems
270536	Cable Trays for Communications Systems
270553	Identification for Communications Systems
271116	Cabinets, Racks, Enclosures for Communications Systems
271119	Termination Blocks and Patch Panels for Communications Systems
271500	Communications Horizontal Cabling
271619	Communication Patch Cords

END OF DOCUMENT 000000

SECTION 099000 - PAINTING

PARTS 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Painting and finishing of all interior and exterior items and surfaces, unless otherwise indicated or listed under exclusions below:
 - 1. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated. Include field painting of exposed exterior and interior plumbing, mechanical and electrical work, except as indicated below.
 - 2. Paint exterior stucco where indicated on Drawings.
- B. Work Included:
 - 1. The intent and requirements of this Section is that all work, items and surfaces which are normally painted and finished in a building of this type and quality, shall be so included in this contract, whether or not said work, item or surface is specifically called out and included in the schedules and notes on the drawings, or is, or is not, specifically mentioned in these specifications.
- C. The following general categories of work and items that are included under other sections shall not be a part of this section:
 - 1. Shop prime painting of structural and miscellaneous iron or steel.
 - 2. Shop prime painting of hollow metal work.
 - 3. Shop finished items.
- D. The Room Finish Schedules or Keyed notes indicated on the drawings indicates the location of interior room surfaces to be painted or finished. The schedule indications are general and do not necessarily define the detail requirements. Include all detailed refinements and further instructions as may be given for the required complete finishing of all spaces and rooms.

1.02 SUBMITTALS:

- A. Product Data: Submit complete manufacturer's descriptive literature and specifications in accordance with the provisions of Section 01 30 00.
 - 1. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item when applicable. When required, provide a list of paint and coating materials proposed for use, which equates such materials with the design-basis products specified.
- B. Samples: In accordance with provisions of Section 01300, submit, on 8-1/2 inch by 11 inch hardboard, samples of each color, gloss, texture and material selected by the Architect from standard colors available for the coatings required.
 - 1. For natural and stained finishes, provide sample on each type and quality of wood used on the project.
- C. Manufacturer's Instructions: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, application rates, and composition analysis.

1.03 QUALITY ASSURANCE:

- A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.
 - a. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
 - b. Comply with South Coast Air Quality Management District (SCAQMD) Rule 1113. A copy of this regulation can be obtained from <http://www.aqmd.gov/rules/reg/reg11/r1113.pdf>.
- B. Field Sample: When and as directed by the Architect, apply one complete coating system for each color, gloss and texture required. When approved, the sample panel areas will be deemed incorporated into the Work and will serve as the standards by which the subsequent Work of this Section will be judged.

1.04 DELIVERY, STORAGE, AND HANDLING:

- A. Storage and Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.
- B. Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name and trade name. Store where directed in accordance with manufacturer's instructions.

1.05 PROJECT CONDITIONS:

- A. Do not apply exterior materials during fog, rain or mist, or when inclement weather is expected within the dry time specified by the manufacturer. No exterior or interior painting shall be done until the surfaces are thoroughly dry and cured. Do not apply paint when temperature is below 50° F. Avoid painting surfaces when exposed to direct sunlight.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Manufacturer's catalog names and number of paint types in this Section herein are based on products manufactured or distributed by the Dunn-Edwards Corporation www.dunnedwards.com and are the basis of design against which the Architect will judge equivalency. The quantity of titanium dioxide, the use of clays, aluminum silicate, talc and the purity of acrylic materials are a few of the criteria which will be used by the Architect in determining equivalency of materials.
- B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 Product Requirements. When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product.
- C. Acceptable Manufacturers
 - 1. Carboline www.carboline.com
 - 2. Deft www.deftfinishes.com
 - 3. Valspar www.valsparwood.com

2.02 MATERIALS:

A. Paints: Provide ready-mixed, except field catalyzed coatings. Pigments shall be fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixture. Paints shall have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.

B. Accessory Materials: Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes shall be of high quality and approved by manufacturer.

C. Colors shall be selected from color chip samples provided by manufacturer of paint system approved for use. Match approved samples for color, texture and coverage.

D. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

E. Restricted Components: Paints and coatings shall not contain any of the following.

1. Acrolein.
2. Acrylonitrile.
3. Antimony.
4. Benzene.
5. Butyl benzyl phthalate.
6. Cadmium.
7. Di (2-ethylhexyl) phthalate.
8. Di-n-butyl phthalate.
9. Di-n-octyl phthalate.
10. 1,2-dichlorobenzene.
11. Diethyl phthalate.
12. Dimethyl phthalate.
13. Ethylbenzene.
14. Ethylene Glycol.
15. Formaldehyde.
16. Hexavalent chromium.
17. Isophorone.
18. Lead.
19. Mercury.
20. Methyl ethyl ketone.
21. Methyl isobutyl ketone.
22. Methylene chloride.
23. Naphthalene.
24. Toluene (methylbenzene).
25. 1,1,1-trichloroethane.
26. Vinyl chloride.

2.04 MIXES:

A. Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

PART 3-EXECUTION

3.01 EXAMINATION:

- A. Examine surfaces to be painted before beginning painting work. Work of other trades that has been left or installed in a condition not suitable to receive paint, stain other specified finish shall be repaired or corrected by the applicable trade before painting. Painting of defective or unsuitable surface implies acceptance of the surfaces.
- B. Beware of a condition known as critical lighting. This condition causes shadows that accentuate even the slightest surface variations. A pigmented sealer will provide tooth for succeeding decorative coating, but "does not" equalize smoothness or surface texture. Any corrective action to drywall must be done by the drywall contractor prior to decorating.

3.02 PROTECTION:

- A. Protect previously installed work and materials, which may be affected by Work of this Section.
 - 1. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.
 - 2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or splatter from fouling surfaces not being painted.
 - 3. Protect surfaces, equipment, and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking, and staging.
- B. Provide wet paint signs, barricades, and other devices required to protect newly finished surfaces. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.03 PREPARATION:

- A. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.
- B. Concrete and Masonry: Surfaces shall be dry, clean, and free of dirt, efflorescence, encrustation, and other foreign matter. Glazed surfaces on concrete shall be roughened or etched to uniform texture.
- C. Ferrous Metal: Clean oil, grease, and foreign matter with solvent. Surface shall be primed within 3 hours after preparation.
- D. Sand and scrape metal to remove loose primer and rust.
- E. Non-Ferrous Metal: Chemically or solvent clean and then treat with an etching-type solution if recommended by the finish manufacturer. Cleaned and retreated Non-Ferrous Metal shall be primed the same day that cleaning has been performed.
- F. Wood Surfaces: Remove dust, grit and foreign matter. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs when fully cured.
- G. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
- H. Existing surfaces to be recoated shall be thoroughly cleaned and deglossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as specified for new work.

3.03 PREPARATION (Continued):

- I. Thoroughly backpaint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, cabinetwork, etc., which will be concealed after installation. Backpaint items to be painted or enameled with the priming coat. Use a clear sealer for backpriming where transparent finish is required.
- J. Bare and covered pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work shall be cleaned prior to priming.
- K. Preparation of other surfaces shall be performed following specific recommendations of the coatings manufacturer.
- L. Bond breakers and curing agents shall be removed and the surface cleaned before primers, sealers or finish paints can be applied.
- M. All drywall surfaces shall be completely dry and dust free before painting. Skim coated drywall shall be sealed with a sealer recommended by the paint manufacturer for this surface. Use the appropriate light or medium tack masking tape.

3.04 APPLICATION:

- A. Apply painting and finishing materials in accordance with the manufacturer's recommendations.
 - 1. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
- B. Apply each material at not less than the manufacturer's recommended spreading rate:
- C. Apply prime coat to surface which is required to be painted or finished.
- D. Finish exterior doors on tops, bottoms, and edges same as exterior faces, after fitting.
- E. Sand lightly and dust clean between succeeding coats.

3.05 CLEANING, TOUCH-UP AND REFINISHING:

- A. Carefully remove all spattering, spots and blemishes caused by work under this section from surfaces throughout the project.
- B. Upon completion of painting work remove all rubbish, paint cans, and accumulated materials resulting from work in each space or room. All areas shall be left in a clean, orderly condition.
- C. Runs, sags, misses, holidays, stains and other defects in the painted surfaces, including inadequate coverage and mil thickness shall be satisfactorily touched up, or refinished, or repainted as necessary.

3.06 FINISH SCHEDULE

- A. Apply the following finishes to the surfaces specified on the finish schedule or on the drawings. Apply all materials in accordance with manufacturer's instructions on properly prepared surfaces and foundation coats. All intermediate undercoats must be tinted to approximate the final color.

1. Architect will issue a color schedule prior to start of painting to designate the various colors and locations required for the work.

3.06 FINISH SCHEDULE (Continued):

A. Interior Systems:

1. Gypsum Board

- a. Eggshell - Zero VOC

First Coat

VINYLASTIC Select, Zero VOC Interior Wall Sealer (VNSL00)

Second Coat

SPARTAWALL, Interior Zero VOC, Low Odor Eggshell Paint (SWLL30)

Third Coat

SPARTAWALL, Interior Zero VOC, Low Odor Eggshell Paint (SWLL30)

NOTICE

Availability of products listed in this specification may be affected by local, state, or federal regulatory requirements for architectural coatings. Consult your Dunn-Edwards representative for information on current product availability. Submittals prepared by Dunn-Edwards in accordance with this specification may include product codes that are modified with a letter suffix (e.g., W 901V or W 901E) to indicate the specific product formulation currently available to meet applicable requirements.

END OF SECTION

SECTION 102213 - WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard-duty wire mesh partitions.
 - 2. Heavy-duty wire mesh partitions.

1.3 DEFINITIONS

- A. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.
- B. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Indicate clearances required for operation of doors and gates.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: 12-by-12-inch (300-by-300-mm) panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.
- E. Delegated-Design Submittal: For wire mesh partitions indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Welding certificates.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wire mesh partition hardware to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire mesh items to provide protection during transit and Project-site storage. Use vented plastic.
- B. Inventory wire mesh partition door hardware on receipt, and provide secure lockup for wire mesh partition door hardware delivered to Project site.
 - 1. Tag each item or package separately with identification, and include basic installation instructions with each item or package.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of construction contiguous with wire mesh units by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. California Wire Products, Corona, CA
- B. TROAX, Inc.
- C. King Wire Partitions, Inc.

2.2 MATERIALS

- A. Steel Wire: ASTM A510 (ASTM A510M).
- B. Steel Plates, Channels, Angles, and Bars: ASTM A36/A36M.
- C. Steel Sheet: Cold-rolled steel sheet, ASTM A1008/A1008M, Commercial Steel (CS), Type B.

- D. Steel Pipe: ASTM A53/A53M, Schedule 40, unless another weight is indicated or required by structural loads.
- E. Steel Tubing: ASTM A500/A500M, cold-formed structural-steel tubing or ASTM A513, Type 5, mandrel-drawn mechanical tubing.
- F. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers.
- H. Post-Installed Anchors: Capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components are zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
- I. Power-Driven Fasteners: ICC-ES AC70.
- J. Seismic Bracing: Angles with legs not less than 1-1/4 inch (32 mm) wide, formed from 0.040-inch- (1.0-mm-) thick, metallic-coated steel sheet; with bolted connections and 1/4-inch- (6-mm-) diameter bolts.
- K. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, complying with MPI#79.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- L. Zinc-Rich Primer: Compatible with topcoat, complying with SSPC-Paint 20 or SSPC-Paint 29.
- M. Galvanizing Repair Paint: High-zinc-dust-content paint for regalanizing welds in steel, complying with SSPC-Paint 20.

2.3 HEAVY-DUTY WIRE MESH PARTITIONS

- A. Mesh: 0.192-inch- diameter steel wire, resistance welded into 1-1/2-by-2-1/2-inch rectangular mesh.
- B. Vertical and Horizontal Panel Framing: 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3.2-mm) cold-rolled steel channels; with holes for 3/8-inch- (9.5-mm-) diameter bolts not more than 12 inches (300 mm) o.c.
- C. Horizontal Panel Stiffeners: Two cold-rolled steel channels, 1 by 1/2 by 1/8 inch (25 by 13 by 3.2 mm), bolted or riveted toe to toe through mesh.
- D. Top Capping Bars: 3-by-1-inch (76-by-25-mm) steel channels.

- E. Posts for 90-Degree Corners: 1-1/2-by-1-1/2-by-1/8-inch (38-by-38-by-3.2-mm) steel angles or tubes[or 2-by-2-by-0.075-inch (50-by-50-by-1.9-mm) cold-rolled steel angles or tubes], with holes for 3/8-inch- (9.5-mm-) diameter bolts aligning with bolt holes in vertical framing; with 1/4-inch (6.4-mm) steel base plates.
- F. Posts for Other-Than-90-Degree Corners: 2-inch- (50-mm) OD by 1/8-inch (3.2-mm) steel pipe or round tube, with holes for 3/8-inch- (9.5-mm-) diameter bolts aligning with bolt holes in vertical framing; with 1/4-inch (6.4-mm) steel base plates.
- G. Adjustable Corner Posts: Two 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3.2-mm) cold-rolled, steel channels or 2-by-2-by-0.075-inch (50-by-50-by-1.9-mm) steel tubes connected by steel hinges at 36 inches (900 mm) o.c. attached to posts; with 1/4-inch- (6-mm-) diameter bolt holes aligning with bolt holes in vertical framing; with 1/4-inch (6.4-mm) steel base plates.
- H. Line Posts: 3-inch-by-4.1-lb (76-mm-by-1.9-kg) or 3-1/2-by-1-1/4-by-1/8-inch (89-by-32-by-3.2-mm) steel channels; with 1/4-inch (6.4-mm) steel base plates.
- I. Three and Four-Way Intersection Posts: 2-by-2-by-0.075-inch (50-by-50-by-1.9-mm) steel tubes, with holes for 3/8-inch- (9.5-mm-) diameter bolts aligned for bolting to adjacent panels; with 1/4-inch (6.4-mm) steel base plates.
- J. Floor Shoes: Metal, not less than 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
- K. Accessories:
 - 1. Sheet Metal Base: 0.060-inch- (1.5-mm-) thick, steel sheet.
 - 2. Adjustable Filler Panels: 0.060-inch- (1.5-mm-) thick steel sheet, capable of filling openings from 2 to 12 inches (50 to 300 mm).
 - 3. Wall Clips: Manufacturer's standard, cold-rolled steel sheet[; allowing up to 1 inch (25 mm) of adjustment.
- L. Finish: Powder-coated finish unless otherwise indicated.
 - 1. Color: As indicated by manufacturer's designations.

2.4 WIRE MESH STAIRWAY PARTITIONS

- A. Standard-Duty Stairway Partitions:
 - 1. Diamond Mesh: 0.135-inch- (3.5-mm-) diameter, intermediate-crimp steel wire woven into 1-1/2-inch (38-mm) diamond pattern and securely clinched to frames.
 - 2. Square Mesh: 0.135-inch- (3.5-mm-) diameter, lock-crimp steel wire woven into 1-1/2-inch (38-mm) square pattern, inserted through frame holes and welded into frame. Vertical wires are plumb, and horizontal wires are perpendicular to vertical wires.
 - 3. Rectangular Mesh: 0.135-inch- (3.5-mm-) diameter, lock]-crimp steel wire woven into 2-by-1-inch (50-by-25-mm) rectangular pattern, inserted through frame holes and welded into frame. Vertical wires are plumb, and horizontal wires are perpendicular to vertical wires.

4. Vertical Panel Framing: 1-1/4-by-5/8-by-0.097-inch (32-by-16-by-2.5-mm) cold-rolled, C-shaped steel channels; with 1/4-inch- (6-mm-) diameter bolt holes spaced not more than 18 inches (450 mm) o.c. along center of framing.
 5. Horizontal Panel Framing: 1-by-1/2-by-1/8-inch (25-by-13-by-3.2-mm) cold-rolled steel channels.
 6. Horizontal Panel Stiffeners: 1-by-1/2-by-1/8-inch (25-by-13-by-3.2-mm) cold-rolled steel channels with wire woven through, or two 1-by-1/2-by-1/8-inch (25-by-13-by-3.2-mm) cold-rolled steel channels bolted or riveted toe to toe through mesh.
- B. Door Jamb Framing: 2-by-2-by-1/8-inch steel pipe or tubing.
- C. Floor Shoes: Steel, cast iron, or cast aluminum, not less than 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
- D. Wall Clips: Manufacturer's standard, cold-rolled steel sheet[; allowing up to 1 inch (25 mm) of adjustment].
- E. Finish for Uncoated Ferrous Steel: [Hot-dip galvanized] [Hot-dip galvanized and shop primed for field painting] [Shop primed for field painting] [Enamel finish] [Powder-coated finish] unless otherwise indicated.
1. Color: [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range] <Insert color>.

2.5 FABRICATION

- A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. Furnish bolts, hardware, and accessories required for complete installation with manufacturer's standard finishes.
1. Fabricate wire mesh items to be readily disassembled.
 2. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint.
- B. Heavy-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
1. Mesh: mesh to framing.
 2. Framing: Fabricate framing with mortise and tenon corner construction.
 - a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
 - b. Fabricate three-and four-way intersections using manufacturer's standard connecting clips and fasteners.
 - c. Fabricate partition and door framing with slotted holes for connecting adjacent panels.

3. Fabricate wire mesh partitions with 3 to 4 inches (75 to 100 mm) of clear space between finished floor and bottom horizontal framing.
 4. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.
 5. Doors: Align bottom of door with bottom of adjacent panels.
 - a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.
 6. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.
- C. Wire Mesh Ceilings: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
1. Mesh: Securely clinch or weld mesh to framing.
 2. Framing: Fabricate framing with mortise and tenon corner construction.
 - a. Provide stiffeners as indicated or, if not indicated, as required by panel span and as recommended by wire mesh ceiling manufacturer. Weld stiffeners to framing.
- D. Wire Mesh Stairway Partitions: Provide door jamb framing on each side of doors. Attach tamper shields centered behind exit devices.

2.6 STEEL AND IRON FINISHES

- A. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on powder-coat finish, suitable for use indicated, with a minimum dry film thickness of 2 mils.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors for suitable conditions where wire mesh items will be installed.
- C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRE MESH PARTITIONS ERECTION

- A. Anchor wire mesh partitions to floor with 3/8-inch- (9.5-mm-) diameter postinstalled expansion anchors at 12 inches (300 mm) o.c. through anchor clips located at each post and corner. Shim anchor clips as required to achieve level and plumb installation.
 - 1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.
- B. Anchor wire mesh partitions to floor with 3/8-inch- (9.5-mm-) diameter postinstalled expansion anchors at 12 inches (305 mm) o.c. through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.
 - 1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.
- C. Anchor wire mesh partitions to walls at 12 inches (305 mm) o.c. through back corner panel framing and as follows:
 - 1. For concrete and solid masonry anchorage, use expansion anchors.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed gypsum board assemblies, use lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
 - 5. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.
- D. Secure top capping bars to top framing channels with 1/4-inch- (6-mm-) diameter "U" bolts spaced not more than 28 inches (700 mm) o.c.
- E. Provide line posts at locations indicated or, if not indicated, as follows:
 - 1. On each side of sliding-door openings.
 - 2. For partitions that are 7 to 9 feet (2.1 to 2.7 m) high, spaced at 15 to 20 feet (4.6 to 6.1 m) o.c.
 - 3. For partitions that are 10 to 12 feet (3.0 to 3.7 m) high, located between every other panel.
 - 4. For partitions that are more than 12 feet (3.7 m) high, located between each panel.
- F. Provide seismic supports and bracing as indicated or, if not indicated, as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.
- G. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.
- H. Install doors complete with door hardware.

- I. Install service windows complete with window hardware.
- J. Weld or bolt sheet metal bases to wire mesh partitions.
- K. Bolt accessories to wire mesh partition framing.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace defective work, including doors and framing that are warped, bowed, or otherwise unacceptable.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 102213

SECTION 133423 – AISLE CONTAINMENT-MODULAR SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes fabricated aluminum framed containment panels and doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for containment panel system.
- B. Shop Drawings: For containment panel system. Include plans, elevations, sections, details, accessories, and fastening and anchorage details, including mechanical fasteners.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For containment panel system to include in maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair finish or replace control booths that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year limited warranty.

PART 2 - PRODUCTS

2.1 FABRICATED ALUMINUM CONTAINMENT PANEL MODULAR SYSTEM

- A. General: Fabricate containment panel modular system from an integrated set of mutually dependent components to form a completed assembly, ready for installation on Project site. Size to fit rack configuration as shown on drawings.
 - 1. Basis of Design is Subzero Engineering SL Series Containment Panels. Other manufacturers that meet design criteria may be considered. Submit substitution request in accordance with Division 1 requirements.
- B. Structural Framework: Fabricated from 1.5"x.75" aluminum panel frames; with clear anodic finish.
- C. Doors: As indicated on Drawings.
 - 1. Swinging Door: Subzero Engineering Elite Series LP door with automatic closing hinge. Provide self supporting aluminum frame.
- D. Containment Panel Assembly: Assembly consisting aluminum frame and 3mm acrylic panel insert.
 - 1. Smoke Developed per ASTM E84, Class A
 - 2. Flame Spread per ASTM E84, Class C
 - 3. UL Horizontal, UL94, 94HB

2.2 FABRICATION

- A. Factory fabricate containment panels completely.
- B. Factory preglaze windows and doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including concrete bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.
- B. Examine rack location, wiring and cable trays to verify actual locations of connections before containment panel installation.

3.2 INSTALLATION

- A. Install containment panels according to manufacturer's written instructions.
- B. Set containment panels plumb and aligned.

3.3 ADJUSTING

- A. Adjust doors, operable windows, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.
- C. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION 133423

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Transition fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
 2. CPVC: Chlorinated polyvinyl chloride plastic.
 3. PE: Polyethylene plastic.
 4. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

- A. Submittals shall be formatted per Section 220000 “General Plumbing Requirements”. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. “No Exception Taken”.
 - 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.

- B. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.

- C. Welding certificates.
 - 1. Welding certificates.
 - 2. Product Information for approval before purchase
 - 3. Operation and Maintenance Manuals

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. All plumbing pipe, tube and fittings shall be manufactured exclusively in the United States.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals:
 - 1. Conform to AWS A5.8.
 - 2. Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 3. Use 15% silver brazing filler metal without flux.
- F. Welding Filler Metals: Comply with AWS D10.12. for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.

2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES.

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.6 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 220500

SECTION 220523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 220000 “General Plumbing Requirements”. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. “No Exception Taken”.
 - 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.
- C. The Manufacturer, Contractor or Supplier Shall Include A Written Statement That The Submitted Equipment, Hardware Or Accessory Complies With The Requirement Of This Particular Specification Section.
1. The Manufacturer Shall Resubmit This Specification Section Showing Compliance with Each Respective Paragraphs and Specified Items And Features.
 2. All Exceptions Shall Be Clearly Identified by Referencing Respective Paragraph And Other Requirements Along With Proposed Alternative.
 3. Individual or Partial Submittals Are Not Acceptable and Will Be Returned Without Review.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 2. ASME B31.1 for power piping valves.
 3. ASME B31.9 for building services piping valves
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, and soldered ends.
 3. Protect threads, flange faces, grooves, and weld ends.
 4. Set ball valves open to minimize exposure of functional surfaces.
 5. Set check valves in either closed or open position.
 6. Set gate valves closed to prevent rattling.
 7. Set butterfly valves closed or slightly open.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.5 for flanges on steel valves.
 - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 5. ASME B16.18 for solder-joint connections.
 - 6. ASME B31.9 for building services piping valves.
- C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- D. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- G. RS Valves in Insulated Piping: With 2-inch stem extensions.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. Valve Bypass and Drain Connections: MSS SP-45.
- J. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handlever: For quarter-turn valves smaller than NPS 6.
 - 3. Chainwheel: Device for attachment to gear, handlever, or stem; of size and with chain for mounting height, according to "Valve Installation" Article.
- K. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. NIBCO INC.
 - c. Red White Valve Corp.
2. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

B. Brass Ball Valves, Three-Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Jomar Valve.
 - b. KITZ Corporation.
 - c. WATTS.
2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, One-Piece with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. NIBCO INC.
 - c. WATTS.

 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.
- B. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.

 2. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.
- C. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.

- b. NIBCO INC.
- c. WATTS.

2. Description:

- a. Standard: MSS SP-110 or MSS-145.
- b. CWP Rating: Minimum 200 psig.
- c. Body Design: Two piece.
- d. Body Material: Bronze.
- e. Ends: Press.
- f. Press Ends Connections Rating: Minimum 200 psig.
- g. Seats: PTFE or RTPFE.
- h. Stem: Bronze or brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.
- k. O-Ring Seal: EPDM or Buna-N.

D. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Apollo Flow Controls; Conbraco Industries, Inc.
- b. NIBCO INC.
- c. WATTS.

2. Description:

- a. Standard: MSS SP-110 or MSS-145.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Bronze.
- e. Ends: Threaded or soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Full.

E. Bronze Ball Valves, Three-Piece with Full Port and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Apollo Flow Controls; Conbraco Industries, Inc.
- b. NIBCO INC.
- c. WATTS.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig.
- c. Body Design: Three piece.
- d. Body Material: Bronze.
- e. Ends: Threaded.
- f. Seats: PTFE.
- g. Stem: Bronze or brass.
- h. Ball: Chrome-plated brass.
- i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If ball valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Grooved-End Copper Tubing and Steel Piping: Grooved.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Brass ball valve, one piece. Provide with threaded or solder-joint ends.
 - 2. Bronze ball valve, one piece with bronze or stainless-steel trim. Provide with threaded or solder-joint ends.
 - 3. Brass ball valves, two-piece with full-port and brass or stainless-steel trim. Provide with threaded or solder-joint ends.
 - 4. Bronze ball valves, two-piece with full-port and bronze, brass or stainless-steel trim. Provide with threaded or solder-joint ends.
 - 5. Brass ball valves, three-piece with full port and brass or stainless-steel trim.
 - 6. Bronze ball valves, three-piece with full port and bronze, brass or stainless-steel trim.
 - 7. Bronze ball valves, two-piece with regular port and bronze or stainless-steel trim.
 - 8. Bronze swing check valves with bronze disc, Class 125 or Class 150, with soldered or threaded end connections.
 - 9. Bronze gate valves, NRS, RS, Class 125 or Class 150 with soldered or threaded ends.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe-positioning systems.

- B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 220000 "General Plumbing Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:

1. "No Exception Taken".
2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.

- B. Product Data: For each type of product indicated including component cut-sheets and pre-approved details.

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Environmental Product Declaration: For each product.
 3. Health Product Declaration: For each product.
 4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
- C. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
1. Trapeze pipe hangers.
 2. Metal framing systems.
 3. Pipe stands.
- D. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of trapeze hangers.
 2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel stainless steel.

2.3 TRAPEZE PIPE HANGERS

- ### A.
- Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line, an Eaton business.
 - b. Flex-Strut Inc.
 - c. Unistrut; Part of Atkore International.

2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel stainless-steel, Type 304 stainless-steel, Type 316 extruded-aluminum Insert material channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel stainless steel.
8. Metallic Coating: No coating Plain Pregalvanized G90 Electroplated zinc Hot-dip galvanized Gold (yellow zinc dichromate) galvanized.
9. Paint Coating: Green epoxy, acrylic, or urethane.
10. Plastic Coating: PVC.
11. Combination Coating: .

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. PHD Manufacturing, Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel stainless-steel channel with inturned lips.
5. Channel Width: Select for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel stainless steel.
8. Metallic Coating: No coating Plain Pregalvanized G90 Hot-dip galvanized
9. Paint Coating: Green epoxy, acrylic, or urethane.
10. Plastic Coating: PVC.

2.5 THERMAL HANGER-SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. National Pipe Hanger Corporation.
 2. Pipe Shields Inc.
 3. Piping Technology & Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

- C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig ASTM C552, Type II cellular glass with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - c. Simpson Strong-Tie Co., Inc.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line, an Eaton business.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 2. Indoor Applications: Zinc-coated or stainless steel.
 - 3. Outdoor Applications: Stainless steel.

2.7 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand:
 - 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection pads.

C. Low-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Vertical Members: Two galvanized stainless-steel, continuous-thread, 1/2-inch rods.
4. Horizontal Member: Adjustable horizontal, galvanized stainless-steel pipe support channels.
5. Pipe Supports: Roller Strut clamps Clevis hanger Swivel hanger.
6. Hardware: Galvanized Stainless steel.
7. Accessories: Protection pads.
8. Height: 12 inches above roof.

D. High-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Single vulcanized rubber or molded polypropylene.
3. Vertical Members: Two galvanized stainless-steel, continuous-thread, 1/2-inch rods.
4. Horizontal Member: One adjustable-height, galvanized- or stainless-steel, pipe-support slotted channel or plate.
5. Pipe Supports: Roller Clevis hanger Swivel hanger.
6. Hardware: Galvanized Stainless steel.
7. Accessories: Protection pads, 1/2-inch, continuous-thread, galvanized-steel rod, 1/2-inch, continuous-thread, stainless-steel rod.
8. Height: 36 inches above roof.

E. High-Profile, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: Two or more; vulcanized rubber molded polypropylene.
3. Vertical Members: Two or more, galvanized stainless-steel channels.
4. Horizontal Members: One or more, adjustable-height, galvanized stainless-steel pipe support.
5. Pipe Supports: Roller Strut clamps Clevis hanger Swivel hanger.
6. Hardware: Galvanized Stainless steel.
7. Accessories: Protection pads, 1/2-inch, continuous-thread rod.
8. Height: 36 inches above roof.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.8 PIPE-POSITIONING SYSTEMS

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.10 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Pipe Stand Installation:
1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- H. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal hanger-shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 - 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
 - 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 220000 “General Plumbing Requirements”. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. “No Exception Taken”.
 - 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product indicated.
- C. Samples: For color, letter style, and graphic representation required for each identification material and device.
- D. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- E. Valve numbering scheme.
- F. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 GENERAL

- A. Manufacturers:
 - 1. Craftmark Identification Systems
 - 2. Seton Identification Products
 - 3. Setmark

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services, Inc.
 - c. Seton Identification Products.
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 3. Letter Color: White.
 - 4. Background Color: Red.
 - 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 8. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - 2. Brady Corporation.
 - 3. Seton Identification Products.
- B. Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher.
- C. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.3 STENCILS

- A. Stencils for Piping:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Marking Services, Inc.
 - c. Seton Identification Products.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.
 - 3. Stencil Material: Brass.

4. Stencil Paint: Exterior, gloss, alkyd enamel or acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel or acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.4 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 2. Brady Corporation.
 3. Brimar Industries, Inc.
- B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surface of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- E. Pipe Label Color Schedule:
 - 1. Low-Pressure Compressed Air Piping:
 - a. Background: Safety blue.
 - b. Letter Colors: White.
 - 2. High-Pressure Compressed Air Piping:
 - a. Background: Safety blue.
 - b. Letter Colors: White.
 - 3. Domestic Water Piping
 - a. Background: Safety green.

- b. Letter Colors: White.
4. Sanitary Waste and Storm Drainage Piping:
- a. Background Color: Safety green.
 - b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 2 inches, round.
 - b. Hot Water: 2 inches, round.
 - c. Low-Pressure Compressed Air: 2 inches, round.
 - d. High-Pressure Compressed Air: 2 inches, round.
 - 2. Valve-Tag Colors:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.
 - c. Low-Pressure Compressed Air: Natural.
 - d. High-Pressure Compressed Air: Natural.
 - 3. Letter Colors:
 - a. Cold Water: Black White.
 - b. Hot Water: Black.
 - c. Low-Pressure Compressed Air: Black.
 - d. High-Pressure Compressed Air: Black.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. CPVC piping. (We specify CPVC in some residential/senior living projects per client's request)
4. Piping joining materials.
5. Encasement for piping.
6. Transition fittings.
7. Dielectric fittings.

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 220000 "General Plumbing Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 1. "No Exception Taken".
 2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For transition fittings and dielectric fittings.
- C. Sustainable Design Submittals:
 1. Product Data: For adhesives, indicating VOC content.
 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect, Construction Manager and/or Owner no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Architect's, Construction Manager's and/or Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on applicable piping.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type K water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- F. Copper, Brass, or Bronze Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Mueller Industries, Inc.
 - c. NIBCO INC.
2. Fittings: Cast-brass, cast-bronze or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 and larger with stainless steel grip ring and EPDM O-ring seal.
3. Minimum 200-psig working-pressure rating at 250 deg F.

G. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Anvil International.
 - b. Shurjoint-Apollo Piping Products USA Inc.
 - c. Victaulic Company.
2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75/B 75M copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:
 - a. Copper-tube dimensions and design similar to AWWA C606.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating: 300 psig.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

2.5 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Dresser, Inc.
 - b. Jay R. Smith Mfg. Co.
 - c. JCM Industries, Inc.
- D. Plastic-to-Metal Transition Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
 - 2. Description:
 - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Company.
2. Description:
 - a. CPVC or PVC four-part union.
 - b. Brass or stainless-steel threaded end.
 - c. Solvent-cement-joint or threaded plastic end.
 - d. Rubber O-ring.
 - e. Union nut.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Central Plastics Company.
 - b. WATTS.
 - c. Wilkins.
 2. Standard: ASSE 1079.
 3. Pressure Rating: 125 psig minimum at 180 deg F.
 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Central Plastics Company.
 - b. WATTS.
 - c. Wilkins.
 2. Standard: ASSE 1079.
 3. Factory-fabricated, bolted, companion-flange assembly.
 4. Pressure Rating: 125 psig minimum at 180 deg F.

5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell G-Fire by Johnson Controls Company.
 - c. Precision Plumbing Products.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install PEX tubing with loop at each change of direction of more than 90 degrees. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
- G. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
 - 1. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following: Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings nipples or unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits or nipples.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.

- I. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.
- J. Install hangers for copper ductile iron tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- K. Support horizontal piping within 12 inches of each fitting.
- L. Support vertical runs of copper ductile iron tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

- 1. Close drain valves, hydrants, and hose bibbs.
- 2. Open shutoff valves to fully open position.
- 3. Open throttling valves to proper setting.
- 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. **Shutoff Duty:** Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Hose bibbs.
2. Trap-seal primer valves.
3. Trap-seal primer systems.
4. Flexible connectors.

- B. Related Requirements:

1. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
2. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 220000 "General Plumbing Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:

1. "No Exception Taken".
2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.

- B. Product Data: For each type of product.

- C. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.
- B. Comply with NSF 372 for low lead.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 HOSE BIBBS

- A. Hose Bibbs:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Jay R. Smith Mfg. Co.
 - b. MIFAB, Inc.
 - c. WATTS.
 - d. Woodford Manufacturing Company.
 - e. Acorn Manufacturing
 - 2. Standard: ASME A112.18.1 for sediment faucets.
 - 3. Body Material: Bronze.
 - 4. Seat: Bronze, replaceable.
 - 5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
 - 6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 - 7. Pressure Rating: 125 psig.
 - 8. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.

9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Rough bronze, Chrome or nickel plated.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Wheel handle or Operating key.
14. Operation for Finished Rooms: Wheel handle or Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb

2.4 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Precision Plumbing Products.
 - b. Zurn Industries, LLC.
2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B88, Type L; copper, water tubing.
4. Cabinet: Recessed or Surface-mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
 - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Refer to Plumbing design drawings.
8. Size Outlets: NPS 1/2 or NPS 5/8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

- C. Comply with requirements for grounding equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 IDENTIFICATION

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Hubless, cast-iron soil pipe and fittings.
- 2. Copper tube and fittings.
- 3. Specialty pipe fittings.

- B. Related Requirements:

- 1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
- 2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
- 3. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 220000 "General Plumbing Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:

- 1. "No Exception Taken".
- 2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.

- B. Product Data: For each type of product.

- C. Sustainable Design Submittals:

- 1. Product Data: For adhesives, indicating VOC content.
- 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

- D. Shop Drawings: For hubless, single-stack drainage system include plans, elevations, sections, and details.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect, Construction Manager and Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Architect's, Construction Manager's and Owner's written permission.

1.6 WARRANTY

- A. Listed manufacturers to provide labelling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
 - 2. Waste, Force-Main Piping: 50 psig, 100 psig or 150 psig.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AB & I Foundry; a part of the McWane family of companies.
 - 2. Charlotte Pipe and Foundry Company.
 - 3. Tyler Pipe; a part of McWane family of companies.
- B. Pipe and Fittings: ASTM A888 or CISPI 301.
- C. CISPI, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ANACO-Husky.
 - b. Charlotte Pipe and Foundry Company.
 - c. Tyler Pipe; a subsidiary of McWane Inc.
 - 2. Standards: ASTM C1277 and CISPI 310.
 - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ANACO-Husky.
 - b. Charlotte Pipe and Foundry Company.
 - c. Tyler Pipe; a subsidiary of McWane Inc.
 - 2. Standards: ASTM C1277 and ASTM C1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

- A. Copper Type DWV Tube: ASTM B306, drainage tube, drawn temper.

- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
 - C. Hard Copper Tube: ASTM B88, Type L and Type M, water tube, drawn temper.
 - D. Copper Pressure Fittings:
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 - F. Solder: ASTM B32, lead free with ASTM B813, water-flushable flux.
- 2.5 CPVC Drainage Pipe and Fittings: ASTM F2618 pipe and drainage-pattern fittings.
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Charlotte Pipe and Foundry Company.
 - 2. Spears Manufacturing Company.
 - B. Solvent Cement for Joining CPVC Piping: ASTM F493. Include primer according to ASTM F656.
- 2.6 SPECIALTY PIPE FITTINGS
- A. Transition Couplings:
 - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 2. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company, LLC; a division of MCP Industries.
 - b. Standard: ASTM C1460.

- c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- d. End Connections: Same size as and compatible with pipes to be joined.

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Natural.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.

- J. Provided seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. All cleanouts shall be installed where readily accessible. The contractor shall coordinate all cleanout locations with equipment, cabinets, etc. and architect prior to any installation.
- L. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- M. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- N. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 or 2percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- O. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A674 or AWWA C105/A 21.5.
- P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- Q. Install engineered soil and waste and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.

3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
 - R. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
 1. Install encasement on piping according to ASTM A674 or AWWA C105/A 21.5.
 - S. Install CPVC drainage piping according to ASTM F1668.
 - T. Plumbing Specialties:
 1. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 - U. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 - V. Install sleeves for piping penetrations of walls, ceilings, and floors.
 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
 - W. Install sleeve seals for piping penetrations of concrete walls and slabs.
 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
 - X. Install escutcheons for piping penetrations of walls, ceilings, and floors.
 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- 3.2 JOINT CONSTRUCTION
- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
 - B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
 1. Cut threads full and clean using sharp dies.
 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - c. Do not use pipe sections that have cracked or open welds.

- C. Join copper tube and fittings with soldered joints according to ASTM B828. Use ASTM B813, water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.
- D. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

- 1. Install transition couplings at joints of piping with small differences in ODs.
- 2. In Waste Drainage Piping: Unshielded or Shielded, nonpressure transition couplings.
- 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
- 4. In Underground Force Main Piping:
 - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
 - b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

- 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
- 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits or nipples.
- 4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment." and Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

- 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
- 2. Install stainless-steel or fiberglass pipe hangers for horizontal piping in corrosive environments.
- 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
- 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
- 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
- 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
- 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
 - D. Support vertical piping and tubing at base and at each floor.
 - E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
 - F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
 - G. Install supports for vertical cast-iron soil piping every 15 feet.
 - H. Install supports for vertical steel piping every 15 feet.
 - I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.
 - J. Install supports for vertical copper tubing every 10 feet.
 - K. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

- C. Connect waste and vent piping to the following:
1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Install horizontal backwater valves with cleanout cover flush with floor or in pit with pit cover flush with floor.
 6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 7. Equipment: Connect waste piping as indicated.
 - a. Provide shutoff valve if indicated and union for each connection.
 - b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Cover all floor drains and floor sinks during constructions to prevent debris from entering pipe and protect grates from damages.

- D. Place plugs in ends of uncompleted piping at end of day and when work stops.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI or heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Galvanized-steel pipe, drainage fittings, and threaded joints.
 - 4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - 5. Solid-wall or Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 6. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 7. Dissimilar Pipe-Material Couplings: Unshielded or Shielded, nonpressure transition couplings.
- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI or heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Galvanized-steel pipe, drainage fittings, and threaded joints.
 - 4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
 - 5. Solid-wall or Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 6. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 7. Dissimilar Pipe-Material Couplings: Unshielded or Shielded, nonpressure transition couplings.
- D. Single-Wall, Plastic Sewerage Piping: Use any of the following piping materials for each size range:
 - 1. NPS 2 to NPS 4: joints.
 - 2. NPS 1-1/2 to NPS 4: PE drainage pipe and fittings and fusion joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Miscellaneous sanitary drainage piping specialties.
 - 3. Floor sinks.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. FOG: Fats, oils, and greases.
- C. PVC: Polyvinyl chloride.
- D. FRP: Fiberglass-reinforced plastic.
- E. HDPE: High-density polyethylene.
- F. PE: Polyethylene.
- G. PP: Polypropylene.

1.4 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 220000 "General Plumbing Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. "No Exception Taken".
 - 2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Shop Drawings:

1. Show fabrication and installation details for frost-resistant vent terminals.
2. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: For FOG disposal systems, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

2.2 CLEANOUTS

- A. Cast-Iron Exposed Cleanouts:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. MIFAB, Inc.
 - c. Zurn Industries, LLC.
 2. Standard: ASME A112.36.2M.

3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Clamping Device: as Required.
8. Outlet Connection: Inside calk, Spigot, or Threaded.
9. Closure: Brass plug with straight threads and gasket, or Brass plug with tapered threads.
10. Adjustable Housing Material: Cast iron with threads or setscrews.
11. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, or Stainless steel.
12. Frame and Cover Shape: Round or Square when specifically requested by owner.
13. Top Loading Classification: Heavy duty at exterior locations. Light or Medium Duty within building.

B. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. MIFAB, Inc.
 - c. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch, or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:
 - a. Brass Cast iron.
 - b. Countersunk or raised head.
 - c. Drilled and threaded for cover attachment screw.
 - d. Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 FLOOR SINKS

A. Cast-Iron Floor Sinks:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Jay R. Smith Mfg. Co.
 - b. MIFAB, Inc.
 - c. Watts; a Watts Water Technologies company.

2. Standard: ASME A112.6.7.
3. Pattern: Floor drain.
4. Body Material: Cast iron.
5. Anchor Flange: As Required, with seepage holes.
6. Clamping Device: As Required.
7. Outlet: Bottom, no-hub connection.
8. Coating on Interior Surfaces: Acid-resistant enamel.
9. Sediment Bucket: Not required.
10. Internal Strainer: Dome or Flat.
11. Internal Strainer Material: Aluminum.
12. Top Grate Material: Cast iron, loose.
13. Top of Body and Grate Finish: Nickel bronze, Acid-resistant enamel.
14. Top Shape: Square.
15. Dimensions of Top Grate: Refer to Plumbing Fixture Schedule on Construction plans.
16. Top Loading Classification: No traffic.
17. Funnel: Not required.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 135 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
 5. At each horizontal drainage pipe upper terminal.
 6. Above each Urinal.
- B. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- C. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- D. Install wood-blocking reinforcement for wall-mounting-type specialties.
- E. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- E. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections, and prepare test reports.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 230000 – GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

- A. Basic mechanical requirements specifically applicable to Division 23 Section.
- B. Work includes but is not necessarily limited to the following:
 - 1. Labor, materials, services, equipment, and appliances required for completion of tasks as indicated on drawing or in specification or as inherently necessary to prepare spaces and systems for new installations as follows:
 - a. Heating, ventilating and air conditioning systems and equipment
 - b. Testing, adjusting and balancing

1.3 DRAWINGS AND SPECIFICATIONS

- A. Drawings accompanying these Specifications show intent of Work to be done. Specifications shall identify quality and grade of installation and where equipment and hardware is not particularly specified, Contractor shall provide submittals for all products and install them per manufacturers' recommendations, and in a workmanlike manner.
- B. Examine Drawings and Specifications for elements in connection with this Work; determine existing and new general construction conditions and be familiar with all limitations caused by such conditions.
- C. Plans are intended to show general arrangement and extent of Work contemplated. Exact location and arrangement of parts shall be determined after the Owner has reviewed equipment, as Work progresses, to conform in best possible manner with surroundings, and as directed by the Owner's Representative.
- D. Contract Documents are in part diagrammatic and intended to show the scope and general arrangement of the Work under this Contract. The Contractor shall follow these drawings in laying out the equipment, piping and ductwork. Drawings are not intended to be scaled for roughing in measurements or to serve as shop drawings. Where job conditions require minor changes or adjustments in the indicated locations or arrangement of the Work, such changes shall be made without change in the Contract amount.

- E. Follow dimensions without regard to scale. Where no figures or notations are given, the Plans shall be followed.

1.4 UTILITIES

- A. Location and sizes of electrical, mechanical and plumbing service facilities are shown in accordance with data secured from existing record drawings and site observations. Data shown are offered as an estimating guide without guarantee of accuracy. Check and verify all data given, and verify exact location of all utility services pertaining to Work prior to excavation or performing Work.

1.5 APPLICABLE REFERENCE STANDARDS, CODES AND REGULATIONS

- A. Meet requirements of all state codes having jurisdiction.
- B. State of California Code of Regulations:
 - 1. Title 8, Industrial Relations
 - 2. Title 19, State Fire Marshal Regulations
 - 3. Current California Building Code (CBC), Title 24, Part 2
 - 4. Current California Electrical Code, Title 24, Part 3
 - 5. Current California Mechanical Code, Title 24, Part 4
 - 6. Current California Plumbing Code, Title 24, Part 5
 - 7. Current California Energy Code, Title 24, Part 6
 - 8. Current California Fire Code, Title 24, Part 9
 - 9. Current California Standards Code, Title 24, Part 12
- C. Additional Referenced Standards:
 - 1. AABC Associated Air Balance Council
 - 2. AMCA Air Moving and Conditioning Association
 - 3. AHRI Air-Conditioning, Heating and Refrigeration Institute
 - 4. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
 - 5. ASME American Society of Mechanical Engineers
 - 6. ASTM American Society for Testing and Materials
 - 7. NEMA National Electrical Manufacturer's Association
 - 8. NFPA National Fire Protection Association Standards
 - 9. PDI Plumbing and Drainage Institute
 - 10. UL Underwriters Laboratories
- D. Codes and ordinances having jurisdiction over Work are minimum requirements; but, if Contract Documents indicate requirements, which are in excess of those minimum requirements, then requirements of the Contract Documents shall be followed. Should there be any conflicts between Contract Documents or codes or any ordinances having jurisdiction, report these to the Owner's Representative.
- E. Obtain permits, and request inspections from authority having jurisdiction.

1.6 PROJECT AND SITE CONDITIONS

- A. The arrangement of and connection to equipment shown on the Drawings is based upon information available and is not intended to show exact dimensions peculiar to a specific manufacturer. The Drawings are, in part, diagrammatic and some features of the illustrated equipment installations may require revision to meet actual equipment installation requirements. Structural supports, housekeeping pads, piping connections and adjacent equipment may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions or alterations.
- B. Examine all Drawings and Specifications to be fully cognizant of all work required under this Division.
- C. Examine site related work and surfaces before starting work of any Section.
- D. Install Work in locations shown on approved Drawings, unless prevented by Project conditions.
- E. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission from the Owner's Representative before proceeding.

1.7 COOPERATION WITH WORK UNDER OTHER DIVISIONS

- A. Cooperate with other trades to facilitate general progress of Work. Allow all other trades every reasonable opportunity for installation of their work.
- B. Work under this Division shall follow general building construction closely. Set pipe sleeves and inserts and verify that openings for chases and pipes are provided.
- C. Work with other trades in determining exact location of outlets, pipes, and pieces of equipment to avoid interference with lines required to maintain proper installation of Work.
- D. Make such progress in the Work to not delay work of other trades.
- E. Mechanical Work shall have precedence over the other in the following sequence:
 - 1. Soil and waste piping
 - 2. Hydronic piping
 - 3. Ductwork
 - 4. Domestic water piping
 - 5. Fire sprinkler piping

1.8 DISCREPANCIES

- A. The Contractor shall check all Drawings furnished him immediately upon their receipt and shall promptly notify the Owner's Representative of any discrepancies. Figures marked on Drawings shall in general be followed in preference to scale measurements. Piping and instrumentation diagrams shall in general govern floor plans and sections. Large-scale drawings shall in general govern small-scale drawings.

- B. Where requirements between Drawings and Specifications conflict, the more restrictive provisions shall apply.
- C. If any part of the Specifications or Drawings appears unclear or contradictory, apply to Owner's Representative for interpretation and decision as early as possible, including during bidding period. Do not proceed with such work without Owner Representatives decision. Beginning work of any Section constitutes acceptance of conditions.

1.9 CHANGES

- A. The Contractor shall be responsible to make and obtain approval from the Owner's Representative for all necessary adjustments in piping and equipment layouts as required to accommodate the relocations of equipment and/or devices, which are affected by any approved authorized changes or Product substitutions. All changes shall be clearly indicated on the "Record" drawings.

1.10 SUBMITTALS

- A. Refer to Division 01 for additional requirements.
- B. The manufacturer, contractor or supplier shall include a written statement that the submitted equipment, hardware or accessory complies with the requirement of that particular specification section.
- C. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section.
- D. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- E. Note that prior to acceptance of submittals for review, a submittal schedule shall be submitted to the Owner's Representative.
- F. Submit all Division 23 shop drawings and product data grouped and referenced by the specification technical section number into a complete submittal package for each specification section.
- G. Shop Drawings:
 - 1. Include installation details of equipment indicating proposed location, layout and arrangement, accessories, piping, and other items that must be shown to assure a coordinated installation.
 - 2. Indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
 - 3. If equipment is rejected, revise drawings to show acceptable equipment and resubmit.
- H. Whenever more than one (1) manufacturer's product is specified, the first named product is the basis of design used in the Drawings and the use of alternate-named manufacturer's products or substitutes may require modifications to the design.

- I. The Contractor shall be responsible for all equipment ordered and/or installed prior to receipt of shop drawings returned from the Owner's Representative bearing the Owner's Representative stamp of "Reviewed". All corrections or modifications to the equipment as noted on the shop drawings shall be performed and equipment removed from the job site at the request of the Owner's Representative without additional compensation.
- J. **Manufacturer's Data:** For each manufactured item, provide current manufacturer's descriptive literature of cataloged products, certified equipment drawings, diagrams, performance and characteristic curves if applicable, and catalog cuts.
- K. **Standard Compliance:** When materials or equipment provided by the Contractor must conform to the standards of organizations such as American National Standards Institute (ANSI) or UL, submit proof of such conformance to the Owner Representative for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified. In lieu of the label or listing, submit a certificate from an independent testing organization, which is competent to perform acceptance testing and is approved by the Owner Representative. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard.
- L. **Certified Test Reports:** Before delivery of materials and equipment, certified copies of all test reports specified in individual sections shall be submitted for approval.
- M. **Certificates of Compliance or Conformance:** Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this Contract. Pre-printed certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; or "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance or conformance.

1.11 PROJECT RECORD DOCUMENTS

- A. Refer to Division 01 for additional requirements.
 - 1. All changes, deviations and information recorded on the "Project Record Drawings" set during Construction shall be redrafted onto the latest version of AutoCAD or Revit, where applicable.
 - 2. Submit completed shop drawings to the Owner prior to completion in AutoCAD format. Contractor hand marked or drafted redlined "Project Record Drawings" will not be accepted.

1.12 PRODUCT ALTERNATIVES OR SUBSTITUTIONS

- A. Refer to General Conditions and Division 01 for additional requirements.

1.13 OPERATING INSTRUCTIONS

- A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel.

1.14 MANUFACTURER'S RECOMMENDATIONS

- A. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

1.15 DELIVERY AND STORAGE

- A. Refer to Division 01 for additional requirements.
- B. Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations and with the requirements of NFPA 70B P, Appendix I, titled "Equipment Storage and Maintenance During Construction." Replace damaged or defective items with new items.

1.16 GUARANTEE

- A. Except as may be specified under other sections in the Specifications, guarantee all equipment furnished under the Specifications for a period of one year from date of project acceptance against defective workmanship and material and improper installation. Upon notification of failure, correct deficiency immediately and without cost to the Owner.
- B. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner for their service agency as directed.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Obtain and pay for all permits and inspections, including any independent testing required to verify standard compliance, and deliver certificates for same to the Owner's Representative.

3.2 WORK RESPONSIBILITIES

- A. The drawings indicate diagrammatically the desired locations or arrangement of piping, equipment, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the work to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference with structural conditions.
- B. The Contractor is responsible for the correct placing of Work and the proper location and connection of Work in relation to the work of other trades. Advise appropriate trade as to locations of access panels.
- C. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost, providing the change is ordered before the ductwork, piping, etc. and work directly connected to same is installed and no extra materials are required.
- D. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.
- E. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with any work, carefully check and verify all dimensions, sizes, etc. with the drawings to see that the equipment will fit into the spaces provided without violation of applicable codes.
- F. Should any changes to the Work indicated on the Drawings or described in the Specifications be necessary in order to comply with the above requirements, notify the Owner immediately and cease work on all parts of the contract, which are affected until approval for any required modifications to the construction has been obtained from the Owner.
- G. Be responsible for any cooperative work, which must be altered due to lack of proper supervision or failure to make proper provisions in time. Such changes shall be under direction of the Owner and shall be made to his satisfaction. Perform all Work with competent and skilled personnel.
- H. All work, including aesthetic as well as mechanical aspects of the Work, shall be of the highest quality consistent with the best practices of the trade.
- I. Replace or repair, without additional compensation, any Work, which, in the opinion of the Owner, does not comply with these requirements.

3.3 PAINTING

- A. Refer to Division 09 for additional requirements.
- B. Factory Applied:
 - 1. Mechanical equipment shall have factory-applied painting systems, which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.20.
 - 2. Refer to individual sections of this Division for more stringent requirements.
- C. Field Applied:
 - 1. Paint all mechanical equipment as required to touch up, to match finish on other equipment in adjacent spaces or to meet safety criteria.
 - 2. Paint all exposed, uninsulated mechanical piping, valves, supports, hangers and appurtenances. Provide minimum 5 mils dry film thickness.
 - 3. Paint ductwork flat black that are visible behind air outlets and inlets.
 - 4. Paint all exposed and rooftop ductwork, roof mounted mechanical equipment, ductwork supports, hangers and appurtenances.
 - 5. Paint shall be a high performance polyurethane enamel coating system.
 - a. Acceptable paint manufacturers include Ameron, Tnemec or engineer approved equal.
 - b. Acceptable primer manufacturers include Ameron Amershield VOC, Tnemec's Series 1075 (1074) Endura-Shield, semi-gloss (gloss) sheen or equal.
 - c. Provide minimum 5 mils dry film thickness.

END OF SECTION 230000

SECTION 230519 – METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Thermometers
 - 2. Thermowells
 - 3. Test plugs
- B. Related Requirements:
 - 1. Section 232113 “Hydronic Piping”
 - 2. Section 232116 “Hydronic Piping Specialties”

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 “General Mechanical Requirements”.
- B. Product Data: For each type of product indicated.
- C. Schedule: For thermometers, pressure gauges, thermowell and test plugs indicating manufacturer's number, scale range, and location for each.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gauge from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Select gauges such that the high limit of range does not exceed a factor of 1.5x the standard operating point for that particular system.
- B. Select gauges so that system operating pressure is found within the middle 1/3 of overall range.

2.2 DIAL THERMOMETERS

A. Manufacturers

- 1. Ashcroft Commercial Inc.
- 2. Marsh Bellofram
- 3. Terice, H. O. Co.
- 4. Weiss Instruments, Inc.
- 5. Weksler Instruments Inc.
- 6. 3D Instruments
- 7. Or equal.

B. Bimetallic-Actuated

- 1. Description: Adjustable angle, Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.200.
- 2. Case: Highly polished, hermetically sealed, stainless steel, 5-inch diameter.
- 3. Element: Bimetal coil.
- 4. Dial: Satin-faced, or highly polished, non-reflective aluminum with permanently etched scale markings.
- 5. Pointer: Black metal.
- 6. Window: Double strength Glass.
- 7. Ring: Stainless steel.
- 8. Connector: Adjustable angle, NPT ½ with ASME B1.1 screw threads.
- 9. Stem: stainless steel, for thermo-well installation and of length to suit installation.
- 10. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.
- 11. Units: Scale shall be degrees Fahrenheit, unless otherwise indicated, suitable for the media operating temperatures.

2.3 THERMOWELLS

A. Manufacturers:

- 1. Ashcroft Commercial Inc.
- 2. Marsh Bellofram.
- 3. Terice, H. O. Co.

4. Weiss Instruments, Inc.
5. 3D Instruments
6. Or equal.

B. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping.
3. Pressure Rating: Not less than piping system design pressure.
4. Material: stainless steel.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPT 1/2, NPT 3/4, or NPT 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Extend one-third to two-thirds of pipe diameter into fluid.
10. Lagging Extension: Extension for Insulated Piping: 2 inches nominal and not less than thickness of insulation.
11. Bushings: are prohibited.

C. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 TEST PLUGS

A. Manufacturers:

1. Peterson Equipment Co., Inc.
2. Sisco Manufacturing Co.
3. IMI Hydronic Engineering (Flow Design), Inc.
4. Or equal.

B. Description: Corrosion-resistant brass or stainless-steel body with minimum two core inserts and gasketed and threaded cap with cap retainer, with extended stem beyond insulation for units to be installed in insulated piping.

C. Thread Size: NPT 1/2, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Two chlorosulfonated (CR) polyethylene synthetic and EPDM (Nordel) self-sealing rubber, valves gasketed orifice, suitable for inserting a 1/8" OD probe assembly.

1. Insert material for air, water (except for water heated by high temperature water), oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or high temperature water heated hot water service at 30 to plus 275 deg F shall be EPDM.

F. If test plug requires probes longer than 1-inch, provide to the Owner three probes of the required length for the installed test plug.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install bimetallic-actuated dial thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic zone.
 - 2. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
- B. Subject to listed standard ranges from the approved manufacturer, provide the following temperature ranges for thermometers:
 - 1. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
 - 2. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 INSTALLATION

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending a minimum of 2 inches into fluid or to the center of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install test plugs in tees in piping.
- F. Install sight flow indicators, in accessible positions for easy viewing, in piping systems.
- G. Assemble and install connections, tubing, and accessories between flow-measuring elements as prescribed by manufacturer's written instructions.
- H. Install permanent indicators on walls or brackets in accessible and readable positions.
- I. Install connection fittings for attachment to portable indicators in accessible locations.

3.3 CONNECTIONS

- A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance for meters, gauges, machines, and equipment.

3.4 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gauges to proper angle for best visibility.

3.5 CLEANING

- A. Clean windows of meters, and gauges, and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

END OF SECTION 230519

SECTION 230523 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Bronze ball valves.
- 2. Iron, single-flange butterfly valves.

- B. Related Sections:

- 1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate and globe valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. Caution: Use solder with melting point below 421 deg F.
6. ASME B16.18 for solder-joint connections.
7. ASME B31.1 for power piping valves.
8. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. HVAC ball valve applications specified in this Section are limited to NPS 10.

E. Refer to HVAC valve schedule articles for applications of valves.

F. Caution: Revise pressure ratings and insert temperature ratings in valve articles if valves with higher ratings are required.

- G. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves smaller than NPS 4.
- J. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.
- K. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES (SIZES ½” THROUGH 2”)

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milwaukee Valve Company.
 - b. NIBCO INC.
 - c. Watts Regulator Co.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES (SIZES 2-1/2” THROUGH 12”)

- A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
2. Description:
- a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze or ductile iron.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for ball and butterfly valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Globe or Ball
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 5. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 CHILLED-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Ball Valves: Two piece, full port, stainless-steel trim.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron, Single-Flange Butterfly Valves: Aluminum-bronze disc, 200 CWP, EPDM seat.
 - 2. For underground valve box applications:
 - a. Butterfly Valves: Class 150, single flange

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

- B. Related Sections:

1. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
2. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 REFERENCES

- A. ASME B31.9 Building Services Piping
- B. MSS SP58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application and installation
- C. MSS SP-69 Pipe Hangers and Supports – Selection and Application
- D. MSS SP-89 Pipe Hangers and Supports – Fabrication and Installation Practices

1.4 DEFINITIONS

- A. ASCE: American Society of Civil Engineers
- B. ASME: American Society of Mechanical Engineers
- C. ASTM: America Society for Testing and Material

- D. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.
- E. MFMA: Metal Framing Manufacturers Association
- F. SEI: Structural Engineering Institute

1.5 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to Standard ASCE/SEI 7 – Minimum Design Loads for Buildings and Other Structures.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.6 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 “General Mechanical Requirements”. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. “No Exception Taken”.
 - 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product indicated including component cut sheets and pre-approved details.
- C. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Pipe stands.
 - 4. Equipment supports.

- D. Delegated Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.7 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.8 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to current ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel stainless steel.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with in-turned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Metallic Coating: Electroplated zinc, Mill galvanized, In-line, hot galvanized or Mechanically-deposited zinc.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with in-turned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of PVC coated carbon steel, hot dipped galvanized carbon steel or stainless steel.

2.5 VERTICAL RISER CLAMPS FOR INSULATED PIPES

A. Vertical Riser Clamps for Insulated Steel Pipes:

1. Manufacturer shall be Pipe Shields Inc. Model E2100 or equal.
2. Carbon steel pipe material, steel straps and base that is compliance with ASTM A36.
3. Insulation shall be calcium silicate, asbestos free, treated with water repellent.
4. Jacket shall be galvanized steel that is in compliance with ASTM A-527.
5. Fasteners shall comply with ASTM A-307 plated.
6. Coating shall be primer coated.

B. Vertical Riser Clamps for Insulated Copper Pipes:

1. Manufacturer shall be Hydra-Zorb Titan Riser Clamp or equal.
2. 25/50 flame spread/smoke spread index.
3. Eliminates insulation compression.
4. Crush resistant.
5. Vertical load rating up to 2400 lbs.

2.6 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers

1. Pipe Shields Inc.
2. Pittsburg Corning Foamglas ONE
3. ITW Insulation Systems TRYMER 2000 XP

B. Cold Piping: Insulation-Insert Material - ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Hot Piping: Insulation-Insert Material - Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.8 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Stainless steel.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

- d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and corrosion-resistant attachments for hostile environment applications.
- G. Copper Pipe or Tubing
 1. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
 2. Or use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of non-insulated pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of non-insulated pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
 3. Insulated piping shall use vertical riser clamps for insulated pipe.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment, up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Open-spring isolators.
4. Housed-spring isolators.
5. Pipe-riser resilient supports.
6. Elastomeric hangers.
7. Spring hangers.
8. Snubbers.
9. Restraint channel bracings.
10. Restraint cables.
11. Seismic-restraint accessories.
12. Mechanical anchor bolts.
13. Adhesive anchor bolts.

- B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.
2. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development.

1.4 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 “General Mechanical Requirements”. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
1. “No Exception Taken”.
 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product.
1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction].
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- C. Shop Drawings:
1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- D. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces required to select vibration isolators and seismic restraints and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - d. Preapproval and Evaluation Documentation: By [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction], showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.
- E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPM number from OSHPD, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Contractor shall consult on requirements with Structural Engineer of Record or other acceptable qualified engineer by the authority having jurisdiction.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads.

1. Manufacturer and Model:

- a. Basis of Design

- 1) Mason Industries Type MBSW

- b. Or Approved Equal by:

- 1) California Dynamics Corporation
- 2) Kinetics Noise Control
- 3) Vibrex
- 4) Isotech Industries

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Waffle pattern.
6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Resilient and elastomeric

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts.

1. Manufacturer and Model:
 - a. Basis of Design
 - 1) Mason Industries Type ND
 - b. Or Approved Equal by:
 - 1) California Dynamics Corporation
 - 2) Kinetics Noise Control
 - 3) Vibrex
 - 4) Isotech Industries
2. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators.

1. Manufacturer and Model:
 - a. Basis of Design
 - 1) Mason Industries Type SLFH
 - b. Or Approved Equal by:
 - 1) California Dynamics Corporation
 - 2) Kinetics Noise Control
 - 3) Vibrex
 - 4) Isotech Industries
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing.

1. Manufacturer and Model:
 - a. Basis of Design
 - 1) Mason Industries Type C
 - b. Or Approved Equal by:
 - 1) California Dynamics Corporation
 - 2) Kinetics Noise Control
 - 3) Vibrex
 - 4) Isotech Industries
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Top housing with attachment and leveling bolt, threaded mounting holes and internal leveling device.

2.6 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Manufacturer and Model:
 - a. Basis of Design
 - 1) Mason Industries Type SSLFH

- b. Or Approved Equal by:
 - 1) California Dynamics Corporation
 - 2) Kinetics Noise Control
 - 3) Vibrex
 - 4) Isotech Industries
- 2. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
- 3. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.7 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods.

- 1. Manufacturer and Model:
 - a. Basis of Design
 - 1) Mason Industries Type HD
 - b. Or Approved Equal by:
 - 1) California Dynamics Corporation
 - 2) Kinetics Noise Control
 - 3) Vibrex
 - 4) Isotech Industries
- 2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
- 3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.8 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression.

- 1. Manufacturer and Model:
 - a. Basis of Design
 - 1) Mason Industries Type 30N OR PC30NS
 - b. Or Approved Equal by:
 - 1) California Dynamics Corporation

- 2) Kinetics Noise Control
 - 3) Vibrex
 - 4) Isotech Industries
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.9 SNUBBERS

A. Manufacturer and Model:

1. Basis of Design
 - a. Mason Industries Type Z-1011
2. Or Approved Equal by:
 - a. California Dynamics Corporation
 - b. Kinetics Noise Control
 - c. Vibrex
 - d. Isotech Industries

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

2.10 RESTRAINT CHANNEL BRACINGS

A. Manufacturer and Model:

1. Basis of Design
 - a. Mason Industries Type Seismic Sway Bracing System

2. Or Approved Equal by:
 - a. California Dynamics Corporation
 - b. Kinetics Noise Control
 - c. Vibrex
 - d. Isotech Industries

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.11 RESTRAINT CABLES

A. Manufacturer and Model:

1. Basis of Design
 - a. Mason Industries Type SCBA Assembly, SCR, UC & CCB
2. Or Approved Equal by:
 - a. California Dynamics Corporation
 - b. Kinetics Noise Control
 - c. Vibrex
 - d. Isotech Industries

B. Restraint Cables: ASTM A 603 galvanized ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.12 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturer and Model:

1. Basis of Design
 - a. Mason Industries Type SCR, UC & CCB
2. Or Approved Equal by:
 - a. California Dynamics Corporation
 - b. Kinetics Noise Control
 - c. Vibrex
 - d. Isotech Industries

B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.13 MECHANICAL ANCHOR BOLTS

- A. Manufacturer and Model:
 - 1. Basis of Design
 - a. Mason Industries Type SAB/SAS
 - 2. Or Approved Equal by:
 - a. California Dynamics Corporation
 - b. Kinetics Noise Control
 - c. Hilti
- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.14 ADHESIVE ANCHOR BOLTS

- A. Manufacturer and Model:
 - 1. Basis of Design
 - a. Mason Industries Type SAA
 - 2. Or Approved Equal by:
 - a. California Dynamics Corporation
 - b. Kinetics Noise Control
 - c. Hilti
- B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for

exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction].
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete" and Section 033053 "Miscellaneous Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- K. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Structural Engineer of Record.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
 - 9. Test and adjust restrained-air-spring isolator controls and safeties.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 “General Mechanical Requirements”. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. “No Exception Taken”.
 - 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product.
- C. Samples: For color, letter style, and graphic representation required for each identification material and device.
- D. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Craftmark Identification Systems
 - 2. Seton Identification Products
 - 3. MSI Marking Services
 - 4. Setmark

2.2 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass or anodized aluminum, 0.032-inch minimum thickness and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets or contact-type permanent adhesive, compatible with label and substrate.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Three-layer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick and having predrilled holes for attachment hardware.
 - 2. Color Coding:
 - a. Letter Color: White.
 - b. Background Color: Red.
 - 3. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 6. Fasteners: Stainless-steel rivets or contact-type permanent adhesive, compatible with label and substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Color Coding:
1. Background Color: Yellow.
 2. Letter Color: Black.
- C. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- F. Fasteners: Stainless-steel rivets or self-tapping screws.
- G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 PIPE LABELS

- A. Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pre-tensioned Pipe Labels for Outside Diameter Less or Equal to 8 Inches: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels for Outside Diameter Greater than 8 Inches: Printed plastic with contact-type, permanent-adhesive backing. Either marker shall show accepted color-coded background, proper color of legend in relation to background color, accepted legend letter size, accepted marker length.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- F. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with ¼-inch letters for piping system abbreviation and ½ inch sequenced numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2 by 11 inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as “DANGER”, “CAUTION” or “DO NOT OPERATE.”
 - 4. Color:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting"
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Within one foot of each valve and control device.
 - 2. Near each branch connection and riser takeoff.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. Near major equipment items and other points of origination and termination.
 - 5. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 6. Spaced at maximum intervals of 20 feet along each run, but not less than once in each room at entrance and exit of each concealed space.
 - 7. On piping above removable acoustical ceilings.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
 - 1. Chilled-Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 - 2. Refrigerant Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

3.5 DUCT LABEL INSTALLATION

- A. Locate ductwork labels where ductwork is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Within one foot of each control device.
 - 2. Near each branch connection and riser takeoff.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. Near major equipment items and other points of origination and termination.

5. Spaced at maximum intervals of 20 feet along each run, but not less than once in each room at entrance and exit of each concealed space.
 6. On ductwork above removable acoustical ceilings.
- B. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
1. Return Air and Outside Air:
 - a. Background Color: Green.
 - b. Letter Color: White
 2. ASME A13.1 Colors and Designs: For hazardous material exhaust.

3.6 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except valves within factory-fabricated equipment units; faucets; convenience and lawn-watering hose connections. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
 - a. Chilled Water: 2 inches, round.
 - b. Refrigerant: 2 inches, round.
 2. Valve-Tag Color:
 - a. Chilled Water: Natural.
 - b. Refrigerant: Natural.
 3. Letter Color:
 - a. Chilled Water: Black.
 - b. Refrigerant: Black.
- C. All above and below grade and interior and exterior valves shall be tagged. Submit valve tag chart to the Owner Representative for review and approval at the completion of the project.

3.7 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Balancing Air Systems:
 - a. Constant-volume air systems.
- 2. Balancing Hydronic Piping Systems:
 - a. Variable-flow hydronic systems.
- 3. Testing, Adjusting, and Balancing Equipment:
 - a. Motors.
 - b. Condensing units.
 - c. Heat-transfer coils.
 - d. Pumps
- 4. Testing, adjusting, and balancing existing systems and equipment.
- 5. Sound tests.
- 6. Vibration tests.
- 7. Duct leakage tests.
- 8. Control system verification.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.

- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: Conduct a TAB conference at Project site with the Engineer and Commissioning Agent after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.5 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 "General Mechanical Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. "No Exception Taken".
 - 2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. TAB Report:
 - 1. Air-Balance Report for Prerequisite IEQ 1: Documentation indicating that work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - 2. TAB Report for Prerequisite EA 2: Documentation indicating that work complies with ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

- D. System Readiness Checklists: Submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.7 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Engage an independent TAB Contractor certified by AABC, NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or TABB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.8 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.
 - 2. Hydronics:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.
 - c. Water treatment is complete.
 - d. Systems are flushed, filled, and air purged.
 - e. Strainers are pulled and cleaned.
 - f. Control valves are functioning per the sequence of operation.
 - g. Shutoff and balance valves have been verified to be 100 percent open.

- h. Pumps are started and proper rotation is verified.
- i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
- j. Variable-frequency controllers' startup is complete and safeties are verified.
- k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE Standard 111 or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.

- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - b. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - c. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Obtain approval from Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets and outlets airflow.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.

- D. Verify final system conditions.
 - 1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 - 2. Re-measure and confirm that total airflow is within design.
 - 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 - 4. Mark all final settings.
 - 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 - 6. Measure and record all operating data.
 - 7. Record final fan-performance data.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 - 1. Check liquid level in expansion tank.
 - 2. Check highest vent for adequate pressure.
 - 3. Check flow-control valves for proper position.
 - 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 - 5. Verify that motor starters are equipped with properly sized thermal protection.
 - 6. Check that air has been purged from the system.

3.7 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above in General Procedures for Hydronic Systems.
- B. Adjust the variable-flow hydronic system as follows:
 - 1. Verify that the differential-pressure sensor is located as indicated.
 - 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
 - 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.

- 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
2. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
5. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
6. Prior to verifying final system conditions, determine the system differential-pressure set point.
7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-

frequency controller to control system differential-pressure set point. Record pump data under both conditions.

8. Mark final settings and verify that all memory stops have been set.
9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
10. Verify that memory stops have been set.

3.8 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.9 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

3.10 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
 1. Entering- and leaving-water temperature.
 2. Water flow rate.
 3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
 4. Dry-bulb temperature of entering and leaving air.
 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.11 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.12 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.

4. Check the condition of filters.
 5. Check the condition of coils.
 6. Check the operation of the drain pan and condensate-drain trap.
 7. Check bearings and other lubricated parts for proper lubrication.
 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
1. New filters are installed.
 2. Coils are clean and fins combed.
 3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 4. Balance each air outlet.

3.13 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 percent or minus 0 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 4. Cooling-Water Flow Rate: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.14 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing

devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

- B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

- 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
- 2. Include a list of instruments used for procedures, along with proof of calibration.
- 3. Certify validity and accuracy of field data.

- B. Final Report Contents: In addition to certified field-report data, include the following:

- 1. Fan curves.
- 2. Manufacturers' test data.
- 3. Field test reports prepared by system and equipment installers.
- 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

- C. General Report Data: In addition to form titles and entries, include the following data:

- 1. Title page.
- 2. Name and address of the TAB specialist.
- 3. Project name.
- 4. Project location.
- 5. Architect's name and address.
- 6. Engineer's name and address.
- 7. Contractor's name and address.
- 8. Report date.
- 9. Signature of TAB supervisor who certifies the report.
- 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
- 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
- 12. Nomenclature sheets for each item of equipment.
- 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
- 14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.

- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Balancing stations.
 6. Position of balancing devices.

- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.

 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.

 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.

- e. Filter static-pressure differential in inches wg.
- f. Preheat-coil static-pressure differential in inches wg.
- g. Cooling-coil static-pressure differential in inches wg.
- h. Heating-coil static-pressure differential in inches wg.
- i. Outdoor airflow in cfm.
- j. Return airflow in cfm.
- k. Outdoor-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft.
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System and air-handling-unit number.
- b. Location and zone.

- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft.
- g. Indicated airflow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual airflow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

H. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.16 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority.
- B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, Owner may contact AABC, NEBB or TABB Headquarters regarding the Performance Guaranty.
- F. Prepare test and inspection reports.

3.17 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Review these documents for coordination with additional requirements and information that apply to work under this Section

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply air.
 - 2. Indoor, concealed return air.
 - 3. Indoor, exposed return air.
- B. Related Sections:
 - 1. Section 230719 "HVAC Piping Insulation."
 - 2. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 "General Mechanical Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. "No Exception Taken".
 - 2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.

3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; SoftTouch Duct Wrap
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Owens Corning; SOFTR All-service Duct Wrap.

2.2 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller
 - c. Knauf Insulation.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Vapor-Barrier Permeance: ASTM 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Childers Brand; H. B. Fuller Construction Products.; CP10
 - b. Eagle Bridges - Marathon Industries.; 550
 - c. Foster Brand; H. B. Fuller Construction Products.; 146-50
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.

2.3 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.; CP-76.
 - b. Foster Brand; H. B. Fuller Construction Products.; 95-44.
 - c. Mon-Eco Industries, Inc.; 44-05
 - d. Eagle Bridges – Marathon Industries; 405.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: 20 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.4 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Compac Corporation; 110 and 111.
 - b. ABI, Ideal Tape Division; 491 AWF FSK.
 - c. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 - d. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.5 SECUREMENTS

- A. Bands:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
 4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Midwest Fasteners or approved equal.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
 5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- B. Wire: 0.062-inch soft-annealed, stainless steel.
1. Manufacturers: Subject to compliance with requirements, provide product by:
 - a. C & F Wire, or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap un-faced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FINISHES

- A. Insulation with ASJ, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.6 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Indoor, concealed supply and outdoor air.
 2. Indoor, exposed supply and outdoor air in unconditioned space.
 3. Indoor, concealed return located in unconditioned space.
 4. Indoor, exposed return located in unconditioned space.
- B. Items Not Insulated:
 1. Metal ducts with duct liner of sufficient thickness to comply with Title 24 energy code.
 2. Metal ducts located in conditioned spaces.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums and casings.
 5. Flexible connectors.
 6. Vibration-control devices.
 7. Factory-insulated access panels and doors.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply and return air duct and plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 1.5 inches thick and 0.75-lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping.
 - 2. Chilled-water piping.
 - 3. Refrigerant suction and hot-gas piping.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 "General Mechanical Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. "No Exception Taken".
 - 2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory and field applied, if any). Clearly mark the materials being provided and its intended use of each product
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports if requested by the Owner's Representative.

1.5 QUALITY ASSURANCE

- A. Insulation materials shall be manufactured at facilities certified and registered with an approved registrar to conform to the ISO 9001 Quality Standard.
- B. All work shall conform to accepted industry and trade standards for commercial and industrial insulations and shall conform with manufacturer's recommendations.
- C. Installation shall be by licensed applicators.
- D. Insulation materials that have become wet or contaminated shall not be installed.
- E. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- F. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials (insulation, coverings, tapes, cements, adhesives, coatings, etc.) to the jobsite in factory containers with manufacturer's label showing manufacturer, product name and product hazard information.

- B. Insulation shall be delivered to the job site in original, unopened manufacturer's containers.
- C. Insulation shall be stored in a dry location and kept dry throughout construction. Wet or damaged insulation shall be removed and replaced by the Contractor at no additional cost.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Systems."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain CFC, asbestos, lead, mercury, or mercury compounds.
- B. Insulation shall meet fire and smoke hazard ratings as tested under procedure ASTM E-84, NFPA 255, and UL 723 and shall not exceed flame spread rating of 25 and maximum smoke developed rating of 50.
- C. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville's Micro-Lok *HP* all-service (ASJ) vapor-retarder jacket with a self-sealing longitudinal closure lap (SSL) and butt strips.
 - b. Owens Corning; ASJ Fiberglas Pipe Insulation.
 - 2. Preformed mineral fiber pipe insulation with factory applied all-service vapor-retarder jacket (ASJ) jacket with a self-sealing longitudinal closure lap (SSL) and butt strips or approved alternate to seal butt joints. Preformed mineral fiber pipe insulation shall conform to ASTM C547. The ASJ facing shall conform to ASTM C1136 Type I.
 - 3. Preformed mineral fiber pipe insulation with factory applied all-service vapor-retarder jacket (ASJ) jacket shall have a flame spread rating not greater than 25 and a smoke developed rating not greater than 50 when tested as in accordance with ASTM E84, UL 723.
 - 4. Thermal conductivity (k-value): 0.23 Btu-in/hr-ft²-°F at 75°F

5. Preformed mineral fiber pipe insulation shall have a water vapor sorption of less than 5% by weight as tested in accordance ASTM C 547.
6. All service jacket (ASJ) shall have a water vapor permeance of 0.02 perms or less as tested in accordance to ASTM E96, procedure "A".
7. When a vapor mastic is required, a water vapor permeance of 0.02 per ASTM E-96 Procedure B must be achieved.
8. All accessory materials such as field installed jackets, mastics, coatings, tapes, fasteners shall be recommended by each component manufacturer for the specified application or as listed in the NAIMA Guide to Insulating Chilled Water Systems with Mineral Fiber Pipe Insulation.
9. Fittings, valves, tees, etc. shall be insulated with fiberglass insulation inserts covered with white PVC insulated fitting covers.

D. Flexible Elastomeric Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC Armaflex.
 - b. Aeroflex USA, Inc. Aerocel.
 - c. K-Flex USA Insul-sheet.
2. Closed-cell. Comply with ASTM C 534, Type I for tubular materials.
3. Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
4. Pipe insulation shall be fabricated according to the requirements of ASTM C1639 "Standard Specification for Fabrication of Cellular Glass Pipe and Tubing Insulation".
5. Thermal Conductivity: 0.25 Btu-in/hr-ft²-°F at 75°F.
6. Short runs of pipe or valves and fittings where it is impractical to install tubing insulation shall be insulated with two layers of 1/4" elastomeric foam tape.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated. Adhesives shall contain no flammable solvents if that option is available.
- B. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 200 deg F.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Design Polymeric
 - b. Foster Products Corporation
 2. For indoor applications use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aero seal.
 - b. Armacell LCC; 520 BLV Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
2. For indoor applications use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Design Polymerics DP 2590-CA
 - b. ITW TACC, Division of Illinois Tool Works; SP80, T1080
 - c. Marathon Industries, Inc.
2. For indoor applications use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Design Polymerics DD2590-CA.
 - b. ITW TACC, Division of Illinois Tool Works; SP80, T1080
 - c. Marathon Industries, Inc.
2. For indoor applications use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
2. For indoor applications use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

- A. Materials shall water based and be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 40 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Design Polymerics 3040 with zero VOC's.
 - c. Foster Products Corporation, H. B. Fuller Company; 30-90.
 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-10.
 - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
 - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.4 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - c. Marathon Industries, Inc.; 405.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Or equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications and use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. PVC Jacket Color:
 - a. Chilled-Water Piping:
 - 1) Chilled Water Supply: Dark Blue
 - 2) Chilled Water Return: Light Blue
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Moisture Barrier Jacket:
1. Manufacturer: Pittsburg Corning PITTWRAP or approved equal.
 2. 125 mil thick heat-seal multi-ply laminate consisting of three layers of a polymer-modified bituminous compound separated by glass reinforcement and aluminum foil.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Factory cut and rolled to size.
 3. Finish and thickness are indicated in field-applied jacket schedules.
 4. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and 40 pound kraft paper.
 6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.

- h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 REMOVABLE INSULATION JACKETS

A. Manufacturers:

1. ThermaXX LLC.
2. INSULTECH.
3. Firwin.

B. Insulation:

1. Glass mat, type E needled fiber, 1" at 11.3 LB/CF.
2. Maximum Use Temperature 400 deg F.

C. Jacket:

1. Hot Side
 - a. PTFE Fiberglass Composite Jacketing, 16.5 oz/sq. yd. minimum
 - b. Estimation of Maximum Use Temperature 550 deg F.
2. Cold Side
 - a. PTFE Fiberglass Composite Jacketing, 16.5 oz/sq. yd. minimum
 - b. Estimation of Maximum Use Temperature 600 deg F.

D. Thread:

1. Does not decompose below 800 deg F.
2. Does not melt.
3. Diameter: 0.0114
4. Break Point: 35 Lbs.

E. Construction:

1. Double sewn lock stitch with a minimum 4 to 6 stitches per inch. Jackets shall be sewn with two (2) parallel rows of stitching. The thread must be able to withstand the skin temperatures without degradation.
2. Hog rings, staples, and wire are not acceptable methods of closure.
3. No raw cut jacket edges shall be exposed.
4. Jackets shall be fastened using hook and loop (Velcro) straps and 1" slide buckles.
5. Provide a permanently attached aluminum or stainless-steel nameplate on each jacket to identify its location, size, and tag number.
6. Provide a stainless steel or brass grommet at the low point of each jacket, in wet areas for moisture drain (on horizontal jackets as required).

7. The insulation shall be designed to minimize the convection current in the space between the hot metal surface and the inner layer of insulation. To this end, during jacket fabrication, the layers of insulating mat shall be placed in an overlapping pattern.
8. All jacket pieces which match mating seams must include an extended 2" flap constructed from the exterior fabric and shall be secured using hook & loop closure (Velcro) parallel to the seam.
9. Insulation must be sewn as integral part of the jacket to prevent shifting of the insulation.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch thick, 1/2 inch 3/4 inch wide with closed seal.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, Monel.
1. Manufacturers: Subject to compliance with requirements, provide product by:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify all inspection and acceptance testing of the piping as required by the specification has been completed and that the piping is ready for installation of insulation.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 4. Verify there is adequate clearance to install the pipe insulation in accordance with the operation performance parameters of the specification, such as access to controls, valves and for maintenance and repair.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Insulation shall not be installed until the following have been completed and documentation has been submitted to Owner for approval and record:
 - 1. Cleaning and flushing
 - 2. Pressure testing
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.

- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- J. Install insulation with least number of joints practical.
- K. Install rigid pre-insulated pipe supports to protect from compression of insulation material due to point loads.
- L. Provide aluminum sleeves at all pipe support joints, between hanger support and exterior layer of insulating systems, to protect from compression of insulation material due to point loads.
- M. Install insulation on piping accessories requiring future reoccurring access and service with factory fabricated insulation covers that are easily removed and reapplied.
- N. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- O. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- P. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1.5 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- Q. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- R. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- S. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- T. Existing pipe insulation damaged or affected by the work of this contract shall be repaired to comply with these specifications except that materials and thicknesses may match existing unless otherwise directed by the Owner's Representative.
- U. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations:
 - 1. Terminate insulation with sleeve seal at wall penetration.
 - 2. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations: Install insulation continuously through walls and partitions.
- E. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

- B. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- C. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 - 5. On chilled water systems, the butt end of every fourth pipe insulation section, and the ends or raw edges of insulation terminations at equipment connections, fittings and fire stop systems shall be sealed with vapor retarder mastic per NAIMA Guide to Insulation Chilled Water Systems, 2015.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 THERMAL BLANKET INSTALLATION

- A. Apply removable and reusable insulating thermal blankets on systems operating at greater than 180°F, and other water systems as follows:
 1. Valves.
 2. Strainers.
 3. Pumps.
 4. Regulators.
 5. Flow meters.
 6. Flow control, balancing, and instrumentation devices.
 7. Steam Trap assemblies (except the trap, itself, which shall be uninsulated)
 8. Service connection piping at locations that require maintenance, i.e. tube pull and heat exchanger head removal.
 9. HTW anchors, guides, expansion joints and pipe supports.
- B. Blanket Overlap: Install blanket with a minimum 2 inches overlap of adjacent insulation, as existing insulation with a minimum of 2 inches overlap. Where blanket cannot overlap existing oversized insulation, blanket shall butt up to existing insulation with a friction closing seam. Open gaps are prohibited. Blanket diameters which are 2 inches larger than existing insulation must be capped to eliminate open air void.
- C. Any one piece shall not exceed 40 lbs. in weight.

3.9 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1.5-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install as follows:
 1. With 1-inch overlap at longitudinal seams and end joints; for horizontal applications.
 2. Seal with manufacturer's recommended adhesive.

3. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install as follows:

1. With 2-inch overlap at longitudinal seams and end joints.
2. Overlap longitudinal seams arranged to shed water.
3. Seal end joints with weatherproof sealant recommended by insulation manufacturer.
4. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.

3.12 ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Chilled Water Supply and Return, Indoors, 40°F and above:
 1. NPS 1.25 inch and smaller: Mineral Fiber, pre-formed pipe insulation, 0.5 inch thick.
 2. NPS 1.5 inch and larger: Mineral Fiber, pre-formed pipe insulation, 1 inch thick.
- B. Refrigerant Piping:
 1. Low Pressure Gas Line, NPS smaller than 1 inch: Flexible elastomeric, 1 inch thick.
 2. Low Pressure Gas Line, NPS 1 inch and larger: Flexible elastomeric, 1.5 inch thick.
 3. Liquid Line: Flexible elastomeric, 1 inch thick.
- C. Condensate Drain Piping:
 1. All Pipe Sizes: Flexible elastomeric, 0.5 inch thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Concealed: None.
- C. Piping, Exposed: PVC, Color-Coded by system, 30 mils thick for all indoor applications.

D. Piping, Exposed - Steam and Condensate, Condensate Vent.

1. Aluminum, Stucco Embossed: 0.020 inch thick.
2. Smooth aluminum for elbows and fittings is acceptable if not available in stucco embossed.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Concealed: None.
- C. Piping, Exposed: Aluminum, Stucco Embossed, 0.024 inch thick.

END OF SECTION 230719

SECTION 230900 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Provide a fully operational control system for the tenant buildout.

1.2 RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents.
- B. The following sections constitute related work:
 - 1. Division 1.
 - 2. Section 230000 "General Mechanical Requirements"
 - 3. Section 230519 "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
 - 4. Section 230993 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 DESCRIPTION

- A. General: The Building Systems Gateway Module shall consist of a high-speed, peer-to-peer network module interfaced with existing building web-based operator interface Web-Server. Each Building System, located by Building Floor Plans, shall be access by a point-and-click graphic from the Server to the Building Systems Gateway Module. The existing Web-Server shall gather data from each Building Systems Gateway Module and generate web pages accessible through a conventional web browser on each PC connected accessible to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
- B. Building Systems Gateway Module shall use ASHRAE BACnet over TCP/IP communications protocol for communication between existing operator workstations and/or existing Web-Server for communication between connected Building System Gateway Modules. Schedules, setpoints, trends, and alarms shall be BACnet objects.

1.4 QUALITY ASSURANCE

- A. Installer and Manufacturer Qualifications
 - 1. Installer shall have an established working relationship with Control System Manufacturer.

2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.5 CODES AND STANDARDS

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the codes as building permit is pulled under:
 1. National Electric Code (NEC)
 2. ANSI / ASHRAE 135-2016: Data Communication Protocol for Building Automation and Control Systems (BACNET)

1.6 SYSTEM PERFORMANCE

- A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
 1. Graphic Display and Refresh Rate: A graphic with dynamic points and alarms shall display with current data within 10 sec.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product include the following:
 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
 3. Product description with complete technical data, performance curves, and product specification sheets.
 4. Installation, operation and maintenance instructions including factors effecting performance.
 5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
 - a. Servers.
 - b. Gateways.
 - c. DDC controllers.
 - d. Enclosures.
 - e. Electrical power devices.
 - f. Accessories.
 - g. Flow, Temperature, Gas, Level, Moisture, Motion, Pressure Instruments.

- h. Control dampers and actuators.
 - i. Control valves and actuators.
 - 6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
 - 7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.
- B. Shop Drawings:
- 1. General Requirements:
 - a. Include cover drawing with Project name, location, Owner, Architect, Contractor and issue date with each Shop Drawings submission.
 - b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
 - 2. Plan Drawings indicating the following:
 - a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork and piping.
 - b. Room names and numbers with coordinated placement to avoid interference with control products indicated.
 - c. Each desktop workstation, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
 - d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
 - e. Network communication cable and raceway routing.
 - f. Information, drawn to scale, of Control enclosures and equipment mounted inside.
 - g. Proposed routing of wiring, cabling, conduit, and tubing, coordinated with building services for review before installation.
 - 3. Schematic drawings for each controlled HVAC system indicating the following:
 - a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
 - b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
 - c. A graphic showing location of control I/O in proper relationship to HVAC system.
 - d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
 - e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.
 - f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
 - g. Narrative sequence of operation.
 - h. Graphic sequence of operation, showing all inputs and output logical blocks.
 - 4. Control panel drawings indicating the following:

- a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
 - b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates and allocated spare space.
 - c. Front, rear, and side elevations and nameplate legend.
 - d. Unique drawing for each panel.
5. DDC system network riser diagram indicating the following:
- a. Each device connected to network with unique identification for each.
 - b. Interconnection of each different network in DDC system.
 - c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.
 - d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.
6. DDC system electrical power riser diagram indicating the following:
- a. Each point of connection to field power with requirements (volts/phase/hertz/amperes/connection type) listed for each.
 - b. Each control power supply including, as applicable, transformers, power-line conditioners, transient voltage suppression and high filter noise units, DC power supplies, and UPS units with unique identification for each.
 - c. Each product requiring power with requirements (volts/phase/hertz/amperes/connection type) listed for each.
 - d. Power wiring type and size, race type, and size for each.
7. Monitoring and control signal diagrams indicating the following:
- a. Control signal cable and wiring between controllers and I/O.
 - b. Point-to-point schematic wiring diagrams for each product.
 - c. Control signal tubing to sensors, switches and transmitters.
 - d. Process signal tubing to sensors, switches and transmitters.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For DDC system to include in emergency, operation and maintenance manuals.
1. Include the following:
 - a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
 - b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
 - c. As-built versions of submittal Product Data.
 - d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.

- e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
- f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
- g. Engineering, installation, and maintenance manuals that explain how to:
 - 1) Design and install new points, panels, and other hardware.
 - 2) Perform preventive maintenance and calibration.
 - 3) Debug hardware problems.
 - 4) Repair or replace hardware.
- h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
- i. List of recommended spare parts with part numbers and suppliers.
- j. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
- k. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
- l. Licenses, guarantees, and warranty documents.
- m. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
- n. Owner training materials.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials and parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Include product manufacturers' recommended parts lists for proper product operation over five-year period following warranty period. Parts list shall be indicated for each year.
- C. Furnish parts, as indicated by manufacturer's recommended parts list, for product operation during one-year period following warranty period.

1.10 WARRANTY

- A. Warrant work as follows:
 - 1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
 - 2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

3. Warranty period shall begin on the last day of the month in which the first Owner Logon is logged into the Building System Gateway Module for the particular Building connected.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period.
5. Owner maintains a service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

1.11 OWNERSHIP OF PROPRIETARY MATERIAL

- A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
 1. Graphics
 2. Record Drawings
 3. Database
 4. Application Programming Code
 5. Documentation

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.13 COORDINATION

- A. Coordinate location of exposed control sensors with plans and room details before installation.
- B. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

PART 2 - PRODUCTS

2.1 APPROVED CONTROL SYSTEMS

- A. The following are approved control system suppliers, manufacturers, and product lines:
 1. "Metasys" by Johnson Controls, Inc.
 2. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line.

3. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

2.2 EXISTING TIE-IN

- A. The control system shall be seamlessly integrated into the building's existing Building Automation System (BAS). Controls contractor to provide required module(s) and devices/accessories for connection of new control system to existing control system.

2.3 MATERIALS

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.4 INPUT AND OUTPUT INTERFACE

- A. General. Hard-wire input and output points to the Building Systems Gateway Module.
- B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no Building Systems Gateway Module damage.
- C. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.
- D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 200 pulses per second.
- E. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary Outputs. Binary outputs shall send an on-or-off signal for on and off control. Building Systems Gateway Module binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.
- G. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Systems Gateway Module analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.
- H. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.5 CONTROLLERS

- A. General: Provide Building Controllers by Automated Logic Corporation.
- B. Communication
 - 1. Service Port: Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on the Drawings.
 - 2. Signal Management: BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
 - 3. Data Sharing: Each BC and AAC shall share data as required with each networked BC and AAC.
 - 4. Stand-Alone Operation: Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.
- C. Environment: Controller hardware shall be suitable for anticipated ambient conditions.
 - 1. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
 - 2. Controllers shall have diagnostic LEDs for power, communication, and processor.
 - 3. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
 - 4. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.
- D. Memory
 - 1. Controller memory shall support operating system, database, and programming requirements.
 - 2. Each BC and AAC shall retain BIOS and application programming for at least 30 days in the event of power loss with the use of an Uninterruptable Power Supply.
 - 3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.
- E. Immunity to Power and Noise: Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft). All controllers shall have a UPS dedicated to each control panel. The UPS shall provide power to the control panel for at least 8 minutes. All DDC Controllers shall be on emergency power provided by Division 16.
- F. Transformer: ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 POWER SUPPLIES

- A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
- B. Power Supply to Building System Gateway Module shall be from a dedicated 120VAC UPS power source.

2.7 DUCT TYPE TEMPERATURE SENSORS

- A. BAPI or approved equal.
 - 1. Operating Temperature: -40 to 240°F
 - 2. Sensing Element: NTC 10K (Type II) Thermistor
 - 3. Accuracy at Calibration Temperature: +/- 1 °F
- B. Sensors in ducts shall be mounted in locations to sense the correct temperature of the air only and shall not be located in dead air spaces, in close proximity to coils so as to display inaccurate temperatures, or positions obstructed by ducts, equipment, and so forth. Locations where installed shall be within the vibration and velocity limit of the sensing element.
- C. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A neoprene grommet (Seal-tite fitting and mounting plate) shall be used on the sensor assembly to prevent air leaks.
- D. Duct sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. Duct sensors probe shall be constructed of 304/316 stainless steel.
- E. Duct sensors shall not be mounted within 36 inches of heating and cooling coils. For VAV applications, duct sensors shall not be mounted within 24 inches of heating and cooling coils.
- F. For outdoor air duct applications, use a weatherproof mounting box with weatherproof cover and gasket.

2.8 ROOM TEMPERATURE SENSORS

- A. Room temperature sensors shall be Siemens 2200 Series with display and setpoint adjustment, or equal.

2.9 CONTROL ENCLOSURES

- A. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
- B. All outdoor control cabinets shall be fully enclosed NEMA 4 construction with gasketed and hinged door and removable subpanels.

- C. Interconnections between devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
- D. Provide ON/OFF power switch with over current protection for control power sources to each local panel. Provide 120 V power receptacles.

2.10 ACTUATORS

- A. Manufacturers:
 - 1. Belimo
 - 2. Or equal
- B. Warranty: Valve and damper actuators shall carry a manufacturer's 5-year warranty.
- C. Entire actuator shall be UL or CSA approved by a National Recognized Testing Laboratory.
- D. Valves: Actuators shall be specifically designed for integral mounting to valves without external couplings.
- E. Actuator shall have microprocessor based motor controller providing electronic cut off at full open so that no noise can be generated while holding open. Holding noise level shall be inaudible.
- F. Noise from actuator while it is moving shall be inaudible through a tee-bar ceiling.
- G. Actuators shall provide protection against actuator burnout using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation or use of magnetic clutches are not acceptable.
- H. Modulating actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. Actuators shall have positive positioning circuit so that controlled device is at same position for a given signal regardless of operating differential pressure. Actuators that internally use a floating actuator with an analog signal converter are not acceptable.
- I. Where indicated on Drawings, actuators shall include:
 - 1. 2 to 10 VDC position feedback signal
 - 2. Limit (end) position switches
- J. All 24 VDC/DC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC. Actuators operating on 120 VAC power shall not require more than 10 VA.
- K. All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation.

- L. Actuators shall be provided with a conduit fitting and a minimum three-foot electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
- M. Actuators shall be capable of being mechanically and electrically paralleled to increase torque where required.
- N. All non-spring or capacitor return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered.
- O. Actuators shall be designed for a minimum of 60,000 full cycles at full torque and be UL 873 listed.
- P. Actuators shall clearly indicate position of damper/valve.

2.11 CONTROL VALVES

- A. Manufacturers:
 - 1. Belimo
 - 2. Or equal
- B. Characterized Ball Type
 - 1. Valves shall be specifically designed for modulating duty in control application with guaranteed average leak-free life span over 200,000 full stroke cycles.
 - 2. Industrial quality with nickel plated forged brass body and female NPT threads.
 - 3. Blowout proof stem design, glass-reinforced Teflon thrust seal washer and stuffing box ring with minimum 600 psi rating (2-way valves) or 400 psi rating (3-way valves). The stem packing shall consist of 2 lubricated O-rings designed for on-off or modulating service and requiring no maintenance.

2.12 ELECTRICAL DEVICES

- A. Relays:
 - 1. Control relays shall be UL listed plug-in type with dust cover and LED —energized indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
 - 2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable $\pm 200\%$ (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.
- B. Current transmitters:
 - 1. AC current transmitters shall be the self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale,

- with internal zero and span adjustment and $\pm 1\%$ full-scale accuracy at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA Recognized.
 3. Unit shall be split-core type for clamp-on installation on existing wiring.
- C. Current switches:
1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

2.13 CONDUIT AND FITTINGS

- A. Conduit for Control Wiring, Control Cable and Transmission Cable: Electrical metallic tubing (EMT) with compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections.
- B. Outlet Boxes (Dry Location): Sheradized or galvanized drawn steel suited to each application, in general, four inches square or octagon with suitable raised cover.
- C. Outlet Boxes (Exposed to Weather): Threaded hub cast aluminum or iron boxes with gasket device plate.
- D. Pull and Junction Boxes: Size according to number, size, and position of entering raceway as required by National Electrical Codes. Enclosure type shall be suited to location.

2.14 IDENTIFICATION

- A. Automatic Control Valve Tags
 1. For valves, etc., use metal tags with a 2-inch minimum diameter, fabricated of brass, stainless steel or aluminum. Attach tags with chain of same materials. For lubrication instructions, use linen or heavy duty shipping tag.
 2. Tag valves with identifying number and system. Number valves by floor level, column location and system served.
 3. Prepare lists of all tagged valves showing location, floor level, and tag number, use. Prepare separate lists for each system. Include copies in each maintenance manual.
- B. Thermostat Tags
 1. Label thermostats with respective VAV box tag.
- C. Wire Tags
 1. All multi-conductor cables in all pull boxes and terminal strip cabinets shall be tagged.
 2. Provide wire Tags as per Division 26.
- D. Conduit Tags

1. Provide tagging or labeling of conduit so that it is always readily observable which conduit was installed or used in implementation of this Work.

E. Miscellaneous Equipment Identification

1. Screwed-on, engraved black lamincoid sheet with white lettering on all control panels and remote processing panels. Lettering sizes subject to approval.
2. Inscription, subject to review and acceptance, indicating equipment, system numbers, functions and switches. For panel interior wiring, input/output modules, local control panel device identification.

F. Local Control Panels

1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.
2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.
3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that systems are ready to receive work.
- B. Beginning of installation means installer accepts existing conditions.
- C. The project plans shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- D. The contractor shall inspect the site to verify that equipment is installable as show, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- E. The Controls Contractor shall examine the drawings and specifications for other parts of the work, and if head room or space conditions appear inadequate or if any discrepancies occur between the plans and his work and the plans for the work of others, he shall report such discrepancies to the Architect/Engineer and shall obtain written instructions for any changes necessary to accommodate his work with the work of others.

3.2 COORDINATION

- A. All equipment and materials shall be installed in accordance with the manufacturer's instructions.

- B. Controls contractor shall coordinate with the selection of the HVAC equipment supplied by the mechanical contractor.
- C. Locate all controls devices (except those remote devices at valves, dampers and similar locations) within NEMA 1 enclosures adjacent to EMS microprocessor in mechanical rooms. Do not locate accessory devices (such as transducers) outside enclosures.
- D. Locate remote control instruments or accessories on insulated/covered casings/pipes/ducts or the finished surfaces of the covering. Seal penetrations to assure no leaks are present around stems that penetrate into the air or water systems.
- E. Secure controls conduit to building structure. Do not substitute attachments to work of other trades (such as pipes, ducts, other conduits, and other equipment/devices support structures). Provide accessory steel supports, as required. Provide flexible connections to isolated equipment and sensors.
- F. Coordinate installation of all control devices and elements installed by other trades. Coordinate to assure that all necessary isolation valves, pressure taps, drain and overflow connections for control devices and elements installed in piping systems are provided. The controls contractor is responsible for coordinating these locations with the installing contractor.
- G. Life Safety: This work does not include any Fire Alarm work or duct smoke detectors, or fire/smoke dampers or similar Life Safety Devices or systems shutdown by the EMCS based on fire alarm or refrigerant monitoring system activation.

3.3 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

- A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.
- B. Deliver the following to duct fabricator and Installer for installation in ductwork. Include installation instructions to Installer and supervise installation for compliance with requirements.
 - 1. DDC control dampers.
 - 2. Airflow sensors and switches.
 - 3. Pressure sensors.
- C. Deliver the following to plumbing and HVAC piping installers for installation in piping. Include installation instructions to Installer and supervise installation for compliance with requirements.
 - 1. DDC control valves.
 - 2. Pipe-mounted flow meters.
 - 3. Pipe-mounted sensors, switches and transmitters.
 - 4. Pipe-mounted thermowells.

3.4 GENERAL INSTALLATION REQUIREMENTS

- A. Install products to satisfy more stringent of all requirements indicated.

- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. Support products, tubing, piping wiring and raceways. Brace products to prevent lateral movement and sway or a break in attachment when subjected to a 50 lb force.
- D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.
- E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- F. Welding Requirements:
 - 1. Restrict welding and burning to supports and bracing.
 - 2. No equipment shall be cut or welded without approval. Welding or cutting will not be approved if there is risk of damage to adjacent Work.
 - 3. Welding, where approved, shall be by inert-gas electric arc process and shall be performed by qualified welders according to applicable welding codes.
 - 4. If requested on-site, show satisfactory evidence of welder certificates indicating ability to perform welding work intended.
- G. Fastening Hardware:
 - 1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
 - 2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
 - 3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.
- H. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.5 ELECTRICAL SYSTEM INSTALLATION

- A. Comply with all Division 26 Installation Requirements.
- B. Install low voltage power and BACnet communication trunks in conduit in the following locations regardless of local building code allowances otherwise.
 - 1. Mechanical rooms
 - 2. Electrical rooms
 - 3. Vertical risers (exception: fire rated continuous closet like a telephone closet)
 - 4. Open Areas where the wiring will be exposed to view or tampering
- C. Conceal conduit within finished shafts, ceilings and wall as required. Install exposed conduit parallel with or at right angles to the building walls and ceilings.

- D. Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that:
1. Circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
 2. All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.
 3. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
 4. Where Class 2 wiring is run exposed, wiring to be run parallel along a surface or perpendicular to it, and NEATLY tied at 3m (10 ft.) intervals minimum.
- E. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to-wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- F. Plug or cap all unused conduit openings and stub-ups. Do not use caulking compound.
- G. Route all conduit to clear beams, plates, footings and structure members. Do not route conduit through column footings or grade beams.
- H. Set conduits as follows:
1. Expanding silicone fire stop material sealed watertight where conduit is run between floors and through walls of fireproof shaft
 2. Cap open ends of conduits until conductors are installed.
 3. Where conduit is attached to vibrating or rotating equipment, flexible conduit with a minimum length of 18 inches and maximum length of 36 inches shall be installed and anchored in such a manner that vibration and equipment noise will not be transmitted to the rigid conduit.
 4. Where exposed to the elements or in damp or wet locations, waterproof flexible conduit shall be installed. Installation shall be as specified for flexible metal conduit.

3.6 CLEANING

- A. The Controls Contractor shall clean up all debris resulting from his or her activities daily. The contractor shall remove all cartons, containers, crates, etc. under his (or his subcontractors) control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.
- B. At the completion of work in any area, the Controls Contractor shall clean all of his/her work, equipment, etc., making it free from dirt and debris, etc.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.7 PROTECTION

- A. The Controls Contractor shall protect all work and material from damage by his/her work or workers or sub-contractors, and shall be liable for all damage thus caused.
- B. The Controls Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Controls Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on-site that is not immediately installed. The Controls Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.8 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 5. Test each system for compliance with sequence of operation.
 - 6. Test software and hardware interlocks.
- B. DDC Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - 2. Check instruments for proper location and accessibility.
 - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 - 4. Check instrument tubing for proper fittings, slope, material, and support.
 - 5. Check installation of air supply for each instrument.
 - 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
 - 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 - 8. Check temperature instruments and material and length of sensing elements.
 - 9. Check control valves. Verify that they are in correct direction.
 - 10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
 - 11. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.

- C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.9 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.10 CALIBRATION

- A. The following devices shall be factory calibrated prior to installation and calibration certificates shall be provided by the manufacturer:
 - 1. Water flow meters
 - 2. Air differential pressure sensors
 - 3. Water differential pressure sensors
 - 4. Humidity sensors
 - 5. Dewpoint sensors
 - 6. CO2 sensors
- B. The following devices shall be field calibrated after installation:
 - 1. RTD temperature sensors
 - 2. Current switches
 - 3. Air flow sensors

3.11 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Startup Testing: Complete startup testing to verify operational control system before notifying Owner's Representative of system demonstration. Provide Owner's Representative with schedule for startup testing. Owner's Representative may have representative present during any or all startup testing.
 - 1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished.
 - 2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
 - 3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
 - 4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
 - 5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
 - 6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
 - 7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.

3.12 ACCEPTANCE

- A. After tests described in this specification are performed to the satisfaction of the Owner's Representative, the Owner's Representative will accept control system as meeting completion requirements. Owner's Representative may exempt tests from completion requirements that cannot be performed due to circumstances beyond the Contractor's control.

3.13 TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment. Refer to the controls portion of this Specification and the Drawings for a complete understanding of the control sequences. Contractor shall be responsible for coordinating Division 230900 service representatives of the equipment manufacturers to implement these control sequences along with Division 26. Prior to providing submittals, all field wiring connections shall be determined and shown on the submittals for electrical and controls interface.
- B. All set-points, overrides, or ranges listed in this sequence of operation and objectives shall be adjustable through the graphic user interface (GUI) and not on the (programming) wire sheet. I.E. through the graphic interface you can manipulate timers, enable/disable, etc.
- C. Related Sections include the following:
 - 1. Section 230900 "Direct Digital Control System" for control equipment, devices, and for submittal requirements.

1.3 DEFINITIONS

- A. AI: Analog input.
- B. AO: Analog output.
- C. ASC: Application specific controllers.
- D. DDC: Direct digital control.
- E. CHW: Chilled water.
- F. CV: Control valve.
- G. DI: Digital Input.
- H. DO: Digital Output.
- I. HHW: Heating hot water.

- J. SOO: Sequence of operations.
- K. VAV: Variable air volume.

1.4 GENERAL

- A. Contractor shall review sequences prior to programming and suggest modifications where required to achieve the design intent. Contractor may also suggest modifications to improve performance and stability or to simplify or reorganize logic in a manner that provides equal or better performance.
- B. Include costs for minor program modifications if required to provide proper performance of the system.
- C. Unless otherwise indicated in SOO, control loops shall be enabled and disabled based on the status of the system being controlled to prevent wind-up.
- D. The term “proven” (i.e. “proven on” / “proven off”) shall mean that the equipment’s DI status point matches the state set by the equipment’s DO command point.
- E. The term “PID loop” or “control loop” is used generically for all control loops and shall not be interpreted as required proportional plus integral plus derivative gains on all loops. Unless specifically indicated otherwise, do not use the derivative term on any loops unless field tuning is not possible without it.
- F. All set-points, timers, dead-bands, PID gains, etc. listed in sequences shall be capable of being adjusted by the operator without having to access programming whether indicated as adjustable in sequences or not. Software (virtual) points shall be used for these set-points. Fixed scalar numbers shall not be imbedded in programs unless the value will never need to be adjusted.
- G. Values for all points, including real (hardware) points used in control sequences shall be capable of being overridden by the user (e.g. for testing and commissioning). If hardware design prevents this for hardware points, they shall be equated to a software point and the software point shall be used in all sequences.
- H. Zones
 - 1. This section applies to all single zone systems and sub-zones of air handling systems, such as terminal units, etc.
 - 2. Set-points
 - a. The controls contractor shall coordinate with the tenant to setup the initial cooling temperature set-point for the zone.
 - 3. Control Loops
 - a. One Cooling Control Loop shall operate to maintain space temperature at set-point. It shall be continuously active.

- b. The Cooling Loop shall maintain the space temperature at the active cooling set-point. The output of the loop shall be a virtual point ranging from 0% (no cooling) to 100% (full cooling).
- c. The loop shall use proportional + integral logic or fuzzy logic. Proportional-only control is not acceptable, although the integral gain shall be small relative to the proportional gain. P and I gains shall be adjustable from the campus network.
- d. See other sections for how the outputs from this loop is used.

1.5 SEQUENCE OF OPERATIONS

A. Computer Room Air Conditioning Unit with DX Coil (AC-3) and Computer Room Air Handling Units with CHW Coils (FCU-1 and FCU-2)

- 1. The systems shall be controlled together via the manufacturer's Zone Master control system for lead/lag alternation, rotation and operation.
- 2. For FCU-1 and FCU-2, set the CHW valve to be controlled by the return air temperature sensor and set the fan speed to modulate based on the CHW valve position (manufacturer's pre-programmed control settings).
- 3. For AC-3, set the DX cooling to be controlled by the return air temperature sensor and set the fan speed to modulate based on the variable compressor speed (manufacturer's pre-programmed control settings).
- 4. The systems shall be enabled to operate 24/7. The systems shall operate to maintain a return air temperature of 84°F (adjustable).
- 5. Alarms:
 - a. High space temperature: generate an alarm if the space temperature in the data center is 86°F or higher (adjustable) for greater than 2 minutes (adjustable).

B. Existing Computer Room Air Handling Units with CHW Coils (FCU-4 and FCU-5)

- 1. The units shall be enabled to operate 24/7.
- 2. The control system shall monitor the fan speed of FCU-1, FCU-2 and AC-3. If the fan speed of all units is greater than 80% (adjustable) for 5 minutes (adjustable), FCU-4 and FCU-5 shall be enabled and shall operate via factory controls to maintain a return air temperature of 84°F (adjustable).
- 3. The minimum run time of FCU-4 and FCU-5 shall be 30 minutes (adjustable).
- 4. FCU-4 and FCU-5 shall be disabled if the fan speed of FCU-1, FCU-2 and AC-3 drops below 60% (adjustable) for 5 minutes (adjustable).

C. Humidifier Operation

- 1. The humidifier output shall be controlled via a 0-10V signal from the control system.
- 2. The humidifiers shall modulate to maintain an average space relative humidity setpoint of 40% RH (adjustable). The humidifiers shall be staged on and off as needed to meet setpoint.
- 3. Alarms:
 - a. Humidifier status alarm for no proof of humidifier.
 - b. Generate an alarm if the space RH sensor is below 30% RH (adjustable) after a delay of 5 minutes (adjustable).

PART 2 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
 - 1. Copper tube and fittings.
 - 2. Steel pipe and fittings.
 - 3. Plastic pipe and fittings.
 - 4. Joining materials.
 - 5. Dielectric fittings.
- B. Related Sections include the following:
 - 1. Section 230719 "HVAC Piping Insulation" for piping insulation.

1.3 DEFINITIONS

- A. PTFE: Polytetrafluoroethylene.

1.4 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 "General Mechanical Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. "No Exception Taken".
 - 2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of the following:
 - 1. Piping, tubing and fittings data. Submit data indicating that pipe, tube and fittings are manufactured exclusively in the United States.
 - 2. Fittings.
 - 3. Joining materials.

4. Coating data. Include product information and coating procedures.

C. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Welding (WPS) and Brazing (BPS) Procedure Specifications.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.7 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations or coring of foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base.
- F. Coordinate installation of pipe sleeves or coring of existing walls for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 07 Section "Penetration Firestopping" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Chilled-Water Piping: 150 psig at 80 deg F.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L, ASTM B 88 Type K.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. Copper or Bronze Pressure-Seal Fittings:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Viega, LLC.
 - b. NIBCO, INC.
 - 2. Housing: Copper.
 - 3. O-Rings and Pipe Stops: EPDM.
 - 4. Tools: Manufacturer's special tools.
 - 5. Minimum 200-psig working-pressure rating at 250 deg F
- D. Wrought-Copper Fittings: ASME B16.22.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. S. P. Fittings; a division of Star Pipe Products.

2.3 STEEL PIPE AND FITTINGS

- A. Piping and fittings shall be manufactured exclusively in the United States.

- B. Steel Pipe, NPS $\frac{3}{4}$ through NPS 1 $\frac{1}{2}$: ASTM A53, Type S (seamless) Grade A, Schedule 40, black steel, plain ends.
- C. Steel Pipe, NPS 2 through NPS 10: ASTM A53, Type S (seamless) and Type ERW (welded) Grade A or B, Schedule 40, black steel, plain ends.
- D. Steel Pipe Nipples: ASTM A733 made of ASTM A53, Schedule 40, black steel; seamless.
- E. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- F. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- H. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- I. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.4 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel if unexposed, 316 stainless steel if flange is exposed.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

- F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping
 - 1. CPVC Piping: ASTM F 493.
 - a. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - c. Wilkins; a Zurn company.
 - 2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - c. Wilkins; a Zurn company.
 - 2. Description:
 - a. Standard: ASSE 1079.

- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 175 psig.
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company
 - d. Pipeline Seal and Insulator, Inc.
- 2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection
 - b. Grinnell Mechanical Products
 - c. Matco-Norca, Inc.
 - d. Precision Plumbing Products, Inc.
 - e. Victaulic Company
- 2. Description:
 - a. Standard: IAPMO PS 66.
 - b. Electroplated steel nipple, complying with ASTM F 1545.
 - c. Pressure Rating: 300 psig at 225 deg F.
 - d. End Connections: Male threaded or grooved.
 - e. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Chilled-water piping, aboveground areas, NPS 2 and smaller, shall be the following:
 - 1. Type L drawn-temper copper tubing, with 95-5 soldered wrought-copper fittings.
 - 2. Insulated per Section 230719 HVAC Piping Insulation.
- B. Chilled-water piping, aboveground areas, NPS 2-1/2 and larger, shall be the following:
 - 1. Black steel pipe, ASTM A53, Type S (seamless) or Type ERW (welded); with standard weight ASTM A234 forged steel fittings for butt-weld connection and flanged joints.
 - 2. Insulated per Section 230719 HVAC Piping Insulation.
- C. Condensate-Drain Piping: Type L drawn-temper copper tubing, with 95-5 soldered wrought-copper fittings

3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using mechanically formed tee fittings or integrally reinforced forged branch outlet fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- R. Install shutoff valve immediately upstream of each dielectric fitting.
- S. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet.
2. NPS 1: Maximum span, 7 feet.
3. NPS 1-1/2: Maximum span, 9 feet.
4. NPS 2: Maximum span, 10 feet.
5. NPS 2-1/2: Maximum span, 11 feet.
6. NPS 3 and Larger: Maximum span, 12 feet.

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

G. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

1. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.
- I. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Inspect finish of exposed, hydronic piping, including outlets, valves, specialties, and devices, after installation is complete. Remove burrs, dirt, and debris. Repair damaged finishes including chips, scratches, and abrasions.
3. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
4. Flush hydronic piping systems with minimum 5 ft/s velocity clean water; then remove and clean or replace strainer screens. Promptly passivate and chemically treat piping systems after flush per requirements in Section 232513 "Water Treatment for Closed-Loop Hydronic Systems."
5. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
6. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

3.8 CLEANING AND PROTECTION

- A. Remove all packaging, unused fasteners, and other installation materials from the project site.

- B. Provide protection as required to leave the work in undamaged condition at the time of completion.

3.9 PAINTING

- A. Refer to Division 09 for additional requirements.
- B. Coating system consists of surface prep, base coat of Carbomastic 15 and a top coats of Carbothane 134, or equivalent.
 - 1. Install:
 - a. Surface Prep - SSPC SP1-3
 - b. 1st coat – 7.0 to 10.0 mils Carbomastic 15 Aluminum Flake Epoxy Mastic
 - c. 2nd and 3rd coats - Carbothane 133 satin or 134 Gloss Aliphatic Urethane
 - 2. Manufactured by Carboline.
 - 3. Color shall be coordinated with architectural finish.
 - 4. All manufacturer’s installation instructions, including surface preparation, application methods and equipment, mixing and thinning guidelines, application conditions, and curing schedule shall be adhered to.

END OF SECTION 232113

SECTION 232116 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Hydronic specialty valves.
 - 2. Air-control devices.
 - 3. Strainers.
 - 4. Connectors.

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 "General Mechanical Requirements". The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. "No Exception Taken".
 - 2. "Exception". All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product:
 - 1. Include construction details and material descriptions for hydronic piping specialties.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
 - 3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- B. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTY VALVES

- A. Bronze, Calibrated-Orifice, Balancing Valves:
 - 1. Manufacturers:
 - a. Bell & Gossett, A Zylem brand.
 - b. Armstrong Pumps, Inc.
 - c. TACO Comfort Solutions, Inc.
 - 2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 - 3. Ball: Brass or stainless steel.
 - 4. Plug: Resin.
 - 5. Seat: PTFE.
 - 6. End Connections: Threaded or socket.
 - 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - 8. Handle Style: Lever, with memory stop to retain set position.
 - 9. CWP Rating: Minimum 125 psig.
 - 10. Maximum Operating Temperature: 250 deg F.

2.2 COIL PIPING PACKAGE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. NuTech Hydronic Specialty Products..
 - 2. Flow Design Inc.
 - 3. Griswold Controls.

B. Coil Piping Package – 1/2" to 2”:

1. Supply Side:

- a. Manual air vent with pressure/temperature port.
 - 1) Brass body, EPDM core and O-ring, knurled handle and cap.
 - 2) Side vent with 1/8" hose barb and 1/4" NPT.
 - 3) Extended length.
 - 4) Minimum rating of 250 PSIG at 250°F.
- b. Combination Y-strainer with integral pressure/temperature port. Isolation ball valve with extended handle shall be independent from piping package.
 - 1) Forged or cast brass body. EPDM O-ring. Plated steel handle with vinyl grip. Blow out-proof stem. Chrome plated ball with Teflon seats.
 - 2) Strainer with 20 mesh stainless steel screen with removable cap. Strainer shall be fitted with a hose end blow down valve with cap and chain.
 - 3) Minimum rating of 400 PSIG at 250°F.

2. Return Side:

- a. Union with pressure/temperature port and manual air vent.
 - 1) Brass O-ring type union. EPDM O-ring. Knurled handle and cap. Blowout-proof stem. Side vent with 1/8" hose barb. 1/4" and 1/2" NPT. Extended length.
 - 2) Minimum Ratings 400 PSIG at 250°F.
- b. Integral union with pressure/temperature port. Isolation ball valve with extended handle shall be independent from piping package.
 - 1) Forged or cast brass body. EPDM O-ring. Plated steel handle with vinyl grip. Blow out-proof stem. Chrome plated ball with Teflon seats.
 - 2) Minimum rating of 400 PSIG at 250°F.
- c. No manual or automatic balancing valves required on main pipe.

C. Coil Piping Package 2-1/2" to 12”:

1. Supply Side:

- a. Manual air vent with pressure/temperature port.
 - 1) Brass body, EPDM core and O-ring, knurled handle and cap.
 - 2) Side vent with 1/8" hose barb and 1/4" NPT.
 - 3) Extended length.
 - 4) Minimum rating of 250 PSIG at 250°F.
- b. Combination flange end Y-strainer with integral pressure/temperature port. Isolation high performance butterfly valve with extended handle shall be independent from piping package.
 - 1) Y-strainer shall have cast iron body. Fiber gasket. Stainless steel strainer screen. ANSI 125# Flanged. Strainer shall include pressure/temperature port and drain valve.

- 2) High performance butterfly valve shall be lug type with ductile iron body, designed to be installed at inlet of strainer. Resilient seat for bubble tight shut off. Blowout proof stem with pinned disc. Universal mounting flange conforms to ISO-5211. 2.5"-6" supplied with adjustable flow positioning plate. Sizes 8"- 12" provided with a gear operator.
 - 3) Minimum rating of 175 PSIG at 250°F.
2. Return Side:
- a. Union with pressure/temperature port and manual air vent.
 - 1) Brass O-ring type union. EPDM O-ring. Knurled handle and cap. Blowout-proof stem. Side vent with 1/8" hose barb. 1/4" and 1/2" NPT. Extended length.
 - 2) Minimum Ratings 600 PSIG at 250°F.
 - b. Integral union with pressure/temperature port. Isolation high performance butterfly valve with extended handle shall be independent from piping package.
 - 1) High performance butterfly valve shall be lug type with ductile iron body, designed to be installed between all types of ANSI 125/150 flanges. Resilient seat for bubble tight shut off. Blowout proof stem with pinned disc. Universal mounting flange conforms to ISO-5211. 2.5"-6" supplied with adjustable flow positioning plate. Sizes 8"- 12" provided with a gear operator.
 - 2) Minimum rating of 175 PSIG at 250°F.
- D. Flange end pressure/temperature port and manual air vent:
1. Pressure/temperature and manual air vent port.
 2. Minimum rating of 175 PSIG at 250°F.
- 2.3 AIR-CONTROL DEVICES
- A. Manual Air Vents:
1. Body: Bronze body ball valve with stainless steel ball, NPS 1/2.
 2. CWP Rating: 150 psig.
 3. Maximum Operating Temperature: 225 deg F.
- B. Automatic Air Vents:
1. Manufacturers:
 - a. Bell & Gossett No. 87.
 - b. Spirotherm Spirotap Model VTP.
 2. Body: Brass or bronze.
 3. Internal Parts: Nonferrous.
 4. Operator: Noncorrosive metal float.
 5. Inlet Connection: NPS 1/2.
 6. Discharge Connection: NPS 1/4 or 1/2.

7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 240 deg F.

2.4 STRAINERS

A. Y-Pattern Strainers up to NPS 1.5:

1. Manufacturers:
 - a. The Metraflex Company.
 - b. Keckley.
 - c. Mueller Steam Specialty.
2. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
3. End Connections: Threaded.
4. Strainer Screen: 40 mesh stainless-steel screen.
5. CWP Rating: 125 psig.

B. Y-Pattern Strainers NPS 2 and Larger:

1. Manufacturers:
 - a. The Metraflex Company Model LPD.
 - b. Or Engineer approved equal.
2. Y-strainer shall be of low pressure drop design with the following Cv values:

a. 2" Pipe	120
b. 2.5" Pipe	160
c. 3" Pipe	236
d. 4" Pipe	460
e. 6" Pipe	952
f. 8" Pipe	1,580
g. 10" Pipe	2,424
h. 12" Pipe	3,200
3. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection. Strainer shall be suitable for horizontal and vertical mounting.
4. End Connections: Flanged ends.
5. Strainer Screen: Stainless-steel, screen perforations shall be:
 - a. For liquid service for NPS 2 – 3, perforation shall be 0.045"
 - b. For liquid service for NPS 4 – 12, perforation shall be 0.125"
6. Pressure Taps: Provide with inlet and outlet pressure plugs.
7. CWP Rating: 125 psig.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install control valves in the return water line of each cooling element.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

3.3 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Section 230519 "Meters and Gages for HVAC Piping."

END OF SECTION 232116

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealant and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

- B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 “General Mechanical Requirements”. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
1. “No Exception Taken”.
 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of the following products:
1. Liners and adhesives.
 2. Sealants and gaskets.
 3. Seismic-restraint devices.
- C. Shop Drawings:
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 2. Factory- and shop-fabricated ducts and fittings.
 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 4. Elevation of top of ducts.
 5. Dimensions of main duct runs from building grid lines.
 6. Fittings.
 7. Reinforcement and spacing.
 8. Seam and joint construction.
 9. Penetrations through fire-rated and other partitions.
 10. Equipment installation based on equipment being used on Project.
 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
- D. Delegated-Design Submittal:
1. Sheet metal thicknesses.
 2. Joint and seam construction and sealing.
 3. Reinforcement details and spacing.
 4. Materials, fabrication, assembly, and spacing of hangers and supports.
 5. Design Calculations: Calculations, including analysis data signed and sealed by the licensed structural engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- B. Welding certificates.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. ASHRAE/IESNA 90.1 requires leakage testing for representative sections totaling no less than 25 percent of installed duct area for ducts designated to operate at a static-pressure class in excess of 3-inch wg . Consider building a mockup of typical portions of the system that can be tested early in the construction process. This standard, as enforced by some authorities having jurisdiction, requires duct systems with static-pressure classes in excess of 3-inch wg to be identified on Drawings.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Factory- or shop-fabricated spiral lock seam duct:
 - a. No snap lock
 - b. Factory-fabricated longitudinal seam acceptable for ducts larger than standard factory sizes
 - 2. Manufacturers:
 - a. United Sheet Metal Division, United McGill
 - b. Semco Manufacturing, Inc.
 - c. Or equal
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for

static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Fittings:

1. Same material and construction as duct in which installed
2. For ductwork exposed to occupant view, do not use fabricated fittings at taps to terminal units and outlets. Instead use saddle tap cut into continuous spiral duct. Intent is for spiral duct to be continuous for aesthetic reasons. Saddle tap flange width shall be 0.5 inches or less.

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. General Applications (except as noted below): G60 Galvanized Coating.
2. Plenum Walls and Blank-Offs Where in Contact with Cooling Coil: G90 Galvanized Coating.
3. Exterior Applications: G90 Galvanized Coating.
4. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 5. Shop-Applied Coating Color: Black
 6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Basic of Design Product: CertainTeed ToughGard R Duct Liner with Enhanced Surface
 - b. Johns Manville
 - c. Knauf Insulation
 - d. Maximum Thermal Conductivity:
 - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile

Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other

buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.

5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.

8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.

10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Hilti Corp.
 - 2. TOLCO; a brand of NIBCO Inc.
 - 3. Unistrut Corporation; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by the Office of Statewide Health Planning and Development for the State of California.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Reinforcing steel angle or channel unistrut clamped to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers as required by NFPA 90A. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class B.
 - 4. Outdoor, Return-Air Ducts: Seal Class A.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 1-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 1-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class B.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class A.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 1-Inch wg and Lower: Seal Class B.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 1-Inch wg: Seal Class A.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class A.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class A.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with [SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems"] [OSHDP Preapproved Manufacturer's Certification (OPM)].
1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify

the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Test for leaks before applying external insulation.
 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

6. Give seven days advance notice for testing.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
- D. Contractor shall develop and implement an IAQ Management Plan for the construction and preoccupancy phases of the building as follows:
1. During construction meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, and Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
 2. Protect stored materials on-site and installed absorptive materials from moisture damage.
 3. If permanently installed air handlers are used during construction, then filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-2012 (with errata, but without addenda). Replace air filtration media immediately prior to occupancy.
- E. Duct system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 8.

- d. SMACNA Leakage Class for Round and Flat Oval: 4.
- 2. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- C. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round and Flat Oval: 4.
- D. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
- E. Liner:
 - 1. Supply Air Ducts: Fibrous glass, Type I, 1 inch thick.
 - 2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
- F. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 with single-thickness turning vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and single-thickness turning vanes.
 - 3) Mitered Type RE 2 with single-thickness vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vaness and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

- 2) Radius Type RE 3 with minimum 1.5 radius-to-diameter ratio and single-thickness turning vanes.
 - 3) Mitered Type RE 2 with single-thickness vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
- a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and single-thickness turning vanes.
 - c. Mitered Type RE 2 with single-thickness vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
- a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 1.0 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.5 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 10 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 12 Inches and Larger in Diameter: Welded.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
2. Taps shall be the more stringent of what is shown on the mechanical drawings and the criteria listed below. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 900 fpm or Lower: 90-degree tap.
 - b. Velocity 901 to 1500 fpm: Conical tap.

- c. Velocity 1501 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Manual volume dampers.
 - 2. Flange connectors.
 - 3. Turning vanes.
 - 4. Duct-mounted access doors.
 - 5. Flexible connectors.
 - 6. Duct accessory hardware.

1.3 ACTION SUBMITTALS

- A. Submittals shall be formatted per Section 230000 “General Mechanical Requirements”. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section. All **exceptions** shall be clearly identified by referencing respective paragraph and other requirements. Next to each specification item, indicate the following:
 - 1. “No Exception Taken”.
 - 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product.
 - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- C. Sustainable Design Submittals:
 - 1. Product data showing compliance with ASHRAE 62.1.
- D. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Combination fire- and smoke-damper, including sleeves; and duct-mounted access doors and remote damper operators.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2D finish for concealed ducts and No. 4 finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- 1.

2.3 MANUAL VOLUME DAMPERS

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.
- B. Fabricate splitter dampers of material same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
- C. Fabricate splitter dampers of single thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/4 inch diameter rod in self aligning, universal joint action flanged bushing with set screw.
- D. Fabricate single blade dampers for duct sizes to 12 x 48 inch.
- E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.
- H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.4 FLANGE CONNECTORS

- A. Manufacturer shall be Ductmate, CL WARD, or equal.

- B. Description: [Add-on] [or] [roll-formed], factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.5 TURNING VANES

- A. Manufacturer shall be Ductmate, CL WARD, or equal.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: [Single] [Double] wall.
- E. Vane Construction: Single wall for ducts up to [48 inches] <Insert dimension> wide and double wall for larger dimensions.

2.6 FLEXIBLE CONNECTORS

- A. Manufacturer: Ventfrabrics, Duro Dyne or equal.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.7 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install flexible connectors to connect ducts to equipment.
- G. Connect flexible ducts to metal ducts with draw bands.
- H. Install duct test holes where required for testing and balancing purposes.
- I. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.
 - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233713 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 ACTION SUBMITTALS

- A. The manufacturer, contractor or supplier shall resubmit the specification section and shall include a written statement that the submitted equipment, hardware or accessory complies with the requirement of that particular section. Next to each specification item, indicate the following:
 - 1. “No Exception Taken”.
 - 2. “Exception”. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- B. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 2. Duct access panels.
- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 GRILLES AND DIFFUSERS

- A. See schedules on mechanical drawings for all product requirements.
- B. Contractor to coordinate framing with the ceiling construction.

- C. Contractor to coordinate finishes with architect.

2.2 ACCESSORIES

A. Flexible Duct Support

- 1. Manufacturers: Titus FlexRight (no known equal)
 - a. Radius forming brace to support 4-inch through 16-inch diameter flexible air ducts.
 - b. Provide nylon cable ties to secure flex duct to FlexRight brace.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Install Titus FlexRight brace at all flexible duct-to-diffuser connections.

3.3 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 238123.12 – LARGE CAPACITY (7 TONS (25 KW) AND LARGER), COMPUTER-ROOM AIR-CONDITIONERS, FLOOR-MOUNTED UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes floor-mounted, computer-room air conditioners of 7 tons and larger.

1.3 DEFINITIONS

- A. COP: Coefficient of performance.
- B. EER: Energy efficiency ratio.
- C. SCR: Silicon controlled rectifier.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include material descriptions, dimensions of individual components and profiles, and finishes for computer-room air-conditioning units.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For computer-room air conditioners.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, using input from installers of the items involved.

- B. Seismic Qualification Data: Certificates, for computer-room air conditioners, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For computer-room air conditioners to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set(s) of filters for each unit.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of computer-room air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
 - 2. Warranty Period for Humidifiers: Manufacturer's standard, but not less than three years from date of Substantial Completion.
 - 3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [DataAire](#)

B. Or equal

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
- D. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

2.3 MANUFACTURED INDOOR UNITS

- A. Description: Self-contained, factory assembled, prewired, and prepiped; consisting of cabinet, fan, filters, and controls; for vertical floor mounting in downflow configuration.
- B. Cabinet and Frame: Welded tubular-steel frame with removable minimum 14 gauge steel panels and insulated with 1-inch-thick duct liner.
 - 1. Floor Stand: Welded tubular steel, with adjustable legs and vibration isolation pads.
 - 2. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Supply-Air Fan:
 - 1. Forward curved, double width, double inlet, centrifugal, with adjustable V-belt drive.
 - 2. Plenum, single inlet, direct drive, electronically commutated, and variable speed.
- D. Refrigeration System:
 - 1. Compressor: Hermetic scroll type with oil strainer, internal motor overload protection, resilient suspension system, and crankcase heater.
 - 2. Refrigeration Circuit:
 - a. Two independent circuits with hot-gas mufflers.
 - b. Low-pressure switch.
 - c. Manually reset, high-pressure switch.
 - d. Thermal-expansion valve with external equalizer.
 - e. Sight glass with moisture indicator.

- f. Service shutoff valves.
 - g. Charging valves.
 - h. Hot-gas bypass.
 - i. Refrigerant charge.
 3. Refrigerant: R-410A.
 4. Refrigerant Evaporator Coil: Direct-expansion coil of seamless copper tubes expanded into aluminum fins, with two circuits, each with solenoid valve.
 - a. Mount stainless-steel drain pan complying with ASHRAE 62.1 under coil assembly.
 5. Remote Air-Cooled Refrigerant Condenser:
 - a. Integral, copper-tube aluminum-fin coil.
 - b. Condenser with surge protection device (SPD) and locking disconnect in the enclosed electrical panel section.
 6. Fan: Direct-drive, variable-speed centrifugal type.
 7. Split system shall have suction- and liquid-line compatible fittings and refrigerant piping for field interconnection.
- E. Hydronic Cooling Coil: Seamless copper tubes expanded into aluminum fins, modulating two-way control valve, and flow switch.
 1. Cooling Medium: Water.
 2. Mount stainless-steel drain pan complying with ASHRAE 62.1 under coil assembly.
- F. Final Filter: 4-inch-thick, disposable, pleated, glass-fiber media.
 1. Initial Resistance: See schedule.
 - a. MERV Rating: MERV 8 according to ASHRAE 52.2.
- G. Disconnect Switch: Locking disconnect with handle accessible with the door closed.
- H. Disconnect Switch: Non-locking, non-automatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
- I. Control System:
 1. Microprocessor unit-mounted panel.
 2. Fan contactor.
 3. Compressor contactor.
 4. Compressor start capacitor.
 5. Control transformer with circuit breaker.
 6. Solid-state temperature-control modules.
 7. Time-delay relay.
 8. Heating contactor.
 9. Smoke sensor.
 10. High-temperature thermostat.

11. Water detection sensor.
12. Solid-state, wall-mounted control panel with start-stop switch and adjustable temperature set point.
13. Remote panel to monitor and change temperature and humidity set points and sensitivities of the unit and unit alarms.
14. Sequential load activation, periodic hot-water-reheat coil flushing, and self-diagnostics.

J. Fan Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load does not require motor to operate in service factor range above 1.0.
3. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
4. Type: Open dripproof or totally enclosed fan cooled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for hydronic piping systems to verify actual locations of piping connections before equipment installation.
- C. Examine walls, floors, and roofs for suitable conditions where computer-room air conditioners will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Layout and install computer-room air conditioners and suspension system coordinated with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Install computer-room air conditioners coordinated with computer-room access flooring Installer.
- C. Install computer-room air conditioners level and plumb, maintaining manufacturer's recommended clearances. Install according to AHRI Guideline B.

- D. Computer-Room Air-Conditioner Mounting: Install using elastomeric pads or elastomeric mounts. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. Minimum Deflection: 1/4 inch
- E. Air-Cooled Refrigerant Condenser Mounting: Install using elastomeric pads or elastomeric mounts on concrete base. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. Minimum Deflection: 1/4 inch.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other heating, ventilating, and air-conditioning Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to computer-room air conditioners, allow space for service and maintenance.
- C. Water and Drainage Connections: Comply with applicable requirements in Section 221116 "Domestic Water Piping." Provide adequate connections for water-cooled units, condensate drain, and humidifier flushing system.
- D. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Provide shutoff valves and piping.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 2. After installing computer-room air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Computer-room air conditioners will be considered defective if they do not pass tests and inspections.

- E. Prepare test and inspection reports.
- F. After startup service and performance test, change filters and flush humidifier.

3.5 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain computer-room air conditioners.

END OF SECTION 238123.12

SECTION 238413 - ULTRASONIC HUMIDIFIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Ultrasonic humidifiers.

1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, distributor tubes/manifolds, and attachments to other work.
 - 1. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members to which humidifiers will be attached.
 - 2. Size and location of initial access modules for acoustical tile.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For humidifiers to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with AHRI 640.
- C. Comply with UL 998.

2.2 ULTRASONIC HUMIDIFIERS

- A. Manufacturers:
 - 1. Condair US series
 - 2. Carel
 - 3. Dristeem
 - 4. Or equal
- A. Capacities and Characteristics:
 - 1. Refer to mechanical drawings.
- B. Provide ultrasonic humidifier generating mineral-free, cold water mist for use with De-Ionized (DI), or Reverse Osmosis (RO) water. Packaged unit, wall mounted, atmospheric mist generation using high frequency vibration elements.
 - 1. Pre-engineered system, for in-space applications, uses high frequency ultrasonic technology to directly distribute fine mist into a space.
 - 2. Humidifier accepts reverse osmosis and de-ionized water (conductivity 1-15 μ S).
 - 3. Electronic controller, which monitors the operation of the system, controls output levels and initiates flush cycles and drains to ensure hygienic operation.
 - 4. Humidifier powered by 110-240 volts single phase power supply.
 - 5. All components should be self-contained in the ultrasonic humidifier. Blower pack (mist distribution system) shall be provided as a separate module for installation with the ultrasonic humidifier.
- C. Unit[s] to be complete with:

1. Microprocessor controller with backlit screen includes:
 - a. The controller modulates the high frequency piezo transducers to meet humidification loads.
 - b. The controller activates self-flushing cycles. This includes controlled flushing of the water in the reservoirs and supply lines, and drain cycles to maintain cleanliness of the water.
 - c. Control panel complete with on/off switch and backlit screen (user interface) for fault, maintenance, and operational indication.
 - d. Single or dual channel analog signal acceptance, supporting On/Off, demand or transducer signal (P and PI control integrated in the humidifier). Ability to control set point from humidifier control when using transducer controls.
 - e. 24 VAC safety loop for On/Off control, and/or high limit.
 - f. Integrated hardware and software allows for remote fault warning

2. Packaged system with ultrasonic technology:
 - a. High quality TiN (Titanium Nitrate) coated transducers for mist production.
 - b. Atomizing mist - water droplet size between 1 -3 Microns.
 - c. Modulating output between 10% and 100% of rated capacity.
 - d. Control accuracy of up to +/- 1% RH using high precision humidistat.
 - e. Water level float system, located inside the humidifier water reservoir to ensure accurate water level control.
 - f. System self-diagnostics during start-up to prevent unsafe operation of the unit[s].
 - g. Durable, chemically polished stainless steel water reservoir.
 - h. Intake air filtration - Minimum rating MERV 12.
 - i. Internal mist pipe(s) made of Antimicrobial and Antistatic Ether-Polyurethane.
 - j. Voltage compatible - 110-240V / 50-60 Hz / 1ph.
 - k. UV water pre-treatment.
 - l. Integral fill cup with minimum 1-inch air gap to prevent back siphoning.
 - m. Complete packaged design allowing Plug-and-Play installation and service access.
 - n. Water management system capable of automatic flushing and inactivity drain cycles.
 - o. Overflow protection on the water reservoir.

D. Options:

1. Blower pack.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for piping systems to verify actual locations of piping connections before humidifier installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install humidifiers with required clearance for service and maintenance. Maintain path, downstream from humidifiers, clear of obstructions as required by ASHRAE 62.1.
- B. Equipment Mounting:
 - 1. Install floor-mounted humidifiers on metal equipment stands.
 - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- C. Install all manufacturer-furnished accessories in accordance with manufacturer's written installation instructions.

3.3 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Install piping adjacent to humidifiers to allow service and maintenance.
 - 2. Install shutoff valve, strainer, backflow preventer, and union in humidifier makeup line.
- B. Install piping specialties furnished by manufacturer but not factory mounted.
- C. Install piping from safety relief valves to nearest floor drain.

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.
 - 3. Locate nameplate where easily visible.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

- B. Connect control wiring between control devices.
- C. Connect control wiring according to Section 260523 "Control Voltage Electrical Power Cables."

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service agent:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Humidifier will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain humidifiers.

END OF SECTION 238413

SECTION 260000 – GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

- A. Basic electrical requirements specifically applicable to Division 26 Sections.
- B. Work includes but is not necessarily limited to the following:
 - 1. Labor, materials, services, equipment, and appliances required for completion of tasks as indicated on drawing or in specification or as inherently necessary to provide complete and operational electrical systems including:
 - a. All temporary construction power including test power, temporary heat and lighting;
 - b. Incidental items not indicated on the drawings nor mentioned in the Specifications that belong to the work described, or are required to provide complete and operable systems, as though called out here in every detail;
 - c. Cleaning, cutting, patching, repairing and painting;
 - d. Testing and commissioning;
 - e. The Contractor shall coordinate this Section with all other Sections of the Specification.

1.3 DRAWINGS AND SPECIFICATIONS

- A. Drawings accompanying these Specifications show intent of Work to be done. Specifications shall identify quality and grade of installation and where equipment and hardware is not particularly specified, Contractor shall provide submittals for all products and install them per manufacturers' recommendations, and in a workmanlike manner.
- B. Examine Drawings and Specifications for elements in connection with this Work; determine existing and new general construction conditions and be familiar with all limitations caused by such conditions.
- C. In the event of a conflict or inconsistency between items indicated on the plans and/or specifications or with code requirements, the note, specification or code which prescribes and establishes the more complete job or the higher standard prevail.
- D. Plans are intended to show general arrangement and extent of Work contemplated. Exact location and arrangement of parts shall be determined after the Owner has reviewed equipment, as Work

progresses, to conform in best possible manner with surroundings, and as directed by the Owner's Representative.

- E. For purposes of clearness and legibility, the electrical drawings are essentially diagrammatic. The size and location of equipment is shown to scale where possible. The contractor shall verify all conditions, data information as indicated on the drawings and in the specification sections where electrical work interfaces with other trades.
- F. Contract Documents are intended to show the scope and general arrangement of the Work under this Contract. Drawings are not intended to be scaled for roughing in measurements or to serve as shop drawings. Where job conditions require minor changes or adjustments in the indicated locations or arrangement of the Work, such changes shall be made without change in the Contract amount.
- G. The contractor shall maintain as built drawings to reflect all changes made during construction and any deviations from the electrical drawings. This includes deviations from circuit numbers and any addition, deletion or relocation of fixtures/outlets shown on working drawings.

1.4 UTILITIES

- A. Location and sizes of electrical, mechanical and plumbing service facilities are shown in accordance with data secured from existing record drawings and site observations. Data shown are offered as an estimating guide without guarantee of accuracy. Check and verify all data given, and verify exact location of all utility services pertaining to Work prior to excavation or performing Work.

1.5 APPLICABLE REFERENCE STANDARDS, CODES AND REGULATIONS

- A. Meet requirements of all state codes having jurisdiction.
- B. State of California Code of Regulations:
 - 1. Title 8, Chapter 4. Division of Industrial Safety, Subchapter 5. Electrical Safety Orders (Cal/OSHA):
 - a. Low-Voltage Electrical Safety Orders (Sections 2299 - 2599)
 - b. High-Voltage Electrical Safety Orders (Sections 2700 - 2989)
 - 2. Title 19, State Fire Marshal Regulations
 - 3. Current California Building Code (CBC), Title 24, Part 2
 - 4. Current California Electrical Code, Title 24, Part 3
 - 5. Current California Mechanical Code, Title 24, Part 4
 - 6. Current California Plumbing Code, Title 24, Part 5
 - 7. Current California Energy Code, Title 24, Part 6
 - 8. Current California Fire Code, Title 24, Part 9
 - 9. Current California Standards Code, Title 24, Part 12
- C. Additional Referenced Standards:

1. ANSI American National Standards Institute
2. IEEE Institute of Electrical and Electronic Engineers
3. NEMA National Electrical Manufacturer's Association
4. NFPA National Fire Protection Association Standards
5. UL Underwriters Laboratories

- D. Codes and ordinances having jurisdiction over Work are minimum requirements; but, if Contract Documents indicate requirements, which are in excess of those minimum requirements, then requirements of the Contract Documents shall be followed. Nothing in these drawings and specifications shall be construed to permit work not conforming to governing codes or regulations. Should there be any conflicts between Contract Documents or codes or any ordinances having jurisdiction, report these to the Owner's Representative.
- E. Obtain permits, and request inspections from authority having jurisdiction.

1.6 PROJECT AND SITE CONDITIONS

- A. The arrangement of and connection to equipment shown on the Drawings is based upon information available and is not intended to show exact dimensions peculiar to a specific manufacturer. The Drawings are, in part, diagrammatic and some features of the illustrated equipment installations may require revision to meet actual equipment installation requirements. Structural supports, housekeeping pads, piping connections and adjacent equipment may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions or alterations.
- B. Examine all Drawings and Specifications to be fully cognizant of all work required under this Division.
- C. Examine site related work and surfaces before starting work of any Section.
- D. Install Work in locations shown on approved Drawings, unless prevented by Project conditions.
- E. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission from the Owner's Representative before proceeding.

1.7 COOPERATION WITH WORK UNDER OTHER DIVISIONS

- A. Cooperate with other trades to facilitate general progress of Work. Allow all other trades every reasonable opportunity for installation of their work.
- B. Work under this Division shall follow general building construction closely. Set pipe sleeves and inserts and verify that openings for chases and pipes are provided.
- C. Work with other trades in determining exact location of outlets, conduits, pipes, and pieces of equipment to avoid interference with lines required to maintain proper installation of Work.
- D. Make such progress in the Work to not delay work of other trades.

1.8 DISCREPANCIES

- A. The contractor shall check all drawings furnished to him immediately upon their receipt and shall promptly notify the owner of any discrepancies. Figures marked on drawings shall in general be followed in preference to scale measurements. Large scale drawings in general govern small scale drawings. The contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby. Where no figures or notations are given, the plans shall be followed
- B. Omissions from the Drawings or Specifications or the erroneous description of details of work which are manifestly necessary to carry out the intent of the Drawings and Specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or erroneously described details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.
- C. If any part of the Specifications or Drawings appears unclear or contradictory, apply to Owner's Representative for interpretation and decision as early as possible, including during bidding period. Do not proceed with such work without Owner Representatives decision. Beginning work of any Section constitutes acceptance of conditions.

1.9 CHANGES

- A. The Contractor shall be responsible to make and obtain approval from the Owner's Representative for all necessary adjustments in piping and equipment layouts as required to accommodate the relocations of equipment and/or devices, which are affected by any approved authorized changes or Product substitutions. All changes shall be clearly indicated on the "Record" drawings.

1.10 SUBMITTALS

- A. Refer to Division 01 for additional requirements.
- B. The manufacturer, contractor or supplier shall include a written statement that the submitted equipment, hardware or accessory complies with the requirement of that particular specification section.
- C. The manufacturer shall resubmit the specification section showing compliance with each respective paragraphs and specified items and features in that particular specification section.
- D. All exceptions shall be clearly identified by referencing respective paragraph and other requirements along with proposed alternative.
- E. Note that prior to acceptance of submittals for review, a submittal schedule shall be submitted to the Owner's Representative.
- F. Submit all Division 26 shop drawings and product data grouped and referenced by the specification technical section number in one complete submittal package.
- G. Shop Drawings:

1. Include installation details of equipment indicating proposed location, layout and arrangement, accessories, piping, and other items that must be shown to assure a coordinated installation.
 2. Indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
 3. If equipment is rejected, revise drawings to show acceptable equipment and resubmit.
 4. Whenever more than one (1) manufacturer's product is specified, the first named product is the basis of design used in the Drawings and the use of alternate-named manufacturer's products or substitutes may require modifications to the design.
 5. The Contractor shall be responsible for all equipment ordered and/or installed prior to receipt of shop drawings returned from the Owner's Representative bearing the Owner's Representative stamp of "Reviewed". All corrections or modifications to the equipment as noted on the shop drawings shall be performed and equipment removed from the job site at the request of the Owner's Representative without additional compensation.
 6. **Manufacturer's Data:** For each manufactured item, provide current manufacturer's descriptive literature of cataloged products, certified equipment drawings, diagrams, performance and characteristic curves if applicable, and catalog cuts.
 7. **Standard Compliance:** When materials or equipment provided by the Contractor must conform to the standards of organizations such as American National Standards Institute (ANSI) or UL, submit proof of such conformance to the Owner Representative for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified. In lieu of the label or listing, submit a certificate from an independent testing organization, which is competent to perform acceptance testing and is approved by the Owner Representative. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard.
 8. **Certified Test Reports:** Before delivery of materials and equipment, certified copies of all test reports specified in individual sections shall be submitted for approval.
 9. **Certificates of Compliance or Conformance:** Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this Contract. Pre-printed certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; or "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance or conformance.
- H. The Contractor shall submit all passcodes and passwords for any hardware and software required for the operations and troubleshooting in all systems and components no less than fourteen (14) calendar days prior to Final Completion.

1.11 PROJECT RECORD DOCUMENTS

- A. Refer to Division 01 for additional requirements.
 - 1. All changes, deviations and information recorded on the "Project Record Drawings" set during Construction shall be redrafted using the latest version of AutoCAD or Revit, where applicable.
 - 2. Submit completed shop drawings to the Owner prior to completion in digital format.
 - 3. Contractor hand-marked or drafted redlined "Project Record Drawings" will not be accepted.

1.12 PRODUCT ALTERNATIVES OR SUBSTITUTIONS

- A. Refer to General Conditions and Division 01 for additional requirements.

1.13 OPERATING INSTRUCTIONS

- A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel.

1.14 MANUFACTURER'S RECOMMENDATIONS

- A. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

1.15 DELIVERY AND STORAGE

- A. Refer to Division 01 for additional requirements.
- B. Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations and with the requirements of NFPA 70B P, Appendix I, titled "Equipment Storage and Maintenance During Construction." Replace damaged or defective items with new items.

1.16 GUARANTEE

- A. Except as may be specified under other sections in the Specifications, guarantee all equipment furnished under the Specifications for a period of one year from date of project acceptance against defective workmanship and material and improper installation. Upon notification of failure, correct deficiency immediately and without cost to the Owner.

- B. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner for their service agency as directed.

PART 2 - PRODUCTS

2.1 COMPETITIVE PRODUCTS

- A. Unless otherwise noted, any reference in the Specification to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may at his option propose substitutions for such material in accordance with the substitution procedure outlined in the Contract Documents.

2.2 MATERIALS

- A. Provide all new materials and equipment, free from any defects, in first-class condition, and suitable for the space provided. Provide materials and equipment approved by UL authority having jurisdiction approved testing agency, wherever standards have been established by that agency.
- B. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of units or equipment need not be products of the same manufacturer.
- C. Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturers' latest standard design that conforms to these Specifications.
- D. Provide materials and equipment with manufacturers' standard finish system, except where otherwise specified. Provide manufacturers' standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment with ANSI Number 61, light gray color.
- E. Environmental and Seismic Conditions: Material and Equipment shall be designed to insure satisfactory operation and operational life in the environmental and seismic conditions which will prevail where they are being installed. Electrical equipment and enclosures shall be designed, constructed and certified to withstand external loading conditions as prescribed by the California Building Code for the locations of the equipment. Supplied equipment shall either be shake table tested and certified or comprehensive seismic calculations shall be provided. All seismic calculations and structural drawings shall bear the seal of a Structural Professional Engineer currently licensed in the State of California. Earthquake design shall be based on the equivalent lateral force analysis procedure (ASCE 7-05 Section 12.8).

PART 3 - EXECUTION

3.1 GENERAL

- A. Obtain and pay for all permits and inspections, including any independent testing required to verify standard compliance, and deliver certificates for same to the Owner's Representative.

3.2 WORK RESPONSIBILITIES

- A. The drawings indicate diagrammatically the desired locations or arrangement of piping, equipment, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the work to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference with structural conditions.
- B. The Contractor is responsible for the correct placing of Work and the proper location and connection of Work in relation to the work of other trades. Advise appropriate trade as to locations of access panels.
- C. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost, providing the change is ordered before the conduit runs, etc. and work directly connected to same is installed and no extra materials are required.
- D. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.
- E. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with any work, carefully check and verify all dimensions, sizes, etc. with the drawings to see that the equipment will fit into the spaces provided without violation of applicable codes.
- F. Should any changes to the Work indicated on the Drawings or described in the Specifications be necessary in order to comply with the above requirements, notify the Owner immediately and cease work on all parts of the contract, which are affected until approval for any required modifications to the construction has been obtained from the Owner.
- G. Be responsible for any cooperative work, which must be altered due to lack of proper supervision or failure to make proper provisions in time. Such changes shall be under direction of the Owner and shall be made to his satisfaction. Perform all Work with competent and skilled personnel.
- H. The electrical drawings do not indicate all fittings, hardware, or appurtenances required for a complete operating installation.
- I. Wiring diagrams are not intended to indicate the exact course of raceways.
- J. One-line and riser diagrams are only schematics and do not show physical arrangements of equipment.

- K. All workmanship, including aesthetic as well as electrical aspects of the Work, shall be of the highest quality consistent with the best practices of the trade.
- L. Replace or repair, without additional compensation, any Work, which, in the opinion of the Owner, does not comply with these requirements.

3.3 CLEANING & PAINTING OF EQUIPMENT

- A. Refer to Division 09 for additional requirements.
- B. Factory Applied:
 - 1. Electrical equipment shall have factory-applied painting systems, which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.20.
 - 2. Refer to individual sections of this Division for more stringent requirements.
- C. Field Applied: Paint electrical equipment as required to touch up, to match finish on other equipment in adjacent spaces, or to meet safety criteria.
- D. After installation, all metal finishes shall be polished and cleaned of all dirt, rust, cement, plaster, grease, and paint.

END OF SECTION 260000

SECTION 260060 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 024116 - Building Demolition

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to Engineer before disturbing existing installation.
- C. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate electrical outages with the Campus. Contractor shall notify the Owner of any power outages a minimum of two weeks in advance and shall only occur if approved by the Owner in writing.
- C. Provide temporary wiring and connections to maintain existing systems in-service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK.

- A. Demolish and extend existing electrical work under provisions of this Section and as indicated on the drawings.
- B. Remove, relocate, and extend existing installations to accommodate new construction.

- C. Remove abandoned wiring to source of supply unless otherwise indicated.
- D. Remove exposed abandoned conduit. Cut conduit flush with walls and floors, and patch surfaces.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods as specified in Section 260533, "Raceways and Boxes for Electrical Systems."
- H. Disconnect and remove abandoned distribution equipment.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.

END OF SECTION 260060

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 260533 "Raceways and Boxes for Electrical Systems"
 - 2. Section 260553 "Identification for Electrical Systems."

1.3 DEFINITIONS

- A. ASTM: American Society of Testing Materials.
- B. ICEA: Insulated Cable Engineers Association.
- C. IEEE: Institute of Electrical & Electronics Engineers.
- D. NEMA: National Electrical Manufacturers Association.
- E. NETA ATS: InterNational Electrical Testing Association - Acceptance Testing Specification.
- F. VFD: Variable frequency drive.

1.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of product, indicating conductor/cable construction, insulation material, thickness of insulation, jacket, cable stranding, and voltage rating of each type of conductor/cable specified, splices and terminations. Indicate date and place of manufacture for each conductor/cable, cable, splice and termination.
- B. Manufacturer's ISO certification.
- C. Product Cable Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Independent Testing Agency.
- B. Field quality-control reports. Perform field testing of cables per para 3.8. Submit six (6) copies of field test reports to owner's representative within two (2) weeks of completion of test.

1.6 QUALITY ASSURANCE

- A. General Requirements: The low voltage power conductors and cable shall be copper, minimum 600V rated unless otherwise indicated. Aluminum conductors and cables shall not be accepted unless otherwise indicated.
- B. Materials and installation shall meet or exceed requirements in the following referenced standards and shall be listed and labelled by UL.
 - 1. ICEA S-95-658/ NEMA WC 70.
 - 2. AEIC CS8.
 - 3. UL 1072.
 - 4. IEEE.
 - 5. ASTM.
 - 6. NEMA.
- C. Conductors and cables shall be of the same manufacturer and shipped to the job site in original unbroken reels.
- D. Conductors and cables shall be manufactured within twelve (12) months of installation. Date of manufacture shall be clearly marked on conductors or conductor reels.
- E. Manufacturer shall have minimum ten (10) years experience in the manufacture of conductors and cables similar to those specified on this project.
- F. Manufacturer shall have ISO 9001 and ISO 9002 certification.
- G. All conductors and cables shall be new and supplied by a local distributor.
- H. If alternate manufacturer of products other than what are specified in this section are submitted, all necessary documents not limited to cut sheets, technical information, test reports from recognized testing labs and factory test reports shall be submitted to the satisfaction of the owner/engineer to ensure quality and conformance to the specifications. Additional testing shall be undertaken if it is concluded by the owner/engineer that the submitted test reports are either insufficient or do not include all tests necessary for product acceptance. The tests shall be conducted by a recognized lab acceptable to the owner/engineer and all tests shall be witnessed by owner's/engineer's personnel. All testing procedures and test results shall be satisfactory to the owner/engineer. Contractor shall be responsible for arranging the tests, for transportation, food and lodging for minimum of one owner's/engineer's representative to witness the test at the testing lab. Include all costs for the above in the bid.

- I. Testing: Provide the services of an independent qualified testing laboratory to perform the specified field tests. Notify the University's Representative fourteen (14) days in advance of performance of work requiring testing.
- J. Conductors, cables, splices and terminations shall be manufactured within twelve (12) months of installation. Each item shall have a permanent marking on the product or the original manufacturers' package indicating the date of manufacture unless otherwise noted.
- K. Testing Agency Qualifications:
 - 1. Testing agency shall be an independent company; shall have been a member of NETA for a minimum of last ten (10) years and has permanent in-house testing engineers and technicians involved with testing of low voltage electrical power conductors and cables similar to those specified on this project.
 - 2. Testing company shall be located within 50 miles radius of the project.
 - 3. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
 - 4. Field Testing technician and supervisor shall have minimum ten (10) years' experience in field testing of low voltage power conductors and cables of the type and rating similar to the conductors and cables to be tested on this project.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
- B. Basis-of-Design Product:
 - 1. General Cable Technologies Corporation.
 - 2. Southwire Incorporated
 - 3. Alpha Wire.
 - 4. Belden Inc.
 - 5. Encore Wire Corporation..
- C. Conductor Material: Electrical grade, soft drawn annealed copper, 98 percent conductivity, and fabricated in accordance with ASTM and ICEA standards. Minimum size is number 12 for branch circuits, number 14 stranded for control wiring. Aluminum conductors are not permitted. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- D. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.
- E. Multiconductor Cable: Not allowed.
- F. Provide separate neutral with each branch circuit serving outlets. When dedicated neutrals are provided, use color spiral to match associated phase.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Ideal Industries, Inc.
 - 2. IlSCO
 - 3. NSi Industries LLC.
 - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 5. 3M; Electrical Markets Division.
 - 6. TE Connectivity - Raychem.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Copper conductors shall be terminated in copper or bronze mechanical connectors or lugs or tool applied compression connections made of copper for all connections except those on wiring devices.
- D. Splices in wires No. 10 and smaller shall be made with twist-on splicing connector in accordance with UL486-C. Connections in wires No. 8 and larger shall be made with compression type connectors in accordance with UL486-A and wrapped with insulated tape in accordance with UL501. Insulating tape shall be applied in a minimum of two layers of half wrap or built to match the overall insulation of the wire.
- E. Splices in underground pull boxes shall be made submersible type and made using “3M” Scotch-cast epoxy kits.
- F. Pressure type connectors are not permitted.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 12 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway
- E. Feeders Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.
- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway
- I. Branch Circuits Installed Below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. All conductors and cables shall be installed in a raceway.
- B. Before installing conductors and cables in existing conduits, verify the continuity of each conduit; each surface conduit is properly supported per code and clear of any debris.
- C. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- G. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Each conductor shall be factory color coded by conductor manufacturer. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance conductors, feeder conductors and the conductors feeding the following critical equipment and services for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical tests stated in latest NETA Acceptance Testing Specification section 7.3.2 (Inspection and Test Procedures-Cables, Low Voltage-600V Maximum). Certify compliance with test parameters per NETA tables.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and

larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

- a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
- b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements. Include color scan images.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.3 Definitions:

- A. NETA ATS: InterNational Electrical Testing Association - Acceptance Testing Specification.
- B. NETA MTS: InterNational Electrical Testing Association - Maintenance Testing Specification.
- C. NFPA : National Fire Protection Association.
- D. IEEE: Institute of Electrical and Electronics Engineers

1.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical catalog cuts for each type of product indicated.
- B. Shop Drawings: Site drawings to scale including details showing location and size of each field connection of grounding system.
 - 1. Wiring Diagrams: Differentiate between manufacturer installed and field installed wiring.
- C. Sustainable Design Submittals:
 - 1. Product Data: For each conductor and cable indicating lead content.

1.5 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans drawn to scale (1/4"=1'-0") showing dimensioned ~~as-built~~ locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Grounding conductors, connectors.

2. Grounding for sensitive electronic equipment.
- B. Qualification Data: For qualified independent testing agency and testing agency's field supervisor.
- C. Field quality-control reports. Submit written test reports including the following:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
1. Testing agency shall be an independent company; shall have been a member of NETA for a minimum of last ten (10) years and has permanent in-house testing engineers and technicians involved with testing of grounding systems similar to those specified on this project.
 2. Testing company shall be located with 50 miles radius of the project.
 3. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 4. Field Testing technician and supervisor shall have minimum ten (10) years' experience in field testing of rounding systems of the type and rating similar to the systems to be tested on this project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 GROUNDING ELECTRODES, CONDUCTORS, CONNECTOR, BUS:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or equal:
1. Grounding Connectors, Bars and Rods:
 - a. Erico - Pentair Electrical Fastening Solutions
 - b. Burndy – A Hubbell Company.
 - c. Ideal Industries, Inc.
 - d. O-Z/Gedney Co. - A brand of Emerson Industrial Automation.
 - e. Thomas & Betts - A Member of the ABB Group.

2. Grounding Conductors and cables:

- a. Southwire
- b. American Insulated Wire
- c. Okonite

2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Lead Content: Less than 300 parts per million

2.3 CONNECTORS

- A. Listed and labeled by UL for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors, Rods and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Lead Content: Less than 300 parts per million

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection,

with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits in the same conduit containing phase and neutral conductors. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding

electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
4. All metallic conduits and cable tray shall be continuously bonded to maintain low resistance ground path and bonded back to the central equipment by the use of bonding jumpers where needed.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.4 LABELING

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer.
 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent qualified testing agency to perform tests and inspections. Refer to section
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified.
 - a. Perform tests by fall-of-potential method according to IEEE 81.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor ~~off~~ five times the applied force.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit: Part of Atkore International
 - b. Cooper B-Line, Inc.; a division of Eaton Inc.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation: A Member of the ABB Group.
 - f. Unistrut; Part of Atkore International,
 - g. Wesanco, Inc.
 - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 6. Channel Dimensions: Selected for applicable load criteria.

- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel, Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Not allowed.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Floor-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To New Concrete: Bolt to concrete inserts.
 - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 3. To Existing Concrete: Expansion anchor fasteners.
 - 4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts
 - 5. To Light Steel: Sheet metal screws.
 - 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. EMT: Electrical metal tubing
- C. ENT: Electrical non-metallic tubing
- D. GRC: Galvanized rigid steel conduit.
- E. HDPE: High density polyethylene pipe
- F. IMC: Intermediate metal conduit.
- G. LFMC: Liquidtite flexible metal conduit
- H. LFNC: Liquidtite flexible non-metallic conduit.
- I. RNC: Rigid non-metallic conduit
- J. RTRC: Reinforced thermosetting resin conduit

1.4 QUALITY ASSURANCE:

- A. Each conduit shall bear manufacturer's trademark and UL label.
- B. Each type of conduit and fittings shall be of a single manufacturer. Multiple manufacturer's of the same material are not acceptable.

- C. Comply with California Electric Code (CEC)

1.5 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 2. Electri-Flex Company.
 - 3. O-Z/Gedney; a brand of EGS Electrical Group.
 - 4. Republic Conduit.
 - 5. Robroy Industries.

6. Thomas & Betts Corporation.
 7. Western Tube and Conduit Corporation.
 8. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be UL listed and labeled as defined in NFPA 70, , and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel
 - b. Type: Compression.
 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Technologies Company; Cooper Crouse-Hinds.
 2. EGS/Appleton Electric.
 - 3.
 4. Hoffman; a Pentair company.
 5. Hubbell Incorporated; Killark Division.
 6. O-Z/Gedney; a brand of EGS Electrical Group.
 7. RACO; a Hubbell Company.

8. Robroy Industries.
 9. Thomas & Betts Corporation.
 10. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep
- I. Gangable boxes prohibited.
- J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- K. Cabinets:
1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.
 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC

3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT
 2. Exposed, Not Subject to Severe Physical Damage: EMT
 3. Exposed and Subject to Severe Physical Damage: GRC.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT
 5. Concealed in concrete walls and columns: RNC Type EPC-40-PVC.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 7. Damp or Wet Locations: GRC,IMC.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use setscrew or compression, steel cast-metal fittings. Comply with NEMA FB 2.10.
 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 250lbs (113 kgs) tensile strength. Leave at least 12 inches of slack at each end of pull wire. Provide acrylic identification tags (2"X4") at each end indicating the source. Cap underground raceways designated as spare above grade alongside raceways in use.
- Q. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- R. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- S. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- T. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - b. Attics: 135 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to centertop of box unless otherwise indicated.
- V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- W. Locate boxes so that cover or plate will not span different building finishes.
- X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Channel support systems.
 - 2. Restraint cables.
 - 3. Hanger rod stiffeners.
 - 4. Anchorage bushings and washers.
- B. Related Sections include the following:
 - 1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I, II or III.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 2.5.
 - c. Component Amplification Factor: 2.5.
 - 3. Design Spectral Response Acceleration at Short Periods (1.045 Second).
 - 4. Design Spectral Response Acceleration at 0.588-Second Period.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.

3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti Inc.
 5. Loos & Co.; Seismic Earthquake Division.
 6. Mason Industries.
 7. TOLCO Incorporated; a brand of NIBCO INC.
 8. Unistrut; Tyco International, Ltd.
- C. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.
- G. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- J. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- K. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
- 2.2 FACTORY FINISHES
- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.
 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 3. Baked enamel or powder coat for metal components on isolators for interior use.
 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Bands and tubes.
 - 4. Tapes and stencils.
 - 5. Tags.
 - 6. Cable ties.
 - 7. Paint for identification.
 - 8. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- C. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E and Section 26 0573 "Short Circuit, Coordination and Arc-Flash Study" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service' feeder and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Color for Neutral: White.
 - 5. Color for Equipment Grounds: Green.
 - 6. Colors for Isolated Grounds: Green with white stripe.
- C. Equipment Identification Labels:
 - 1. Black letters on a white field for equipment connected to normal power and Red letters on a white field for equipment connected to emergency/standby power unless otherwise indicated

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. HellermannTyton.
 - c. Marking Services, Inc.
 - d. Panduit Corp.
 - e. Seton Identification Products.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. HellermannTyton.
 - c. Marking Services, Inc.
 - d. Panduit Corp.
 - e. Seton Identification Products.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyesterflexible label with acrylic pressure-sensitive adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. .
 - c. Grafoplast Wire Markers.
 - d. Ideal Industries, Inc.
 - e. Marking Services, Inc.
 - f. Panduit Corp.
 - g. Seton Identification Products.
 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 4. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Grafoplast Wire Markers.
 - c. HellermannTyton.
 - d. Ideal Industries, Inc.
 - e. Marking Services, Inc.
 - f. Panduit Corp.
 - g. Seton Identification Products.
2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. HellermannTyton.
 - c. Ideal Industries, Inc.
 - d. Marking Services, Inc.
 - e. Panduit Corp.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
 - d. Marking Services, Inc.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HellermannTyton.

- b. LEM Products Inc.
 - c. Marking Services, Inc.
 - d. Seton Identification Products.
- D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be inchunless otherwise indicated. If requested by Architect, match Owner’s existing legend type, size etc.

2.5 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
 - d. Marking Services, Inc.
 - e. Seton Identification Products.

2.6 SIGNS

- A. Baked-Enamel Signs:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Champion America.
 - c. emedco.
 - d. Marking Services, Inc.
 - 2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 3. 1/4-inch grommets in corners for mounting.
 - 4. Nominal Size: 7 by 10 inches.
- B. Metal-Backed Butyrate Signs:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Champion America.
 - c. emedco.
 - d. Marking Services, Inc.

2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
 - d. Marking Services, Inc.
2. Engraved legend.
3. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white face background for equipment connected to normal power and red letters on white face background for equipment connected to emergency/standby power. Verify with Architect if legend has to match Owner's existing signs.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. HellermannTyton.
 2. Ideal Industries, Inc.
 3. Marking Services, Inc.
 4. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.

- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black.

- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

- B. Install identifying devices before installing acoustical ceilings and similar concealment.

- C. Verify identity of each item before installing identification products.

- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer. Refer to drawings for additional information.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- M. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Nonmetallic Preprinted Tags:
1. Place in a location with high visibility and accessibility.
 2. Secure using general-purpose UV-stabilized in all areas except use plenum-rated cable ties in plenum areas.
- W. Baked-Enamel Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- X. Metal-Backed Butyrate Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- Y. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- Z. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch-high, black letters on 20-inch centers.
 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10-foot maximum intervals unless otherwise indicated.
- D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- E. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 1. "EMERGENCY POWER."
 2. "POWER."
 3. "UPS."
- F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.

- I. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- J. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- M. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.
- N. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- O. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Equipment to Be Labeled:
 - a. Panelboards and PDUs: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Enclosed switches.
 - e. Enclosed circuit breakers.
 - f. Remote-controlled switches, dimmer modules, and control devices.
 - g. Battery racks.
 - h. Monitoring and control equipment.
 - i. UPS equipment.

END OF SECTION 260553

SECTION 262600 - POWER DISTRIBUTION UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes freestanding, prepackaged, power distribution units for transforming, conditioning, and distributing electrical power.

1.3 DEFINITIONS

- A. NETA: InterNational Electrical testing Association
- B. EPO: Emergency power-off.
- C. SPD: Surge Protection Device.
- D. THD: Total Harmonic Distortion
- E. UPS: Uninterrupted power supply.

1.4 ACTION SUBMITTALS

- A. Product Data: For power distribution units. Include system description, ratings, capacities, and performance characteristics.
- B. Shop Drawings: Include dimensioned plans, sections, and elevations. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Shop drawings shall be prepared by the factory engineer and include the following information.
 - 1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer installed and field installed wiring.
 - 2. Dimensioned plans and elevations to scale (1/4"=1'-0") showing major components and features.
 - 3. One-line diagram.
 - 4. List of materials.
 - 5. Nameplate legends.
 - 6. Size and number of bus bars and current rating for each bus, including mains and branches of phase, neutral, and ground buses.

7. Short-time and short-circuit current ratings of power distribution units and components.
8. Ratings of individual protective devices.
9. Time-current characteristics curves for each protective device.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.
- B. Product Certificates: For each type of power distribution unit, signed by product manufacturer.
- C. Location of structural supports for structure mounted raceways, busways and seismic bracing.
- D. Layout of power distribution unit in room, area to scale including horizontal and vertical clearances around the substation.
- E. Manufacturer Seismic Qualification Certification: Submit certification that power distribution units, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Source quality-control test reports.
 1. Factory test of each power distribution units shall be done at the manufacturer's testing facility at the factory. Each report shall indicate the date, location and description of the test including test parameters. Report shall be reviewed and signed by the factory testing engineer. Include the name of the testing technician and the engineer. Submit within 2 weeks of completion of the tests.
- G. Field quality-control test reports.
 1. Submit within two (2) weeks of completion of field tests.
 2. Test procedures used.
 3. Test results that comply with requirements.
 4. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

- H. Manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power distribution units to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. If alternate manufacturer of products other than what are specified in this section are submitted, all necessary documents not limited to cut sheets, technical information, test reports from recognized testing labs and factory test reports shall be submitted to the satisfaction of the owner/engineer to ensure quality and conformance to the specifications. Additional testing shall be undertaken if it is concluded by the owner/engineer that the submitted test reports are either insufficient or do not include all tests necessary for product acceptance. The tests shall be conducted by a recognized lab acceptable to the owner/engineer and all tests shall be witnessed by owner's/engineer's personnel. All testing procedures and test results shall be satisfactory to the owner/engineer. Contractor shall be responsible for arranging the tests, for transportation, food and lodging for minimum of one owner's/engineer's representative to witness the test at the testing lab. Include all costs for the above in the bid.
- B. Contractor shall ensure that the manufacturer has a minimum of 15 years experience in the production of Power Distribution Units similar to the type and size specified in this project. Furnish a list of minimum three (3) installations with similar equipment completed within the last five (5) years. Include name, address, telephone number and email of the facility engineer for each installation.
- C. Manufacturer shall maintain a local service center capable of providing training, parts and emergency on-site repairs in less than eight (8) hours maximum response time.
- D. Manufacturer shall have ISO 9001 Certification.
- E. Manufacturer shall have ability to readily provide replacement parts for a minimum period of ten (10) years, from the date of completion of the project
- F. Power distribution unit shall be assembled at the manufacturer's own manufacturing facility using its own major devices (e.g., transformer, circuit breakers) for the assembly. These devices shall be normally carried by the manufacturer as standard catalog items.
- G. Materials and equipment shall be new, modern in design and shall not have been in prior service except as required by factory tests. Major components (e.g., transformer, and switchboard) shall be manufactured within six months of installation.
- H. Source Limitations: Obtain power distribution unit through one source from a single manufacturer through a local distributor with responsibility for entire power distribution unit installation.

- I. All power distribution equipment shall be of the same manufacturer as the substation unless otherwise specified.

specified on this project.

- J. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in NFPA 70, Article 100
- K. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.
- B. Store equipment in spaces with environments controlled within manufacturer's ambient temperature and humidity tolerances for non-operating equipment.

1.9 COORDINATION

- A. Coordinate size and location of concrete bases with actual power distribution unit provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- B. Coordinate layout and installation of power distribution units with access flooring for proper support and seismic restraint of units.
- C. Coordinate layout and installation of power distribution units with Owner's other equipment.
 - 1. Meet jointly with electronic equipment representatives and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute record to other participants.
 - 3. Adjust arrangements and locations of power distribution units to accommodate and optimize arrangement and space requirements of equipment.

1.10 PROJECT CONDITIONS

- A. Environmental Conditions: Units shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability.
 - 1. Storage Temperature Range: Minus 67 to plus 185 deg F (Minus 55 to plus 85 deg C).
 - 2. Operating Temperature Range: 32 to 104 deg F (0 to 40 deg C).
 - 3. Relative Humidity Range: 0 to 95 percent, noncondensing.
 - 4. Altitude: Sea level to 3600 feet (1100 m above sea level).

1.11 WARRANTY

- A. Warranty for complete Power Distribution Unit shall be two (2) years from the date of substantial completion. See special warranty below.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace on site the Transient Voltage Surge Suppressors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Five (5)** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Inc.
 - 2. Liebert Corporation; a division of Emerson.
 - 3. Power Distribution, Inc.
 - 4. Square D; Schneider Electric.
 - 5. United Power Corporation.

2.2 MANUFACTURED UNITS

- A. Description: Integrated and coordinated assembly of power-line-conditioning and distribution components packaged in a single cabinet or modular assembly of cabinets each with full-swivel casters mounted to bottom frame. Include the following components:
 - 1. Input-power, circuit-breaker section.
 - 2. Output panelboard(s).
 - 3. Alarm, monitoring, and control system.
- B. Provide units that are constructed to withstand seismic forces specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Unit Capacity Rating: Unit shall carry indicated rms kilovolt-ampere load continuously without exceeding rated insulation temperature for the following input voltage and load current:
 - 1. Input Voltage: Within rated input-voltage tolerance band of unit.
 - 2. Load Current: Minimum of 3.0 crest factor and 85 percent total harmonic distortion.
- D. Wiring Access: Top wiring access.
- E. All breakers and switches shall be mounted behind closed doors to limit control access to authorized personnel.

2.3 INPUT-POWER, CIRCUIT-BREAKER SECTION

- A. Description: 3-pole, thermal-magnetic-type circuit breaker, rated for indicated interrupting capacity and 125 percent of input current of unit at 100 percent rated load. Circuit breakers 400A frame and above shall be microprocessor type with electronic trip units, field replaceable and field adjustable. Electronic trip units shall include an integral power supply and not depend on an external power supply.
1. Dual-Input Units:
 - a. Two input circuit breakers arranged to provide transfer between two input-voltage sources.
 - b. Controls and interfaces to allow both open- and closed-transition transfer between two input-voltage sources.
 - c. Use a 120-V permissive signal from both upstream voltage sources to indicate acceptable conditions for closed-transition transfer.
 - d. Open second circuit breaker automatically after closed-transition transfer is completed.

2.4 OUTPUT PANELBOARDS

- A. Description: Panelboards complying with Section 262416 "Panelboards" except for mounting provisions. Mount in front of power distribution units behind flush doors. Include the following features:
1. Construction: 42 pole, 240 V, 3 phase; capable of accepting branch circuit breakers rated to 100 A.
 2. Panelboard Rating: 225 A, with main circuit breaker.
 3. Panelboard Phase, Neutral and Ground Buses: Copper, with neutral bus at least 1.732 times the nominal phase bus rating.
 4. Isolated Ground Bus: Copper, adequate for branch-circuit equipment ground conductors; insulated from supports.
 5. Branch Circuit Breakers: Bolton.
 6. Cable Racks: Removable and arranged for supporting and routing cables for panelboard entrance.
 7. Access Panels: Arranged so additional branch-circuit wiring can be installed and connected in the future.

2.5 POWER DISTRIBUTION UNIT CONTROLS

- A. Include the following control features:
1. Emergency, power-off switch integral with power distribution unit.
 2. Alarm Contacts: Electrically isolated, Form C (one normally open and one normally closed), summary alarm; contact set shall change state if any monitored function goes into alarm mode.

2.6 MONITORING, STATUS, AND ALARM ANNUNCIATION

- A. Description: Microprocessor-based monitoring, status, and alarm annunciation panel mounted flush in front of power distribution unit to provide status display and failure-indicating interface for the following:
1. Power Monitoring:
 - a. Input Voltage: Line to line, rms.
 - b. Output Voltage: Line to line, rms.
 - c. Output Voltage: Line to neutral, rms.
 - d. Output current.
 2. Status Indication: Unit on.
 3. Alarm Annunciation:
 - a. High temperature.
 - b. High and low input voltage.
 - c. High and low output voltage.
 - d. Phase loss.
 4. Audible Alarm and Silencing Switch: Alarm sounds when alarm indication occurs. Silencing switch shall silence audible alarm but leave visual indication active until failure or other alarm conditions are corrected.
 5. Remote Alarm: Provide contacts including necessary wiring for remote alarm monitoring at an Owner's centrally attended location via building management system or via Ethernet. Coordinate with owner prior to rough in.

2.7 FINISHES

- A. Manufacturer's standard finish over corrosion-resistant pretreatment and primer.

2.8 SOURCE QUALITY CONTROL

- A. Factory Tests: Design and routine tests shall comply with referenced standards.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment. Comply with IEEE C57.12.91 and NEMA ST 20.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Arrange power distribution units to provide adequate access to equipment and circulation of cooling air.

- B. Anchor or restrain floor-mounting power distribution units according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

3.2 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Install flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent qualified testing agency to perform tests and inspections and prepare test reports.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- C. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification for circuit breakers, molded case; and for transformers, dry type, air cooled, low voltage, small. Certify compliance with test parameters.
 - 2. Perform functional tests of power distribution units throughout their operating ranges. Test each monitoring, status, and alarm function.
 - 3. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 4. Test continuity of each circuit.

- E. Remove malfunctioning units, replace with new units, and retest as specified above.
- F. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of conductor and bus connections.
 - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2. Prepare a certified report identifying connections checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action. Include color photos of the scans.
- G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.4 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- B. Adjust power distribution units to provide optimum voltage to equipment served throughout normal operating cycle of loads served. Record input and output voltages and adjustment settings and incorporate into test results.
- A. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as data racks.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 CLEANING

- A. Vacuum dirt and debris from each unit before energization and acceptance by the owner; do not use compressed air to assist in cleaning.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power distribution units. Training shall be held on site on a date and time convenient to the owner after commissioning of the unit. Provide minimum two weeks advance notice. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 262600

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Toggle switches, 120/277 V, 20 A.
 - 2. Receptacles

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- E. RFI: Radio-frequency interference.
- F. SPD: Surge Protective Device.
- G. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer. Switches, receptacles and cover plates shall be of the same manufacturer.
- B. Comply with National Electrical Manufacturer's Association (NEMA) standards. Furnish products listed and classified by Underwriter's Laboratories Inc. as suitable for purpose specified and shown.
- C. Manufacturer shall have a minimum of ten (10) years experience in the production of wiring devices specified and shall have ISO 9001 and 9002 certifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 2. Leviton Mfg. Company Inc. (Leviton).
 - 3. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: UL Listed and labeled and marked for intended location and application.

- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125V, 20A: Comply with NEMA WD1, NEMA WD6 Configuration 5-20R, UL498, and FSW-C-596.
 - 1. Products: Subject to compliance with requirements, provide one of the following manufacturers
 - a. Hubbell; HBL5361 (single), HBL5362 (duplex).
 - b. Leviton; 5361 (single), 5362 (duplex).
 - c. Pass & Seymour; 5361 (single), 5362 (duplex).
 - 2. Description: Grounded, industrial extra heavy duty specifications grade, back- and side-wired, single-piece grounding brass strap with integral ground, impact-resistant thermoplastic nylon cover and body, smooth face, ~~20A, 125V, duplex~~, with separate grounding screw and NEMA 5-20R plug configurations.

2.4 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following manufacturers
 - 1) Single Pole:
 - 2) Hubbell; HBL1221.
 - 3) Leviton; 1221-2.
 - 4) Pass & Seymour; CSB20AC1.

2.5 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic, 0.035-inch- (1-mm-) thick
 - 3. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum] with lockable cover.

2.6 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red
 - 3. SPD Devices: Blue.
 - 4. Isolated-Ground Receptacles: Orange
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with blackfilled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 20-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports. Submit reports within two (2) weeks of completion of tests.

END OF SECTION 262726

SECTION 270500 - REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide a standard defining the structured communications cabling systems to be installed within customer facility. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards and industry best practices.
2. Scope of Work Compliance.
3. Contractor Qualifications.
4. Warranty.
5. Safety.
6. Working Conditions.

1.2 GENERAL TERMS AND CONDITIONS.

- A. General Contractor is responsible for all required Division 27 scope of work and shall ensure all communication sub-tier contractors adhere to the qualifications set forth in all project Division 27 specifications including project experience and certifications.
 - B. Prices quoted shall be all-inclusive and represent a complete fully-engineered system installation at the Project site as contemplated by and detailed in the drawing package and in accompanying specifications.
 - C. Omissions in the specification of any provision herein described shall not be construed as to relieve the contractor of any responsibility or obligation requisite to the complete and satisfactory delivery, installation, operation and support of any and all systems, equipment or services. Correction of any omission on the part of the contractor, either due to misinterpretation of this specification or any other conditions of the project, shall be the responsibility of the Contractor and shall not result in any contract modification or additional costs to Owner.
- A. Combined Prescriptive and Performance Design Requirements
1. Division 27 includes a combination of prescriptive and performance specifications. Compliance with the performance specifications, as well as coordination and integration of the prescription requirements, will require substantial design work on the part of the Contractor.
 2. The performance requirements are intended to establish overall system performance requirements, satisfy the operational requirements, and establish the inter-coordination requirements for the Division 27 systems.
 3. The prescriptive requirements establish the minimum quality, characteristics, and types of components, equipment, and materials to be used to achieve the stated system performance

- requirements. The Contractor is advised, however, that prescriptive specifications have not been provided to satisfy all of the specified performance requirements.
4. The Contractor shall carefully consider all of the requirements for each of the Division 27 systems when preparing its bid. Any questions regarding the intent of these requirements, the scope of the systems, or their coordination requirements must be submitted in writing prior to bidding in accordance with the Instructions to Bidders. The Contractor shall have no claim for either extra compensation or extra time on the grounds that it did not understand the scope or the requirements of the Division 27 work, and/or the coordination requirements of the Division 27 work with the Work of the other Divisions.
 5. Compliance with the project requirements will be progressively monitored and adjusted through the submittal process, installation period, and performance verification testing.
- B. Drawing Interpretation
1. The drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions or detailed drawings. The Drawings installation and schematic diagrams and symbols to outline the Work to be provided. These drawings do not have any dimensional significance nor do they delineate every item required for the intended Work. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete Work are excluded.
 2. The Work shall be provided in accordance with the intent expressed on the Drawings and Specifications and in conformance with the actual building architectural and structural conditions. When in conflict, field conditions take precedence over the Contract Documents.
 3. The meaning of abbreviations shall be the same, whether in lower case letters or without periods.
 4. The use of words in the singular shall not be considered as singular where other indications denote that more than one item is referred to.
 5. Details that appear on the Contract Documents, which are specific with regard to the dimensioning and positioning of the Work, are intended only for the purpose of establishing general feasibility. They do not replace engineering or field coordination by the Contractor for the Work.
- C. Provide all parts and equipment for a complete and operational system for the Work of Division 27 as described herein and shown on the drawings.
- D. Furnish and install all trenching and backfill, duct banks, conduits, raceways, sleeves, boxes, gutters, shelves, enclosures, shelf and enclosure supports, backboards, pull ropes (in unused or spare conduits) required to make all systems fully operational, including components not shown on the Drawings, but necessary for fully operational systems.
- E. Furnish, install, terminate, test, dress, and identify all wire and cable required to make systems fully operational, including all wire and cabling not shown on the Drawings, but necessary for fully operational systems.
- F. Recognize that the Work entails integration between individual systems, as well as the design and implementation of many systems and component interfaces. Take full responsibility for the complete design, installation, and performance of the total integrated system, including integration between systems and various interfaces, in order to achieve the specified operational features and system performance requirements.

- G. Fully test the systems, demonstrate their satisfactory operation, and train maintenance and operating personnel, as specified in this Section and the Sections governed by this Section.
- H. Where conflicts and/or irregularities occur between project documents, specifications, drawings, and/or applicable codes, rules, regulations, ordinances, standards, guidelines and practices, the more stringent requirement shall apply as reasonably determined by Owner or government agency inspector.
- I. This specification represents the design intent for the project communicated by way of narrative descriptions of intended functionality and single line or detail drawings indicating likely equipment connectivity to achieve that functionality. The designs in this specification do not represent fully engineered technical solutions. Contractors are required to review the designs presented in the project documents closely, submit any questions and clarifications regarding the design intent through the RFI process and develop their own engineered solutions representing a fully functional turn-key solution in their bid responses.
- J. The scope of this project includes the complete system engineering, procurement, fabrication, installation, programming, testing, training and warranty.
- K. Proposed solutions shall be based on the designs communicated in the specifications, but shall include any additional equipment, materials, software, licenses and/or labor required for the contractor to deliver a fully functional turn-key system solution that meets intended operational performance requirements.
- L. It is the responsibility of the Contractor awarded this project to ensure that all quantities, materials, labor, licenses, permits, sales taxes and any and all other costs to provide a turnkey project are included in their bid.
- M. Floor plans, drawings, elevation drawings, and other drawings received by the Contractor as part of the construction process are hereby incorporated into this document by reference. It is the responsibility of the Contractor to ensure that amounts and lengths of cabling and pathways are correct, and that all materials and labor are included to install the system per the drawings and these specifications.
- N. Permits, licenses, applicable sales taxes, insurance requirements, payment/performance bond costs, and other miscellaneous costs are the responsibility of the Contractor and shall be included in the contract price and this scope of work. Such items are to be listed separately on pricing sheets, if provided. Copies of all required permits, licenses, insurance requirements and bond(s) are to be delivered to Owner prior to commencement of any work.
- O. Installation Schedule and Coordination: Contractor shall take the fast-track nature of this project and potential requirement for installation/work schedule adjustments and quick turnarounds into consideration in constructing this project as Owner will NOT entertain or agree to added-cost change orders associated with scheduling changes.
- P. Work will need to be closely coordinated with architect, City Personnel, GC, MEP contractors, structural contractor and all low-voltage contractors and each of their respective schedules.
- Q. This will be a turnkey Project. Any item of the equipment or material not specifically addressed on the drawings, specifications or elsewhere in Division 27 specifications documents, but

required to provide complete and functional systems as contemplated and/or specified herein, shall be provided at no additional charge to owner in a quantity and quality consistent with other specified items.

- R. Coordination with Project Design Team: The build contractor will be responsible for coordinating all communications cabling infrastructure requirements, including review of existing site conditions, review and coordination of electrical power and grounding requirements, conduits and back boxes, structural support requirements, and coordination.
- S. Assembly: The contractor shall procure and assemble all hardware and equipment and any additional materials as required to deliver the completely functioning communications cabling system and/or Audio-Visual System.
- T. Installation: The contractor shall install all equipment, inter-rack and intra-rack cable, wiring of equipment, connectors, panels, plates, and other material at the Project site.
- U. Testing and Adjustment: The contractor shall perform all tests and adjustments, furnish all test equipment necessary and perform all work required to properly configure the systems and to verify their performance in accordance with the information in this document and the design-build integrator's approved engineered designs.
- V. Warranty: The contractor shall warrant the installed system in accordance with the terms of this document and accompanying contractual documents.

1.3 RELATED DOCUMENTS

- A. All divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings including but not limited to Telecommunication Drawings.
- C. Refer to structural seismic requirement design documents specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.4 REFERENCES

- A. Abbreviations and Acronyms:

- 1. A/E: Architect / Engineer (designer)
- 2. BICSI: Building Industry Consulting Service International
- 3. EIA: Electronics Industry Alliance
- 4. ELFEXT Equal Level far End Cross Talk
- 5. FTP Foiled Twisted Pair
- 6. IDF: Intermediate Distribution Facility
- 7. ILEC/LEC: Incumbent Local Exchange Carrier
- 8. ISP: Inside Plant
- 9. IT: Information Technology
- 10. BDF: Building Distribution Frame

- 11. LOMMF: Laser Optimized Multi-Mode Fiber
- 12. MDF: Main Distribution Facility
- 13. MPOE: Minimum Point of Entry
- 14. NEXT: Near End Cross Talk
- 15. OSP: Outside Plant
- 16. PSELFEXT: Power Sum Equal Level Far End Cross Talk
- 17. PSNEXT: Power Sum Near End Cross Talk
- 18. RCDD: Registered Communications Distribution Designer
- 19. TBD: To Be Determined
- 20. TCIM: Telecommunication Cabling Installation Manual
- 21. TDMM: Telecommunications Distribution Methods Manual
- 22. TIA: Telecommunications Industry Association
- 23. UTP: Unshielded Twisted Pair
- 24. WAP: Wireless Access Point

1.5 APPLICABLE REGULATORY REFERENCES

- A. Contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:

- a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
- d. ANSI/TIA-568-D.0 (2016) Generic Telecommunications Cabling for Customer Premises
- e. ANSI/TIA-568-D.1 (2015) Commercial Building Telecommunications Cabling Standards
- f. TIA-568-D.1-2 (2015) Commercial Building Telecommunications Cabling Standard,
- g. ANSI/TIA-568-D.2 (2018) Balanced Twisted Pair Communications Cabling and Components Standards
- h. ANSI/TIA-568-D.3 (2018) Optical Fiber Cabling Components Standard
- i. ANSI/TIA-568-D.4 (2016) Broadband Coaxial Cabling Components Standard
- j. ANSI/TIA-942-B (2019) Telecommunications Infrastructure Standard for Data Centers
- k. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
- l. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
- m. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
- n. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises

- o. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
 - p. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
 - q. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
 - r. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
 - s. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
 - t. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
 - u. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
 - v. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
 - w. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.
2. ISO/IEC
- a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
 - b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. Electric Codes
- a. California Electrical Code, CEC (2016)
 - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
 - c. ANSI/IEEE C2-207, National Electrical Safety Code®
 - d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. 2016 California Title 24
- a. 2019 California Administrative Code, Title 24 Part 1
 - b. 2019 California Building Code, Title 24 Part 2
 - c. 2019 California Electrical Code, Title 24 Part 3
 - d. 2019 California Mechanical Code, Title 24 Part 4
 - e. 2019 California Plumbing Code, Title 24 Part 5
 - f. 2019 California Energy Code, Title 24 Part 6
 - g. 2019 California Fire Code, Title 24 Part 9
 - h. 2019 Green Building Standard Code, Title 24 part 11
 - i. 2019 California Standard Code, Title 24 Part 12
6. Local Codes and Standards – all applicable
7. Avixa (Infocomm)
8. BICSI
- a. Telecommunications Distribution Methods Manual, 13th Edition

- b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
 - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
 - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
 - e. Network Systems and Commissioning (NSC) reference, 1st Edition
 - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
 - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
 - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
 - i. AV Design Reference Manual, 1st Edition
 - j. Network Design Reference Manual, 7th Edition
 - k. Outside Plant Design Reference Manual, 5th Edition
 - l. Wireless Design Reference Manual, 3rd Edition
 - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
9. Anywhere cabling Standards conflict with electrical or safety Codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
 10. Knowledge and execution of applicable codes is the sole responsibility of the contractor.
 11. Any code violations committed at the time of installation shall be remedied at the contractor's expense.

1.6 SCOPE OF WORK

A. General project information:

1. These Specifications and associated drawings are the governing document for the installation of the telecommunications infrastructure and includes project descriptions, specified and recommended products, installation and project management methods, the scope of work and elevation drawing specifications.
2. Through this division specification document, University of California Riverside (UCR) will be referred to as the owner.
3. Owner wishes to contract with a General Contractor, who will sub-tier the supplier/contractor ("ICT-Information and Communication Technology) to provide, install, test and warranty a complete turn-key Infrastructure System for Owner's new Data Center Renovation, the "Project" per the scope of work and specifications stated herein. This inquiry implies no obligation on the part of Owner. Contractor shall bear all costs and expenses incurred in preparing a response a Request for Proposal ("RFP") and subsequent award of project, it being understood and agreed that Owner accepts no responsibility for any costs and/or expenses incurred by winning contractor in preparing and submitting such response.
4. The scope of work will include a complete re-cabling of fiber optic and copper backbone in the existing Data Center room along with the installation of Server racks and cabinets.

B. Purpose:

1. This specification defines quality standards and practices common to all network cabling for UCR project. In addition, said project will have Requests for Proposals (RFP), associated drawings and requirements pertaining to their specific environments. Such collateral will be referred to in this document as “Project Specific Documentation” or simply “Construction Documents”.
2. Voice and Data Networks encompass a broad spectrum of technologies and are distributed into project internal spaces. Installed cables will be used for Ethernet, high and low speed data applications, used in analog and digital voice, not to exclude other future Voice/Data technologies. This specification will include indoor/outdoor cable installations, and backbone cabling, telecommunications closet and equipment cabling, equipment hardware as well as routing and support infrastructure.
3. It is the responsibility of the installing contractor to evaluate these general recommendations and adapt them effectively to actual projects. Contractor is responsible for identifying and bringing to the attention of any design directions that may be in conflict or otherwise improved. All such conflict resolutions shall be in writing from A/E or owner.
4. Note that while many portions of this global specification are addressed to "The contractor", these requirements apply equally to anyone doing the network cabling and infrastructure work within, whether those persons are outside contractors or persons directly employed by the owner.
5. Contractor shall be solely responsible for all parts, labor, testing, documentation and all other associated processes and physical apparatus necessary to turn-over the completed system fully warranted and operational for acceptance by A/E.
6. This specification includes structured cabling design considerations, product specifications and installation guidelines for low-voltage network systems and associated infrastructure including, but not limited to:
 - a. Cabling Sub-system 1 – Horizontal
 - 1) Category 6 cable
 - 2) Work area (equipment outlet) appliances and configuration
 - 3) Horizontal Pathways
 - 4) Copper Patching
 - b. Backbone Cabling
 - 1) Interbuilding backbone – Copper and Fiber
 - 2) Patching / Cross-connect – Copper and Fiber
 - c. Telecommunications Spaces
 - 1) Telecommunications Room Requirements
 - 2) Racks and Cabinets
 - 3) Overhead Pathways
 - d. Communications Grounding Systems
 - e. Communications Labeling and Administration

C. Scheduling:

1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.
2. Project schedule shall include, but are not limited to, the following task sequence:
 - a. New Server Room, IDF Construction and buildout.
 - b. Conduit infrastructure; including vaults/pull box install and conduit duct banks.
 - c. Individual Building Pathway Installation.
 - d. Building Category and AV Cable installations; includes install, termination, labeling, testing, as-built and warranty documentation.
 - e. Audio Equipment installation.
 - f. New backbone fiber optic cabling installations; includes install, termination, labeling, testing, as-built and warranty documentation.
 - g. Service provider cabling and equipment installation.
 - h. Service provider completion and commissioning.

D. Coordination:

1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

1.7 CONTRACTOR QUALIFICATIONS

A. General:

1. Contractor shall have at least 5 years of experience installing and testing structured cabling systems.
2. Contractor shall employ at least one BICSI Registered Communication Distribution Designer (RCDD), and the RCDD shall sign-off on all designs offered, including stamping the design with their current BICSI/RCDD stamp.
3. Contractor shall have the responsibility to obtain any of the necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.
4. Contractor shall be a current manufacturer Certified Installer certificate. A copy of corporate certificate shall be included with quote.
5. Contractor shall have service facilities within 50 miles of project location.
6. At least 75 percent of the technicians on the job shall have a current manufacturer Certified Copper Technicians certificate to install manufacturer Copper Distribution Systems.
7. At least 75 percent of the technicians installing any Fiber Distribution Systems shall have a current manufacturer Certified Fiber Technicians certificate to install Fiber Distribution Systems.
8. The Telecommunications contractor shall provide a project manager to serve as the single point of contact to manage the installation, speak for the contractor and provide the following functions:

- a. Initiate and coordinate tasks with the Construction Manager and others as specified by the project schedule.
- b. Provide day to day direction and on-site supervision of Contractor personnel.
- c. Ensure conformance with all contract and warranty provisions.
- d. Participate in weekly site project meetings.
- e. This individual shall remain project manager for the duration of the project. The contractor may change Project Manager only with the written approval of A/E.

B. References:

1. Communications Contractor shall provide with bid a list of three reference accounts where similar Data, Voice, Fiber Optic Cable, and related migration/cutover equipment installation work was performed within the last year or twelve-month period.

C. Insurance Requirements:

1. Contractor shall be insured and shall provide with bid a Certificate of Indemnification, Certificate of Insurance, and meet all required insurance and licensing policies as specified by A/E Risk Management Division and any Federal, State, and local organization pertaining to data, voice and fiber optic cable installation.
2. Contractor's vehicles brought onto project properties, shall comply with all requirements of all Federal, State, and local agencies. Vehicles shall meet current DOT, state and local, safety inspections where required.

D. Termination of Services:

1. Owner or A/E reserves the right to terminate the Communication Contractor's services if at any time the A/E determines the Communication Contractor is not fulfilling their responsibilities as defined within this document.
2. Contractor's appearance and work ethics shall be of a professional manner, dress shall be commensurate with work being performed.
3. Dress displaying lewd or controversial innuendos shall strictly be prohibited.
4. Conduct on project property shall be professional in nature.
5. Any person in the Contractor's employ working on a project considered by to be incompetent or disorderly, or for any other reason unsatisfactory or undesirable, such person shall be removed from work on the project.
6. The Communications Contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.

E. Other Contractor Responsibilities

1. Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job. All work areas shall be cleaned at the conclusion of the workday and no tools or materials shall be left in a manner as to pose a safety hazard.
2. Contractor shall remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. This is mandatory; Contractors shall consider this when placing bids.
3. Contractor shall abide by the regulations set by A/E or Owner Security Department pertaining to access to and conduct while on project property and shall obey speed limits and parking regulations.

1.8 SYSTEM PERFORMANCE WARRANTY

A. General

1. Contractor shall provide a manufacturer System Warranty on all copper and fiber permanent cabling links.
2. This is a system performance warranty guaranteeing for a minimum of 20 years from acceptance that the installed system shall support all data link protocols for which that copper Category or fiber OS designation is engineered to support according to IEEE and TIA standards.
3. The manufacturer System Warranty may be invoked only if the cabling channel links are comprised of manufacturer connectivity and approved by the manufacturer. Patch cords shall be same manufacturer of cable.
4. Upon acceptance of Warranty, manufacturer will mail a notification letter to the installer and a notification letter and warranty certificate to A/E.

B. Contractor Warranty Obligations

1. Installation firm shall be a current manufacturer Certified Installer in good standing and shall include a copy of the company certification with the bid.
2. Contractor shall name a supervisor to serve on site as a liaison responsible to inspect and assure all terminations are compliant to factory methods taught in manufacturer Technician Certification Training and according to all Standards cited in the Regulatory References section of this document.
3. Contractor liaison shall have a current, up-to-date manufacturer Certified Technician certificate in both copper and fiber. Copies of the copper and fiber certificates of the manufacturer liaison shall be submitted with the bid.
4. Contractor agrees all components comprising active links shall be of the same copper Category or fiber OS/OM designation as the system being installed. Contractor shall under no circumstances mix different Categories or OS/OM classes of cable or termination devices (connectors) within the same link or system.
5. Contractor shall install all racking and support structures according to cited TIA Standards in such fashion as to maintain both Standards and Manufacturer recommendations for uniform support and protection, segregation of different cable types, maintenance of maximum pulling tensions, minimum bend radius, approved termination methods as well as adhering to industry accepted practices of good workmanship.
6. Contractor is responsible for understanding and submitting to manufacturer all documents required prior to project start to apply for this warranty. These include but are not limited to the project information form and SCS warranty agreement.
7. Contractor is responsible for understanding and submitting to manufacturer all documents required at project end. These include completed warranty forms, passing test reports and drawings of floor plans showing locations of links tested.
8. Test results shall be delivered in the tester native format (not Excel) and represent the full test report. Summaries shall not be accepted. Contact manufacturer for a current list of approved testers, test leads and latest operating systems.
9. The Communications Contractor shall correct any problems and malfunctions that are warranty-related issues without additional charge for the entire warranty period. The warranty period shall commence following the acceptance of the project by A/E and written confirmation of Warranty from manufacturer.

1.9 SAFETY

A. General

1. All cabling work being performed on project property or under contract to shall comply with Rules for safe operations, any state or local safety regulations and meet the requirements of OSHA Safety and Health Standards. The contractor Project Manager shall maintain a copy of Rules for Safe Operations for reference. It is the responsibility of the Communications Contractor to immediately correct any unsafe working practices on the part of contractor personnel. Unsafe working environments or conditions created by contractor personnel shall be reported immediately to the Construction Manager.
2. Any liability for correction of conditions created by the contractor's personnel rests with the contractor.
3. The Communications Contractor shall be solely and completely responsible for conditions of the job site (as pertaining to the materials and equipment specified), including safety of persons and property during performance of work.
4. No act, service, drawing review or construction observance by any employee, representative or engineer may be construed as a review or approval of the adequacy of the contractor(s) safety measures, in, on, or near the construction site.

1.10 WORKING CONDITIONS

A. Site Access

1. All cable installations shall be pre-approved by the Construction Manager to ensure that the necessary arrangements have been made for proper access to project sites.
2. A twenty-four-hour prior notice shall be submitted to the Construction Manager for any work schedule changes.
3. Communications Contractor shall display badges or passes as mandated by project property Security Department Rules and Regulations.

B. Scheduling

1. Coordination of site surveys and the issue of project owner owned materials and equipment shall be the responsibility of the Construction Manager. Once said equipment and materials are in the contractor's possession, it is the contractors to safeguard the material and equipment from damage or theft.
2. Information required by the Contractor to price and complete a defined scope of work shall be furnished to the Communications Contractor by the A/E Project Manager in a Scope of Work document and at the time of the site survey (if necessary) and shall be maintained by the Communications Contractor until the completion of the job.
3. It is the contractor's responsibility to begin work promptly according to the Start Dates and to complete work by the Proposed Completion Date listed on the Cable Run Request Form.
4. The Contractor shall notify the Construction Manager in writing of any delays; at that time, they shall come up with a mutually agreeable project schedule.
5. The Communications Contractor shall coordinate with the Construction Manager working hours and job site access issues.
6. The Communications Contractor shall coordinate with the Construction Manager to minimize outages to the existing systems.

7. Any service interruption required by the Communications Contractor shall be requested in writing and scheduled with the Construction Manager.
8. The Communications Contractor shall not proceed with the requested service interruption until written approval is granted by the Construction Manager.
9. All problems, and questions relating to a particular job, shall be referred to the Construction Manager and no changes shall be made without his/her written approval.

C. Harmony Clause

1. Contractor shall coordinate and work in harmony with other trades on the project as well as with A/E personnel.

1.11 COORDINATION

A. Coordinate layout and installation of voice, data, and video communication cabling with other owner contractors and equipment suppliers.

1. Meet jointly with other contractors, equipment suppliers, and owner representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connect and patch panels in equipment rooms and telecommunications rooms to accommodate and optimize arrangement and space requirements of voice and LAN equipment.
4. When indicated on drawings, contractor shall reuse existing copper and fiber optic backbone cables.
5. Provide weekly progress reports and crew schedules to project representatives by 5:00 PM, Thursday of each project work week.

1.12 ACTION SUBMITTALS

A. Product Data: For each product indicated.

1. Submit all product data in accordance with general requirements of the construction documents.
2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Contractor shall provide product data and installation instructions for all fire stopping materials
4. Alternate and "Or Equal" designated products shall be submitted for review and judgment to the A/E prior to installation. The contractor proposed alternate products or components shall be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
5. Any request of an alternate or substitution shall be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.13 Information & Communication Technology (ICT) components

- A. The Contract Documents generally outline industry standard components to be installed as part of the project ICT installation requirements. Such identification is intended to be general in nature rather than exhaustive. All stated quantities are subject to validation by ICT contractor. ICT Contractor is reminded that differences between estimated quantities and those reasonably derived based from the Contract Documents (as well as through bid conferences, job walks, addendums, and other distribution of information) shall be the responsibility of the ICT contractor. There shall be no additional cost incurred by UCR project for not complying with the specifications and requirements of the Contract Documents.
- B. Any variance from those components identified on the drawings and/or below shall be submitted to UCR project representatives for approval prior to ordering and installation; the risk for all costs incurred by the ICT Contractor for materials ordered prior to such written approval shall be borne entirely by the ICT contractor. Nonetheless, it is imperative that the ICT Contractor determine the availability of necessary materials and propose equivalent substitutes as necessary to meet all installation milestones. Delays in ICT installations due to lack of product availability are unacceptable. As catalog numbers change frequently, the ICT Contractor shall verify all part numbers prior to ordering materials. Clarifications shall be issued in response to written Requests for Information (RFI).
- C. Fire Stop and firestopping requirements for the project include:
1. All conduits leaving the entrance room for other portions of the building shall be fire-stopped after the installation of cable.
 2. The Contractor shall fire stop around the tray and, after installation of the cables, within the tray using removable pillow-style products following manufacturers' guidelines. Sound deadening material shall be provided and installed after installation of cable.
 3. Strict adherence to the CEC/NEC NFPA 101 is required for any raceway penetrations of fire-rated walls. See section 07840 for UL system numbers and to construction drawings for details.
 4. All riser conduits shall be sealed using a UL classified fire stop. The Contractor shall provide a copy of the fire seal manufacturer's installation instructions and rating information prior to inspection of the installed materials.
 5. Integrally Fire Stopped Sleeves
 - a. Integrally Fire Stopped Sleeves shall be used for Telecommunications cabling in locations where the cabling pathway penetrates a fire barrier. The IFSS shall replace the use of conduit used in conjunction with other fire stopping methods.
 - b. All manufacture instructions and requirements shall be followed for the installation of the IFSS.
 - c. Documentation shall include picture of completed assemble with time/date stamp.
- D. All new fiber optic cabling, shall be indoor/outdoor-Plenum rated. Unrated cable (such as filled ASP) shall not be installed within the structure except when placed within IMT, PVC or RGS conduit.
- E. Throughout this specification, Belden, Superior Essex, Chatsworth Products, Inc. and other manufacturers are cited. These citations are for the purpose of establishing quality, performance and warranty certification criteria.

1.14 DELIVERY AND STORAGE

- A. ICT Contractor shall provide a materials schedule prior to the start date of cable installation. Material schedule shall specify all material quantities and their delivery date for this project.
- B. ICT Contractor shall provide protection from weather, moisture, dirt, dust and other contaminants for telecommunications cabling and pathway equipment placed in storage.

1.15 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
- 4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:

- 1. Submit management and installation team reference documentation verifying:
 - a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
 - b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents.

C. Qualification Statements:

- 1. The contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.16 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
 - a. The drawing notes shall define field conditions experienced not defined in sheet notes.

- b. The drawings shall identify all fire stop locations and digital picture shall accompany as-built package.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference.
3. Communication contractor to print, frame and mount approved as-built drawings in MPOE. Coordinate location with A/E.

1.17 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.
2. Installers shall have manufacturer certificate of completion for the fire stop solution being proposed.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.
- B. Methodology for fire stop requirements that contractor shall comply with, include:
 1. In any area in which a fire rated wall, partition, floor, or ceiling is penetrated, the Contractor shall be responsible for creating the pathway and sealing around all cables and sleeves with a UL classified fire seal sufficient to return the structure to its original rating. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor. Any opening in a rated structure created by the Contractor that is larger than one inch in diameter shall be equipped with a metal sleeve secured and fire-stopped in place.
 2. Comply with requirements in Section 078413 "Penetration Firestopping."(Check Architect specifications for fire stopping)
 3. Comply with TIA-569-B, Annex A, "Firestopping."

4. Comply with BICSI TDMM, "Firestopping Systems" Article.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall, so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 4 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

3.2 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.3 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION 270500

SECTION 270526 - GROUNDING BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Specifications for grounding and bonding components utilized to provide proper grounding and bonding for telecommunications cabinets, racks, cable tray, ladder tray, cable and equipment.
2. Grounding and bonding components with design criteria.

1.2 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.3 CLOSEOUT SUBMITTALS

A. As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.4 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide manufacturer or comparable product by one of the following:
1. CPI
 2. B-Line
 3. Circa
 4. Or Equal
- B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each component selected shall address the infrastructure requirement.
- C. Description:
1. Sub-contractor is responsible for bonding to ground all newly placed equipment and installed racks or cabinets per the TIA 607-B Standard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.2 INSTALLATION

- A. Process:
1. All newly installed racks and cabinets shall have installed a vertical busbar mounted along one equipment rail to serve as a clean, low-resistance bonding place for any equipment not equipped with a designated grounding pad.
 2. Smaller equipment without an integrated grounding pad shall be bonded to the vertical busbar using a thread-forming grounding screw that is anodized green and includes serrations under the head to cut through oxidation or paint on the equipment flange.
 3. Larger equipment (chassis switches) with a designated grounding terminal shall be bonded to the vertical busbar with and EBC (equipment bonding conductor) kit built to that purpose.
 4. All grounding wire shall be a minimum #6 AWG stranded annealed ground wire, PVC sheathed with nylon. Meets UL83 for THHN or THWN and UL1063.
 5. All OSP cabling terminated with-in new campus MDF shall be terminated to a Building Entrance Terminal with gas fuses.

6. Sub-contractor shall take care to clean (wire brush, scotchbrite pads) any metallic surface to be bonded down to bare metal and apply a film of anti-oxidation paste to the surfaces prior to effecting the bond.
7. All bonding lugs on racks and busbars shall be of two-hole irreversible compression type. Mechanical lugs and single-hole lugs will not be accepted and shall be removed and replaced at Sub-contractor's expense.
8. Every rack or cabinet shall have an individual bonding conductor into the grounding network. Serially connecting (daisy-chaining) of racks is expressly forbidden and will not be accepted.
9. Rack Bonding Conductors (RBC) may tap into an overhead or underfloor aisle ground, or may run to the wall-mounted grounding busbar in smaller Telecommunications rooms containing 5 racks or less.
10. Armored cables shall be properly bonded to the earthing system with a kit built to that purpose.
11. All metallic conduit stub-ups shall be grounded, and where multiple stub-ups are made within an equipment enclosure, they shall be equipped with grounding bushings and bonded together and to the enclosure and the enclosure ground bus.
12. Each metallic raceway, pipe, duct and other metal object entering the buildings shall be bonded together. The Sub-contractor shall use #6 AWG green insulated copper conductors.
13. Each identified telecommunications space within a building shall have a common signal reference ground. The signal reference ground shall conform to the following:
 - a. Within the building, all communication spaces shall be separately bonded to each other and connected to the primary building ground in accordance with the provisions of EIA/TIA 607. The communication ground shall not ground any other equipment or be connected to any potential high voltage source. All racks, frames, drain wires, and all installed communication equipment shall only be grounded to this common reference ground with a minimum size #6 AWG green insulated copper wire.
 - b. The Sub-contractor shall provide, as a minimum, a continuous #3/0 AWG copper electrical conductor connected to a 1/4" x 4" x 12" telecommunications grounding bus bar (TGB) 6" AFF on the plywood backboard of each IDF (or telecommunication space) to terminate chassis and other equipment grounds.
 - c. The ground wires from each individual IDF shall be routed directly to the Building Distribution Frame (BDF), terminated and bonded together via a telecommunications main grounding bus bar (TMGB) of minimum 1/4" x 4" x 20" dimensions. This point of single reference for all closets in a building shall in turn be grounded with a minimum #3/0 AWG ground conductor to the main building ground. If a main building ground is unavailable, the ground wire from the BDF shall be grounded to the nearest electrical panel ground bus bar. The building ground for signal reference shall be the building service entrance ground.
14. Ground Bus Bar Identification.
 - a. The master ground bar shall be labeled as such.
 - b. Each subsidiary ground bar shall be labeled as such and have a unique identifier.
 - c. All ground bars shall have a warning label that states, "If this connector or cable is loose or shall be removed, please call the Telecommunications Manager." All

ground bars will be connected to the building ground with continuous “3/0” AWG wire.

- d. Each ground cable shall be labeled with a unique identifier.

3.3 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.4 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION 270526

SECTION 270529 - HANGER AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provides specifications for non-continuous cable support components utilized to provide pathways support to telecommunications cables traveling outside cable trays, conduits, or other continuous cable supports.
2. Non-continuous cable supports.

1.2 RELATED DOCUMENTS

A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
2. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
3. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.3 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

1.4 WARRANTY

A. Warranty:

1. Sub-contractor shall provide a 25 year System Warranty on all copper and fiber permanent cabling links.
2. This is a system performance warranty guaranteeing for 25 years from acceptance that the installed system shall support all data link protocols for which that copper Category or fiber OM/OS designation is engineered to support according to IEEE and TIA standards.
3. The System Warranty may be invoked only if the cabling channel links are comprised of approved cable infrastructure connectivity and approved cable. Patch cords must be manufactured by same approved cable and/or connectivity system.
4. Upon acceptance of Warranty, manufacturer will mail a notification letter to the installer and a notification letter and warranty certificate to A/E.

PART 2 - PRODUCTS

2.1 NON-CONTINUOUS CABLE SUPPORTS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Erico – Caddy CableCat Support System
2. Copper/BLine – Cable Hook System
3. CEAS Attachments – Stiffy Series
4. Panduit – Jmod Cable Support System
5. Or Equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirement.
 - a. Stiffy Series 200 with comfort cradle Low Voltage supports
 - b. Four inch (0'4") Cat214z34, two inch (0'2") J-Hook Supports Cat324z34

C. Description:

1. Non-continuous cable supports shall be available in multiple sizes, styles and materials. Rigid supports shall be equipped with flared edges and pre-configured bend radius controls.
2. Provide drop wire supports and threaded rod assemblies in areas where structural mounting surfaces are non-functional or inaccessible.
3. Support assemblies shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance UTP and optical fiber cables.
4. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be reusable.
5. Select approved non-continuous cable supports suitable for specific installation environments and/or air handling (plenum) spaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.2 INSTALLATION

- A. Process:

1. Follow manufacturer's instructions and recommended industry standards and guidelines.
2. The installed non-continuous support system must be an independent support structure for the voice/data communication system.
3. Draping cables over other structures in the ceiling is unacceptable. Water pipes, ceiling grid, sprinkler system, electrical supports, air ducts or any other in-ceiling structure may not be used for cable support.
4. Sub-contractor installed supports shall be used to supplement the main cable support system when any cabling leaves the main support system or is unsupported for more than three and one half feet (3'-5'-0") feet.
5. Non-continuous supports shall be installed with rod stock or threaded rod secured to the slab above to support the telecommunications cable infrastructure parallel to the slab throughout the cable plant, unless site conditions dictate a non-parallel installation.
6. Cable must be routed to follow existing corridors and parallel or 90 degree angles from all walls and the cable tray whenever possible.
7. Communication EMT conduit sleeves shall receive conduit waterfall to control bend radius of the communication cable to a minimum of a 4" radius.
8. All pathways shall avoid electromagnetic interference (EMI). Cable that is distributed in partially-enclosed metallic pathways shall be routed with the following minimum clearances:
 - a. Four (4) feet from motors or transformers.
 - b. One (1) foot from conduit and cables used for electrical power and distribution.
 - c. Five (5) inches from fluorescent lighting.

3.3 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.4 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION 270528

SECTION 270533 - CONDUITS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provides specifications for conduit pathways, back boxes and pull box enclosures utilized for the distribution and housing of telecommunications cabling and components:
2. Telecom EMT conduit and boxes

1.2 RELATED DOCUMENTS

- A.** Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B.** All divisions of the specification and general provisions of the Construction Documents.
- C.** Architectural, mechanical, electrical, and all technology drawings.
- D.** Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

PART 2 - PRODUCTS

2.1 CONDUIT AND BACKBOXES

A. EMT conduit

1. Wheatland Tube
2. Appleton
3. Crouse-Hinds
4. Or equal.

B. PVC conduit

1. JM Eagle
2. Electro Flex
3. Or equal

C. Pull boxes

1. Hoffman Engineering Co,
2. Or equal.

D. Back Boxes

1. Thomas & Betts
2. Hubbell Raco

2.2 TELECOMMUNICATIONS CONDUIT AND BACKBOXES

- A. Electrical Metallic Galvanized Tubing and Fittings with natural finish for all conduits not exposed: ANSI C80.3 with compression-type fittings.
- B. Communication EMT conduit sleeves shall receive conduit waterfall to control bend radius of the communication cable to a minimum of a 4" radius.
- C. Indoor Pull boxes: Galvanized steel, screw cover pull box. Grey polyester powder coat finish inside and out. NEMA Type 1. Pull boxes to be sized per NEC code to accommodate the number of EMT conduits as shown on Telecom drawings with adequate clearances, access and cable management space.
- D. Supporting devices: U channel trapeze assemblies, 1/2" Threaded rods, clamps, conduit straps, C-clamps and retainers.
- E. Fasteners: 3/8" Carbon steel expansion anchors with 2 1/2" embed into concrete slab for pull box U-channel support attachment to concrete slab. The anchors must be tested and approved under dual load conditions: Hilti Kwikbolt 3, Ramset/Redhead Trubolt. Or equal.
- F. U-channel systems: 16 gauge steel channels. Provide fittings and accessories that match with the U-channel of the same manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.2 INSTALLATION

- A. Pull boxes:
 1. Install Pull boxes in easily accessible locations.
 2. Install Horizontal cabling boxes immediately above suspended ceilings.
 3. A pull box should not be used in lieu of a bend.
 4. Conduits that enter the pull box from opposite ends with each other should be aligned.

Conduit Trade Size (in.)	Pull box Width (in.)	Pull box Length (in.)	Pull box Depth (in.)	Pull box Width Increase for Additional Conduit
1	4	16	3	2
1 1/4	6	20	3	3
1 1/2	8	27	4	4
2	8	36	4	5
2 1/2	10	42	5	6
3	12	48	5	6
3 1/2	12	54	6	6
4	15	60	8	8

5. For direct access to a box located above

inaccessible ceilings provide a suitable, marked, hinged access panel (or equivalent) in the ceiling. This access panel can also serve as the cover for the box.

6. Install conduit radius waterfall for all EMT conduit sleeves entering telecommunication room or through main pathway fire rated walls, quantity as shown on drawings.
7. Pull box sizing table:

B. Back Boxes

1. Provide 4-11/16" H X 4-11/16" W X 2-1/8" D outlet back boxes at all telecom outlet locations shown on drawings. Provide (1) 1-1/4" conduit from back box to telecom room or pull box except as otherwise noted. All connectors and couplings shall be zinc-plated steel set screw type. Die cast zinc fittings are not to be used. Provide bushing on ends of all conduits. Provide pull string in all conduits.
2. Provide single gang plaster ring on all communications outlet back boxes, unless indicated otherwise.
3. Provide bonding to cable tray pathways.

C. Conduit support and bracing:

1. Coordinate layout and installation of conduits and pull boxes with other trade conditions to ensure adequate clearances, access and cable management.
2. Install and provide support for EMT conduits and pull boxes in accordance with the latest edition of the NEC code, as well as all state and local codes and requirements. Coordinate installation and location with existing conditions. Notify and get the Owners Representative approval before installing conduits and pull boxes where the location need to deviate from the contract documents.
3. Install conduits above ceilings at height to provide access to pull. Install conduits and pull boxes level and square and at proper elevations. Ensure adequate clearances, access and cable management.
4. Use fittings and support devices compatible with conduits and pull boxes and suitable for use and location. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four.
5. Install individual and multiple trapeze hangers and riser clamps as necessary to support the conduits. Provide U-bolts, clamp attachments and other necessary hardware for hanger assemblies and for securing hanger rods and conduits. Space supports for conduits on maximum 10-foot centers.
6. Provide and install expansion or deflection fittings for conduits runs at all instances at seismic or expansion joints to allow for movement in any direction.

D. Conduit routing, bends and radius guidelines:

1. If the conduit has an internal diameter of 2 inches or less the bend radius must be at least 6 times the internal conduit diameter.
2. If the conduit has an internal diameter of more than 2 inches the bend radius must be at least 10 times the internal conduit diameter.
3. Conduit bends should be smooth, even, and free of kinks or other discontinuities that may have detrimental effects on pulling tension or cable integrity during or after installation.
4. If a conduit run requires more than two 90-degree bends then provide a pull box between sections with two bends or less.
5. If a conduit run requires a reverse bend (between 100 degrees and 180 degrees) then insert a pull point or pull box at each bend having an angle from 100 degrees to 180 degrees.
6. Consider an offset as equivalent to a 90-degree bend.
7. A pullbox shall not be used as a 90-degree bend.
8. Communication EMT conduit sleeves shall receive conduit waterfall to control bend radius of the communication cable to a minimum of a 4" radius.
9. Achieve the best direct route with no bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.
10. Contain no continuous sections longer than 100 ft.
11. For runs that total more than 100 ft. in length, pull points or pull boxes should be inserted so that no segment between points/boxes exceeds the 100 ft. limit.
12. Withstand the environment to which they will be exposed.
13. Conduits should not be routed through areas in which flammable material may be stored or over or adjacent to boilers, incinerators, hot-water lines and steam lines.
14. Keep conduits at least 6' away from parallel runs of steam, hot water pipes or mechanical ductwork.

E. Conduit Terminations

1. Join conduits with fittings designed and approved for the purpose. Make the joints tight without protruding lips that can snag cable pulling inside the conduits.
2. Where conduits are terminated with locknuts and bushings align the conduit to enter squarely and install the locknuts with dished part against the box. Use two locknuts, one inside and one outside the box.
3. Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.
4. Conduits that enter a telecom room should terminate near the corners to allow for proper cable racking.
5. Terminate conduits that protrude through the structural floor 3 inches above the surface.
6. Maintain the integrity of all fire stop barriers for all floor or wall penetrations.

F. Provide grounding and bonding for conduits and pull boxes as indicated by NEC code and instructed by manufacturer.

G. Conduits shall be clearly labeled at both ends designating the opposite locations(s) served. The numbering scheme shall be room number plus a suffix to guarantee uniqueness, e.g., 143-1. Labeling must be machine generated.

H. Conduit Protection:

1. Remove burrs, dirt and construction debris from conduits and pull boxes.
2. Conduits should be left capped for protection.
3. Provide final protection and maintain conditions in a manner acceptable to the Owners Representative to ensure that coatings, finishes and pull boxes are without damage or deterioration at completion. Repair damage to galvanized finishes with zinc-rich paint recommended by the manufacturer.

3.3 ACCEPTANCE

- A. All specified conduits and pull boxes indicated on the drawings and specifications shall be complete.
- B. Specified shop drawings and product submittals shall have been submitted for review and all review comments and deficiencies shall have been resolved. Final shop drawings and product submittals shall have been submitted, reviewed and found to meet the requirements of the specifications.
- C. Issues and deficiencies identified in field reports and punch lists shall have been resolved. Final as-built drawings shall have been submitted, reviewed and found to meet the requirements of the specifications.
- D. Sub-contractor shall provide written notice of final completion of the telecom infrastructure. Upon receipt, the Owner's Representative will review/observe the completed installation. Once the Owner's Representative is satisfied that all work is in accordance with the Contract Documents, the Sub-contractor will be notified in writing.

3.4 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work
- B. CLOSEOUT ACTIVITIES
- C. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- D. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION 270533

SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wire-basket cable trays.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cable tray.
 - 1. Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
 - 1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings. Drawings to match same scale as approved design or construction drawing set.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
 - 2. Vertical and horizontal offsets and transitions.
 - 3. Clearances for access above and to side of cable trays.
 - 4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.

- B. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.5.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in 2016 CEC Article 392 and marked for intended location, application, and bonding per Article 800.100/A/1-6.
 - 1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Sizes and Configurations: See drawings for specific requirements for types, materials, sizes, and configurations.
- C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
 - 1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
 - 2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
 - 3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.3 WIRE-BASKET CABLE TRAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cablofil/Legrand.
 2. Cooper B-Line, Inc.
 3. Snake-tray.
 4. Chatsworth Products Inc.
- B. Description:
1. Configuration: Wires are formed into a standard 2-by-4-inch wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
 2. Materials: High-strength-steel longitudinal wires with no bends.
 3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
 4. Sizes:
 - a. Straight sections shall be furnished in standard 10 feet lengths.
 - b. Wire-Basket Depth: 2-inch usable loading depth by 4 inches to 24 inches wide.
 - c. Wire-Basket Depth: 4-inch usable loading depth by 4 inches to 24 inches wide.
 - d. Wire-Basket Depth: 6-inch usable loading depth by 8 inches to 24 inches wide.
 5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
 6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
 7. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.

2.4 MATERIALS AND FINISHES

- A. Steel:
1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1008/A 1008M, Grade 33, Type 2.
 2. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
 3. Finish: Mill galvanized before fabrication.
 - a. Standard: Comply with ASTM A 653SS/A 653M, G90.
 - b. Hardware: Chromium-zinc plated, ASTM F 1136.
 4. Finish: Electrogalvanized before fabrication.

- a. Standard: Comply with ASTM B 633SS.
 - b. Hardware: Galvanized, ASTM B 633SS.
5. Finish: Hot-dip galvanized after fabrication.
- a. Standard: Comply with ASTM A 123/A 123M, Class B2/ASTM A1008, Grade 33, Type 2.
 - b. Hardware: Chromium-zinc plated, ASTM F 1136.
6. Finish: Powder-coat enamel paint.
- a. Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.
 - b. Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
 - c. Epoxy-Resin Topcoat: Epoxy, cold-cured, gloss, MPI# 77.
 - d. Hardware: Chromium-zinc plated, ASTM F 1136.
7. Finish: Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware according to ASTM F 1136.
8. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.

B. Aluminum:

1. Materials: Alloy 6063-T6 according to ANSI H 35.1/H 35.1M for extruded components and Alloy 6061-T6 according to ANSI H 35.1/H 35.1M for fabricated parts.
2. Hardware: Chromium-zinc-plated steel, ASTM F 1136.

2.5 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.6 WARNING SIGNS

- A. Lettering: 1-1/2-inch high, black letters on yellow background with legend "Warning! Not to Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
- B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA VE 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Remove burrs and sharp edges from cable trays.
- E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.
- F. Fasten cable tray supports to building structure and install seismic restraints.
- G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems." Comply with seismic-restraint details according to Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- J. Support bus assembly to prevent twisting from eccentric loading.
- K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.
- M. Support wire-basket cable trays with center support hangers, trapeze hangers, or wall brackets as noted on construction drawings.

- N. Support center support hangers and trapeze hangers for wire-basket trays with 3/8-inch- diameter rods.
- O. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- P. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.
- Q. Make changes in direction and elevation using manufacturer's recommended fittings.
- R. Make cable tray connections using manufacturer's recommended fittings.
- S. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."
- T. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- U. Install cable trays with enough workspace to permit access for installing cables.
- V. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
- W. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.
- X. Clamp covers on cable trays installed outdoors with heavy-duty clamps.
- Y. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in ANSI/NECA/BICSI-607, ITSM-2017, and Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Cable trays with control conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

- E. Bond cable trays to power source for cables contained within with bonding conductors sized according to ANSI/NECA/BICSI-607, ITSM-2017, and Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. Fasten cables on vertical runs to cable trays every 18 inches.
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.
- E. Tie MI cables down every 36 inches where required to provide a 2-hour fire rating and every 72 inches elsewhere.
- F. In existing construction, remove inactive or dead cables from cable trays.

3.4 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
 - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
 - 4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.

5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorqued in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 270536

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARYS

A. Section Includes:

1. Provides specifications information for identification of the various components of the telecommunications infrastructure and pathway system.
2. Labeling and identification.

1.2 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.3 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:
3. Communication sub-contractor to print, frame and mount approved as-built drawings in MPOE. Coordinate location with A/E.

1.4 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected

telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.1 IDENTIFICATION LABELS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Panduit – Thermal Transfer
2. Brady Label System
3. Brother Label System
4. Or Equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each component selected shall address the infrastructure requirements.

C. Description:

1. In new installations (Greenfield), Sub-contractor shall develop and submit for approval a labeling strategy based on the TIA 606-B Circuit Designation and Labeling Standard.
2. All labels shall be machine-manufactured by a labeling machine. Handwritten labels will not be accepted for final labeling.
3. The intention of the labeling scheme is to be TIA/EIA 606-B compliant.
4. It is the responsibility of the sub-contractor to acquire, understand, and utilize the owner's labeling scheme for all component of the voice data communications system.
5. It is the responsibility of the sub-contractor to provide labels sized to show the Owner's labeling scheme in readable font size while still matching the specified hardware identification dimensions.
6. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

D. Indoor Copper and Fiber optic cables and grounding conductors:

1. The cable sheaths shall be labeled with laser-printed polyester self-laminating wrap around labels sized to fit the Owner's labeling scheme in readable font size.

E. Horizontal cable outlet housings and faceplates:

1. Cable termination connectors at each position on the outlet housing shall be labeled with laser-printed polyester labels inserted into the outlet housing labeling window.

F. Copper patch panels:

1. The patch panels shall be labeled on the front and rear top left corner with a laser- printed polyester self-laminating label sequentially identifying the patch panel.

G. Copper patch termination blocks:

1. The termination blocks shall be labeled on the front rows with the termination block designation strip colored per the BICSI requirements identifying the copper cable pairs.

H. Fiber optic termination panels and housings:

1. The panels and housings shall be labeled on the outside front and rear top left corner with a laser-printed polyester self-laminating label sequentially identifying the panel.
2. Cable termination identifier and fiber positions inside the termination panels shall be made using the manufacturer's provided label card behind the plastic panel.

I. Equipment racks:

1. Bakelite plastic label engraved with rack label scheme attached to front and rear facing top angle bracket.
2. Label shall be adhesive backed for secure placement. Optional mounting with self-tapping screws will be at the discretion of owner.

J. Equipment cabinets:

1. Bakelite plastic label engraved with cabinet label scheme attached to top front and rear facing frame of cabinet.
2. Label shall be adhesive backed for secure placement. Optional mounting with self-tapping screws will be at the discretion of owner.

K. Indoor Conduits and pullboxes:

1. Each section of conduit shall be labeled on the outside facing and unobstructed view with a laser-printed polyester self-laminating label sequentially identifying the conduit and its origin and termination end (to and from).
2. Each pullbox shall be labeled on the outside door panel facing and unobstructed view with a laser-printed polyester self-laminating label sequentially identifying the pullbox and building location.

PART 3 - EXECUTION EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section

3.2 INSTALLATION

A. Process:

1. The Owner-provided labeling scheme is intended to comply with TIA/EIA 606-B standard for labeling and administration of a cable plant. It is the responsibility of the sub-contractor to acquire, understand, and utilize the owner's labeling scheme for all component of the voice data communications system including, but not limited to:

2. Indoor Horizontal copper and fiber optic cables (Identify at both ends within 6-inches of termination).
3. Indoor copper and fiber optic backbone cables (Identify at both ends within 12-inches of the point that the cable enters termination panels/blocks, within 12- of the point that the cable enters or exits pullboxes, wall and floor sleeves.
4. Workstation outlets, faceplates and individual outlet connectors.
5. Termination panels.
6. Termination blocks.
7. Racks, cabinets, and equipment enclosures. (front and rear).
8. Indoor conduit pathways and pullboxes.
9. Grounding conductors and ground bars.
10. Label each component with a specified label at an unobstructed view location and where it is accessible for administration.

3.3 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

3.4 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION 270553

SECTION 271116 - CABINETS, RACKS, ENCLOSURES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provides specifications for network cabinets, racks, and telecommunications enclosure components utilized to house various telecommunications infrastructure components and systems equipment.
2. Equipment Racks

1.2 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.3 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.4 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.1 CABINETS, RACKS, ENCLOSURES

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Middle Atlantic
 - a. SNE Series SNE24D-4542-P1

B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:

1. New cabinet and cabinet components shall be black in color. Finish shall be powder coat.
2. Network equipment will mount on to a network equipment suited cabinet 45u or 40u rack units tall, 24 Wide, and 42” and/or 32” deep.
3. Floor mounted racks shall be permanently attached, per structural engineer or manufacturer requirements, to the floor using lag bolt and lag shields for masonry type floors or appropriate fastening hardware for other types of flooring as approved by the owner. Racks installed adjacent to each other will be fastened together using proper bolt, nut, and washer combinations.
4. Rated load for equipment cabinets shall be no less than 2000 pounds.
5. Ladder rack shall be fastened using the proper hanging and connecting hardware, secured in a manner consistent with recommended weight load spacing recommendations.
6. Patch panels, wire cable management hardware, and other related passive equipment will be attached to racks and mounting rails with at least two screws per mounting bracket and located in accordance with the Rack/Cabinet Equipment Elevation Form contained in project documentation on a per job basis.
7. All equipment shall be free from imperfections and defects.
8. All cabinets and racks shall be grounded and bonded to specification of BICSI, Telecommunications Methods Manual and ANSI/NECA/BICSI 607 (2011) Bonding and Grounding Standard or BICSI-ITSM (2015). See grounding section in this document for details.
9. Active equipment shall be positioned in racks and cabinets to work in accordance of the “hot aisle/cold aisle” configuration of that room.
10. Equipment with intake/exhaust patterns other than front-to-back should be remediated with appropriate passive ducts to correct airflow to front-to-back pattern wherever possible.
11. Any rack/cabinet spaces not used should be filled with blank panels to minimize rogue backflow of air within the facility.
12. All racks and cabinets shall have a minimum of 3 feet clearance in the front, with 4 feet being preferable for the movement and installation of equipment. Some equipment may require more clearance. See project documentation or equipment manufacturer’s guidelines for details.
13. All racks and cabinets shall have a minimum of 2 feet clearance in the rear, with 3 feet being preferable for the movement and installation of equipment.

14. Each cabinet enclosure shall have a rectangular frame with removable top panel, side panels and doors. Installed cabinets shall include thermal, power, and cable management accessories that control airflow through the cabinet and keep network and power cables separate and organized.
15. Provide various configurable size blanking panels for each equipment cabinet.
16. The cabinet frame shall be rectangular with four corner posts, manufactured from steel with welded and bolted frame construction. The horizontal frame members shall be steel extrusion with grooves that accept captive hardware to allow attachment of equipment mounting rails and thermal, cable and power management accessories. The captive hardware will slide within the groove allowing rails and accessories to be adjusted in depth without removal from the cabinet. The slide extrusions will be marked with a scale that allows easy top-to-bottom alignment of mounting rails and other accessories when adjusted in depth.
17. Each cabinet shall include two pairs of equipment mounting rails. Mounting rails shall bolt to the side of the cabinet frame at the top and bottom of the frame and shall be adjustable in depth to provide front and rear support for equipment.
18. Equipment Mounting Rails shall be spaced horizontally to support 19" wide EIA-310- D compliant rack-mount equipment. Each RMU will be marked and numbered on the front mounting rails.
19. Attachment points will be M5/M6 cage nuts or 10-32/10-24 threaded rails. Mounting rails shall be square-punched according to the ANSI/EIA-310-D Universal hole pattern. The cabinet will include assembly and equipment-mounting hardware. Each cabinet will include (50) each combination pan head, pilot point mounting screws.
20. The cabinet shall include a solid top panel with four cable access ports located near the front and rear corners of the frame. Each cable access port shall be plastic with a brush seal to allow easy addition and removal of cables while limiting bypass airflow.
21. The cabinet shall include two locking solid side panels with spring loaded latches for easy installation and removal. The cabinet shall be designed to allow baying with or without side panels installed.
22. The sides of the equipment-mounting channels will be punched to allow attachment of equipment support rails, vertical power strips and cable managers along the sides of the rack or for rack-to-rack baying
23. The cabinet shall include a single front door with a high air flow perforated metal panel, hidden tamper-resistant hinges with quick-release hinge pins and a swing handle. The door shall be removable and reversible to open from the right or left. The door shall open to 150° when the cabinet is bayed with other cabinets. The front door shall have a single-point slam latch with a keyed lock.
24. The cabinet shall include a high flow perforated metal double rear door with a swing handle. The doors shall be removable. The doors shall open to 175° when the cabinet is bayed with other cabinets. The double rear door shall have a two-point cam latch with a keyed lock.
25. The mounting rails, top panel, side panels and doors shall be electrically bonded to the cabinet frame. The cabinet frame shall have a prepared location for attaching a grounding lug.
26. The cabinet shall be UL Listed. UL Listing will be stated in the manufacturer's product literature.
27. The cabinet shall include (4) leveling feet, (4) clamps for securing the leveling feet to the floor and a grounding lug for bonding the cabinet frame to the Telecommunications

Grounding Busbar. The manufacturer of the cabinet shall sell compatible casters and equipment mounting hardware as an accessory.

28. Provide Middle Atlantic Products riser base under the raised floor for all racks. Provide riser feet and support angles from same manufacturer. Middle Atlantic Products model # VFEET and #ANGLE.
29. Raised floor riser feet and angles shall be phosphate pre-treated and finished in a durable black powder coat.

D. Accessory Products:

1. Cabinet-mounted vertical power distribution units. Refer to the Division 26 26 00 specifications.

2.2 POWER REQUIREMENTS

- A. Contractor shall be responsible for confirming cabinets containing active equipment have installed (2) PDUs (power strips) to provide sufficient number of receptacles and current capacity to support the equipment.
- B. Minimum power configuration should be no less than 20 A, 120 Vac power, with 208 Vac where needed. All circuits shall be on the same phase of power, coordinate phase requirements when circuits are fed from UPS or transformer. Consult project documentation for details on power needs of specific racks and cabinets.

- 2.3 120Vac Power circuits should have dedicated neutral and ground conductors and no exposed on/off switch or breaker controls that might cause accidental shut-off.

PART 3 - EXECUTION EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.2 INSTALLATION

A. Process:

1. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
 - a. Electrical requirements (conduit installation and capacity).
 - b. The telecommunications rooms are the size indicated in the project drawings.
 - c. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.

- d. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.
2. Assemble racks and cabinets according to manufacturer's instructions. Verify that equipment mounting rails are positioned properly for rack-mount equipment before attaching the rack to the floor.
3. Anchor all racks and cabinets to the concrete floor per the structural requirements and cross brace to the cable runway system above.
4. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.

3.3 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

3.4 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION 271116

SECTION 271119 - TERMINATION BLOCKS AND PATCH PANELS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provides specifications for wall and rack/cabinet-mounted blocks, termination panels and patch panel components utilized to terminate various telecommunications infrastructure cabling and connectivity.
2. Optical Fiber Termination panels.
3. Copper horizontal cabling Patch Panels.

1.2 RELATED DOCUMENTS

- A.** Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B.** Architectural, mechanical, electrical, and all technology drawings.
- C.** Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each product indicated.

1. Submit all product data in accordance with general requirements of the construction documents.
2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Submit all shop drawings in accordance with the general requirements of the construction documents.
2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:

1. Submit management and installation team reference documentation verifying:
 - a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
 - b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:

1. The contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.5 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.6 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.1 OPTICAL FIBER TERMINATION PANELS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Belden
2. Or Approved

B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:

1. 19-inch Rack mountable fiber optic termination shelf with maximum 12 panels slots with integrated splicing for termination inside Telecom rooms.
2. Minimum 1U rack units' height, maximum 4U rack units'.
3. Optical fiber termination panel housings shall be provided for cross-connecting or inter-connecting purposes between OSP, Indoor riser backbone, and/or distribution cables and the active network electronic switches, as noted in drawings.
4. Single mode termination: Fusion splice both ends of each single mode fiber optic strand onto factory connectorized single mode pigtailed mounted in connector housings assembled by the manufacturer of the single mode fiber optic cable.
 - a. Single-Mode splice-on Connector is acceptable.
5. Multimode termination: Terminate both ends of each multimode fiber optic strand onto field installable anaerobic type connectors.
6. All optical fiber housings shall be complete factory-provided assemblies that contain all components including LC duplex connector adapter panels and internal/external bend radius, strain relief and cable clamp components that are provided in a housing which includes an accessible rear access hatch.
7. All optical fiber patch panel trays and associated bulkhead inserts shall have factory numerical labeling included in the design and presentation to the user side of the panel.
8. The optical fiber patch panel bulkheads that house the terminating modules for the fiber backbone cabling and any horizontal optical fiber cabling shall accept TIA 568-C standard-compliant LC-connectors compatible with the optical fiber strands being terminated.

D. Accessory Products:

1. Provide any accessory products related to the optical fiber termination panels to provide a complete and functional infrastructure system.

PART 3 - EXECUTION EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
 1. Electrical requirements (conduit installation and capacity)
 2. The telecommunications rooms are the size shown on the project drawings.
 3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.2 INSTALLATION

- A. Process:
 1. Install all optical fiber and category copper termination panels/panels under the guidelines of the manufacturer's recommended instructions and per all TIA/EIA 568-C standards and manufacturer-approved industry practices as shown in the drawings.
 2. The installation and performance parameters of all installed cable termination panels shall be verified by the contractor through ANSI/TIA 568-C testing procedures.
 3. Label all cable termination panels to identify each port and each specific panel in accordance with the TIA/EIA 606 labeling scheme approved by the Owner.
- B. Installation description:
 1. Contractor shall use existing cabling management pathways and take care to place cable like with like, maintaining original segregation strategies for separating fiber and copper cables as well as any separation necessary between different types of copper cables.
 2. Cables shall be dressed neatly within patch management pathways with care taken to maintain minimum bend radius of not less than 1 times the cord outer diameter for copper and not less than a 1" bend radius for fiber jumpers as per ANSI/TIA 568-C.0
 3. The installation and performance parameters of all installed cable termination panels shall be verified by the contractor through ANSI/TIA 568-C testing procedures.
 4. Label all cable termination panels to identify each port and each specific panel in accordance with the TIA/EIA 606 labeling scheme approved by the Owner.

3.3 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components due to manufacturer defects or

contractor poor performance. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

3.4 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION 271119

SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The work shall consist of the provision, termination, and testing of complete and fully functional Structured Cabling System (SCS) for telephone and data systems network. This work shall include provision of but not limited to the following:
1. Telephone and data system equipment racks, cable runway in BDF/IDFs, patch panels and associated hardware.
 2. Telephone and data system horizontal station cables.
 3. Telephone and data system connectors and faceplates.
 4. Telephone and data system optical/copper patch cords.
 5. Telephone and data system optical fiber/copper riser cables.
 6. Telephone and data system pathways; wire basket cable tray, j-hooks, conduits, boxes, raceways and sleeves.
- B. The work shall not include provision of the following:
1. Telephone handsets and active switching equipment.
 2. Integrated Services Digital Network equipment.
 3. Telephone services or active computer and networking equipment.
 4. Computer and network software.
 5. Copper and Fiber entrance cables, air blown fiber (ABF) bundles and tube cables.
 6. Working Conditions.
- C. Provide all incidental items that belong to the work described and which are required for a complete system.
- D. Section Includes:
1. Provide a standard defining the structured communications cabling systems to be installed within customer facility. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards and industry best practices.
 2. Scope of Work Compliance.
 3. Contractor Qualifications.
 4. Warranty.
 5. Safety.
 6. Working Conditions.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Wire Basket cable tray system, raceways, conduits and boxes, external duct bank tie and other components that make up the infrastructure pathways that will carry the telephone and data cabling shall be furnished and installed by the electrical contractor.
- C. Section 01 91 13 – General Commissioning Requirements.

1.3 GENERAL TERMS AND CONDITIONS

- A. General Contractor is responsible for all required Division 27 scope of work and shall ensure all communication sub-tier contractors adhere to the qualifications set forth in all project Division 27 specifications including project experience and certifications.
- B. Prices quoted shall be all-inclusive and represent a complete fully engineered system installation at the Project site as contemplated by and detailed in the drawing package and in accompanying specifications.
- C. Omissions in the specification of any provision herein described shall not be construed as to relieve the contractor of any responsibility or obligation requisite to the complete and satisfactory delivery, installation, operation and support of any and all systems, equipment or services. Correction of any omission on the part of the contractor, either due to misinterpretation of this specification or any other conditions of the project, shall be the responsibility of the Contractor and shall not result in any contract modification or additional costs to Owner.
- D. Where conflicts and/or irregularities occur between project documents, specifications, drawings, and/or applicable codes, rules, regulations, ordinances, standards, guidelines and practices, the more stringent requirement shall apply as reasonably determined by Owner or government agency inspector.
- E. This specification represents the design intent for the project communicated by way of narrative descriptions of intended functionality and single line or detail drawings indicating likely equipment connectivity to achieve that functionality. The designs in this specification do not represent fully engineered technical solutions. Contractors are required to review the designs presented in the project documents closely, submit any questions and clarifications regarding the design intent through the RFI process and develop their own engineered solutions representing a fully functional turn-key solution in their bid responses.
- F. The scope of this project includes the complete system engineering, procurement, fabrication, installation, programming, testing, training and warranty.
- G. Proposed solutions shall be based on the designs communicated in the specifications, but shall include any additional equipment, materials, software, licenses and/or labor required for the contractor to deliver a fully functional turn-key system solution that meets intended operational performance requirements.

- H. It is the responsibility of the Contractor awarded this project to ensure that all quantities, materials, labor, licenses, permits, sales taxes and any and all other costs to provide a turnkey project are included in their bid.
- I. Floor plans, drawings, elevation drawings, and other drawings received by the Contractor as part of the construction process are hereby incorporated into this document by reference. It is the responsibility of the Contractor to ensure that amounts and lengths of cabling and pathways are correct, and that all materials and labor are included to install the system per the drawings and these specifications.
- J. Permits, licenses, applicable sales taxes, insurance requirements, payment/performance bond costs, and other miscellaneous costs are the responsibility of the Contractor and shall be included in the contract price and this scope of work. Such items are to be listed separately on pricing sheets, if provided. Copies of all required permits, licenses, insurance requirements and bond(s) are to be delivered to Owner prior to commencement of any work.
- K. Installation Schedule and Coordination: Contractor shall take the fast-track nature of this project and potential requirement for installation/work schedule adjustments and quick turnarounds into consideration in constructing this project as Owner will NOT entertain or agree to added-cost change orders associated with scheduling changes.
- L. Work will need to be closely coordinated with architect, City Personnel, GC, MEP contractors, structural contractor and all low-voltage contractors and each of their respective schedules.
- M. This will be a turnkey Project. Any item of the equipment or material not specifically addressed on the drawings, specifications or elsewhere in Division 27 specifications documents, but required to provide complete and functional systems as contemplated and/or specified herein, shall be provided at no additional charge to owner in a quantity and quality consistent with other specified items.
- N. Coordination with Project Design Team: The build contractor will be responsible for coordinating all communications cabling infrastructure requirements, including review of existing site conditions, review and coordination of electrical power and grounding requirements, conduits and back boxes, structural support requirements, and coordination.
- O. Assembly: The contractor shall procure and assemble all hardware and equipment and any additional materials as required to deliver the completely functioning communications cabling system and/or Audio-Visual System.
- P. Installation: The contractor shall install all equipment, inter-rack and intra-rack cable, wiring of equipment, connectors, panels, plates, and other material at the Project site.
- Q. Testing and Adjustment: The contractor shall perform all tests and adjustments, furnish all test equipment necessary and perform all work required to properly configure the systems and to verify their performance in accordance with the information in this document and the design-build integrator's approved engineered designs.
- R. Warranty: The contractor shall warrant the installed system in accordance with the terms of this document and accompanying contractual documents.

1.4 QUALIFICATIONS

A. Manufacture:

1. The SCS specified products for the horizontal cabling (e.g. Cat 6 cable, patch panels, information outlets, faceplates, jacks, patch cords, etc.) shall be supplied by a single manufacturer.
2. Manufacture shall have a minimum of 10 years of experience in the manufacture of the specified cabling products and shall be ISO 9001/14000 Certified.

B. Installer:

1. Installer shall be certified by the manufacture company in all aspects of design, installation and testing of the SCS horizontal cabling specified products.
2. The installer shall utilize the authorized SCS manufacturer horizontal cabling components and distribution channels in provisioning this project.
3. Installer shall own and maintain tools and equipment approved by the cabling system manufacturer for the installation and testing of the SCS Category 6 horizontal cabling balanced twisted pair distribution systems.
4. SCS installer shall carry out the telephone and data network system installation work detailed in this specification.
5. SCS installer shall have a proven track record in the field of telephone, data, fiber cabling and system installation, with at least five previous installations of comparable size and complexity undertaken within the last five years.
6. Installer shall be qualified in the installation and termination of optical fiber cabling as described in this specification.
7. Contract shall have a minimum of one (1) Registered Communications Distribution Designer (BICSI RCDD) and a minimum of two (2) BICSI TECHNICIAN level technicians on staff as full-time employees of the Contractor.
8. A specialist installer company that has completes work of a similar nature shall carry out the telephone and data system installation work detailed in this specification.
9. The Contractor shall hold a valid State of California C-7 Low-Voltage license at the time of bidding.
10. Installer shall be an authorized Belden Partner Alliance Member in good standing and shall provide the Belden 25-year Product Warranty and Lifetime Application Assurance.

1.5 SUMMARY

A. A.This section includes the following items for wiring systems used as signal pathways for voice and high-speed data transmission:

1. Mounting elements.
2. Un-shielded twisted pair.
3. Fiber-optic cabling (Single-mode and/or Multi-mode).
4. Workstation outlets.
5. Backboards.
6. Identification products.

B. DEFINITIONS (ABBREVIATIONS AND ACRYONIMS):

1. ABF: Air Blown Fiber
2. A/E: Architect / Engineer (designer)
3. Backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms or floors distribution terminals, the entrance facilities and the equipment rooms within or between buildings.
4. BDF: Building Distribution Frame.
5. BICSI: Building Industry Consulting Service International
6. CROSS-CONNECT: A facility enabling the termination of cable elements and their interconnection or cross connect.
7. EIA: Electronics Industry Alliance
8. ELFEXT Equal Level far End Cross Talk
9. EMI: Electromagnetic interference.
10. FTP Foiled Twisted Pair
11. IDC: Insulation displacement connector
12. IDF: Intermediate Distribution Facility
13. ILEC/LEC: Incumbent Local Exchange Carrier
14. ISP: Inside Plant
15. IT: Information Technology
16. BDF: Building Distribution Frame
17. LAN: Local area network
18. LOMMF: Laser Optimized Multi-Mode Fiber
19. MDF: Main Distribution Facility
20. MPOE: Minimum Point of Entry
21. NEXT Near End Cross Talk
22. OSP: Outside Plant
23. PSELFEXT: Power Sum Equal Level Far End Cross Talk
24. PSNEXT: Power Sum Near End Cross Talk
25. RCDD: Registered Communications Distribution Designer
26. SCS: Structured Cabling Systems: SCS is defined in this document as all required horizontal category 6 cabling including associated hardware, patch panels, BDF/IDF patch cords, information outlets, faceplates, work area patch cords, installed and configured to provide telephone and/or computer data network connectivity.
27. TBD: To Be Determined
28. TCIM: Telecommunication Cabling Installation Manual
29. TDMM: Telecommunications Distribution Methods Manual
30. TGB: Telecommunications Grounding Busbar (IDF locations)
31. TIA: Telecommunications Industry Association
32. TMGB: Telecommunications Main Grounding Busbar (BDF location)
33. UTP: Unshielded Twisted Pair
34. WAP: Wireless Access Point
- 35.

1.6 SUBMITTALS

- A. Provide three (3) full-size installation samples of the telephone and data system outlet. The sample shall include, as a minimum, one four-port faceplate with two data system connectors

(each terminated with a 12" length of distribution Cabling) and two blanking plates. Provide sample with faceplate labeling and wrap around labels.

B. Shop Drawings:

1. Include dimensional plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack elevations, method of field assembly, workspace requirements and access for cable connections.
2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by University.
3. Cabling Administration Drawings.
4. Wiring diagrams to show typical wiring schematics including the following:
 - a. Workstation outlets, jacks and jack assemblies.
 - b. Patch cords (Category 6 and Fiber Optic).
 - c. Copper patch panels and blocks.
 - d. Fiber-optic enclosures.
 - e. Data equipment racks.

C. Qualification Data: See 1.3.

D. Provide sample copy of copper (horizontal station and riser) and fiber test reports.

E. Submit manufacturers product data sheet(s) for each component of the telephone and data systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification. Indicate each components(s) to be used on each product data sheet(s). Submit details of the warranty (including manufacturer twenty-year warranties) to be provided for the cabling systems, clearly including that all components are covered.

F. Submit samples of the labels to be used for labeling cables, patch panels, termination frames and faceplate for the telephone and data systems.

G. Submit a testing schedule indicating how each telephone and data cabling system component is to be tested. The schedule shall, as a minimum, indicate the testing process from the factory testing through to the final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.

H. Submit Current Belden Partner Alliance Certificates for the relevant staff involved in this project

I. Submit references for a minimum of three similar projects successfully undertaken and completed within the last three years. As a minimum, provide project name and address, client contact name and telephone number and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets and projected time scales.

1.7 AS BUILT DOCUMENTATION

- A. As-built documentation shall consist of all the construction drawings to include each floor plan with the telephone and/or data outlet station location numbers (faceplates identification numbers, e.g. 1A-V12,1A-C15, etc.) inserted next to the telephone and/or data symbols for each location.
- B. The as-built documentation shall also contain the cabling routes taken between the cable tray, conduit and/or J-Hooks and the workstation outlets.
- C. An additional requirement shall be a wire run list created in Microsoft Excel that contains the specific details of each location and all of the cables that are terminated there. Create tabs in the spreadsheet for each IDF/BDF.

1.8 COORDINATION

- A. Coordinate layout and installation of voice and data communication cabling and all equipment hardware with UCR telecommunications representative prior to start of work.
- B. Meet jointly with UCR telecommunications representative to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 1. Record agreements reached in meetings and distribute to other participants.

1.9 MATERIAL STANDARDS – APPLICABLE REGULATORY REFERENCES

- A. Contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
 - 1. ANSI/TIA:
 - a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
 - d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
 - e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
 - f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
 - g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates

- h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
 - i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
 - j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
 - k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
 - l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
 - m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
 - n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
 - o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
 - p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
 - q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
 - r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
 - s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
 - t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
 - u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
 - v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
 - w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
 - x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
 - y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
 - z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
 - aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
 - bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.
2. ISO/IEC
- a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
 - b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.

3. Electric Codes
 - a. California Electrical Code, CEC (2016)
 - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
 - c. ANSI/IEEE C2-207, National Electrical Safety Code®
 - d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. 2016 California Title 24
 - a. 2016 California Administrative Code, Title 24 Part 1
 - b. 2016 California Building Code, Title 24 Part 2
 - c. 2016 California Electrical Code, Title 24 Part 3
 - d. 2016 California Mechanical Code, Title 24 Part 4
 - e. 2016 California Plumbing Code, Title 24 Part 5
 - f. 2016 California Energy Code, Title 24 Part 6
 - g. 2016 California Fire Code, Title 24 Part 9
 - h. 2016 Green Building Standard Code, Title 24 part 11
 - i. 2016 California Standard Code, Title 24 Part 12
6. Local Codes and Standards – all applicable
7. Avixa (Infocomm)
8. BICSI
 - a. Telecommunications Distribution Methods Manual, 13th Edition
 - b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
 - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
 - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
 - e. Network Systems and Commissioning (NSC) reference, 1st Edition
 - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
 - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
 - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
 - i. AV Design Reference Manual, 1st Edition
 - j. Network Design Reference Manual, 7th Edition
 - k. Outside Plant Design Reference Manual, 5th Edition
 - l. Wireless Design Reference Manual, 3rd Edition
 - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
9. Anywhere cabling Standards conflict with electrical or safety Codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
10. Knowledge and execution of applicable codes is the sole responsibility of the contractor.
11. Any code violations committed at the time of installation shall be remedied at the contractor's expense.

1.10 SYSTEMS TESTING

- A. Following telephone, data and fiber optic cable installation and termination at both ends, undertake and record tests to ensure that the cabling system will perform satisfactory in service. In addition to the detail in this specification, the Design-builder shall carry out any additional tests deemed necessary to ensure the satisfactory operation of the telephone, data and fiber optic cable systems. The costs of these additional tests shall be borne by the Contractor.
- B. Provide the University Representative with the opportunity to witness all testing. Notify the University Representative in writing seven working days before the date of commencement of the cable tests. On request, the installer shall demonstrate that the procedure completely identifies the fault conditions being tested for.
- C. Complete the tests identified in all of the telephone and data systems specifications in accordance with TIS-568-B, B2 & B3.
- D. Notify the University Representative in writing seven working days before the date of commencement of the cable tests. Provide details, on that advance date, of the proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of tests personnel.
- E. Personnel shall be competent in and qualified by experience or training for detailed design, installation and testing of telephone, data and fiber optic cable systems.
- F. Include the costs of obtaining, calibrating and maintaining test equipment, and the cost if carrying out and recording the tests, including labor costs.
- G. Ensure that all Test Equipment is in calibration before delivery to the site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment calibration status are carried out.
- H. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment calibration status are carried out.
- I. To support the test procedure, create a printed table of every cable in the building with appropriate columns for each test result and comments.
- J. Sign and date each successful series of test results as the tests proceed. As a minimum, each completed page of test results shall be signed and dated once all the tests in that page have been successfully completed and their results recorded.
- K. The test documentation shall be available for inspection by the University Representative during the installation period. The original documents (not copies or retyped versions) shall be retained and included as part of the as-built information.
- L. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.

- M. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site. The contractor shall use Fluke Networks Versiv DSX-8000 Cable Analyzer with Linkware Management Software for all cable testing.

1.11 JOB CONDITIONS

- A. Prior to stating any work notify the University Representative in writing of dimensional discrepancies and other conditions detrimental to proper performance if the work.
- B. There shall be no additional costs incurred by the University for complying with the specifications and requirements of the Contract Documents.
- C. As catalog number change frequently, the Contractor must verify all part numbers prior to ordering materials. Written clarifications shall be issued in response to written Request for Information (RFI).

1.12 LIFETIME OF SYSTEM

- A. The physical and operational lifetime of the installation is intended to be in excess of ten (10) years.

1.13 WARRANTY

- A. Provide a Belden IBDN System 3600 25 Year Product Warranty and Lifetime Application Assurance Certification for this installation.

PART 2 - PRODUCTS AND SYSTEM REQUIREMENTS

2.1 MANUFACTURERS

- A. Manufacturers (Campus Standard)
 - 1. Belden IBDN Systems 3600, or equal, for Category 6 (voice and data) horizontal structured cabling system.
 - 2. Belden Fiber Express System, or equal, for all Fiber Optic cables, connectors and associated hardware.
 - 3. Chatsworth Products Inc. (CPI), or equal, (see note), for in Telecom Room(s); seven-foot by 19-inch data equipment racks, cable runway and support products to include vertical cable (between racks) management.
 - 4. CPI, or equal, for horizontal wire management products.
 - 5. Arlington 2.5" minimum #38085 (preferred), Erico Caddy, MonoSystems, or equal, for J-Hook Cable Support Systems and other non-continuous cable supports. Hooks shall be attached to structural support devices as manufactured by Erico Caddy, or equal.

6. Superior Essex ARMM, or equal, for twisted pair Copper riser distribution cable.
7. Carlon, or equal, for innerducts and associated fittings.
8. Belden, or equal, for Voice Grade Patch Panels riser distribution in data equipment racks.
9. Belden, or equal, for Copper riser distribution 110 wall mounted wiring blocks.
10. Copper B-line Flex Tray, MonoSystems, Mono-Mesh or equal, for Wire Basket Cable Tray support system.

2.2 TELEPHONE AND DATA SYSTEM HORIZONTAL STATION CABLING

A. Provide Belden 3600 Cable #3613 plenum rated cable, or #3612 riser rated cable, or equal Cable shall be Blue un color. Each cable shall have eight unshielded twisted-pair 24 AWG solid copper conductors (i.e., four pairs), color blue (voice/data) and meet or exceed the specifications for Category 6 cables detailed in the TIA cabling standard for premises horizontal wiring to include:

1. Category 6 cable and all Category 6 channel components shall be manufactured by a single manufacturer.
2. Category 6 UTP balanced twisted pair cable and apparatus channel performance shall be guaranteed up to the maximum 100 meters (328 feet) length and shall meet the following Guaranteed Channel Performance Specifications.
 - a. At a minimum, the balanced twisted-pair cabling system shall exceed the key performance parameters for Cat 6 found in ANSI/TIA-568-C.2 Category 6 standard over the specified frequency ranges by the values listed below. The balanced twisted-pair cabling system shall also meet all the requirements of ISO/IEC 11801 Edition 2.0 2002-09

Parameter	Margin			
	100 MHz	200 MHz	250 MHz	300 MHz
Insertion loss	1.4 dB	2.2 dB	2.6 dB	3.0 dB ^(b)
Return loss ^(a)	4.0 dB	4.0 dB	4.0 dB	4.0 dB ^(b)
PSNEXT	8.0 dB	8.0 dB	7.0 dB	6.0 dB ^(b)
PSACR-N	9.4 dB	10.2 dB	9.6 dB	9.0 dB ^(b)
PSACR-F (formerly PSELFEXT)	8.0 dB	8.0 dB	8.0 dB	8.0 dB

Values represent System 3600 channel margin against TIA-568-C.2 Category 6 standard. The margin is the additional headroom (in dB) compared to the minimum specified value for Category 6 at each frequency point over the specified frequency range.

The worst case margin is determined at the frequency where the measured data point is closest to the limit line. The Category 6 limit line equations are used to determine the worst case margin over the frequency range from 250 MHz to 300 MHz. This margin applies for a worst-case, 4-connector, 100-meter channel configuration.

PSNEXT = Power-sum near-end crosstalk

PSACR-F = Power-sum attenuation-to-crosstalk ratio far-end

PSACRN = Power-sum attenuation-to-crosstalk ratio near-end

(a) = applies to bonded-pair cables and cords, for non-Bonded pairs 2.0 dB

(b) = extrapolated values using Category 6 limit line equations

3. Cable Specifications for Belden 3600

Nominal Outer Jacket OD:	0.230 in
Nominal Outer Jacket Thickness:	0.018 in
Maximum Pulling Tension:	40 lbs.
Nominal Cable Weight:	31 lbs./1,000 ft.
Operating Temperature:	-20°C to 75°C
Installation Temperature:	0°C to 50°C
Conductor Diameter:	23 AWG
Jacket Material:	Low Smoke PVC
ETL Listed Type:	CMP, CMR
Nominal Velocity of Propagation:	72%
Maximum DC Resistance	77 Ohms/Km
Maximum DC Resistance Unbalanced:	3%
Maximum Mutual Capacitance at 1 KHz:	90 pf/100 m
Min Bend Radius During Installation:	2.5"
Voltage Safety Rating:	300 Volts per NEC 800.179

- B. For cabling routed in underground duct, provide Belden #OSP6U Category 6 / UTP Cable (campus standard), or equal, suitable for outside plant use with PE Jacket. Each cable shall have eight unshielded twisted-pair 24 AWG solid copper conductors (i.e., four pairs), color black and meet or exceed the specifications for Category 6 cables detailed in the TIA cabling standard for premises horizontal wiring for Category 6.

Nominal Outer Jacket OD:	0.251 in
Separator Material	X-Spline
Maximum Pulling Tension:	25 lbs.
Nominal Cable Weight:	25 lbs./1,000 ft.
Operating Temperature:	-40°C to 75°C
Installation Temperature:	-40°C to 60°C
Conductor Diameter:	24 AWG
Jacket Material:	LLDPE - Linear Low Density Polyethylene
ETL Listed Type:	OSP
Nominal Velocity of Propagation:	65%
Maximum DC Resistance	93.8 Ohms/Km
Maximum DC Resistance Unbalanced:	3%
Maximum Mutual Capacitance at 1 KHz:	15.7 pf/100 m
Min Bend Radius During Installation:	2.5"
Voltage Safety Rating:	300 Volts per NEC 800.179

2.3 TELEPHONE AND DATA SYSTEM HORIZONTAL STATION CABLING

- A. Provide a Category 6 four-position information outlet for each telephone and/or data system outlet. The outlets shall be capable of supporting telephone (analog and digital) and/or data services. The outlets shall allow the cable to terminate directly onto the connector with no pair separation. The connector termination methods must also offer the possibility to change the connector interface without having to re-terminate the cable (ex.: Change the jack color or replace a jack by a plug interface) the outlets shall be offered in 19 colors. The information outlets shall be Belden REVConnect RV6MJKUGY, (Grey for analog voice, elevators and

emergency phones only), RV6MJKUBK, (Black for data), or equal. Category 6 outlets shall meet the following Guaranteed Margin Performance and Physical Specifications:

Transmission Characteristics (Connectivity)						
Frequency (MHz)	Max. Insertion Loss TIA* (dB)	Max. Insertion Loss Belden** (dB)	Min. NEXT TIA* (dB)	Min. NEXT Belden** (dB)	Min. FEXT TIA* (dB)	Min. FEXT Belden** (dB)
1.000	0.100	0.100	75.000	77.000	75.000	77.000
4.000	0.100	0.100	75.000	77.000	71.100	75.100
8.000	0.100	0.100	75.000	77.000	65.000	69.000
10.000	0.100	0.100	74.000	77.000	63.100	67.100
16.000	0.100	0.100	69.900	72.900	59.000	63.000
20.000	0.100	0.100	68.000	71.000	57.100	61.100
25.000	0.100	0.100	66.000	69.000	55.100	59.100
31.250	0.110	0.100	64.100	67.100	53.200	57.200
62.500	0.160	0.120	58.100	61.100	47.200	51.200
100.000	0.200	0.160	54.000	57.000	43.100	47.100
200.000	0.280	0.240	48.000	51.000	37.100	41.100
250.000	0.320	0.280	46.000	49.000	35.100	39.100
300.000		0.310		44.500		37.600

Mated Connection Table - Footnote:

* TIA-568-C.2 Category 6 Standard.

** Worst-case performance for a CAT6+ mated connection using CAT6+ modular plugs.

Mated Connection Table 2:

Frequency (MHz)	Min. Return Loss TIA* (dB)	Min. Return Loss Belden** (dB)	Min. Balanced TCL TIA* (dB)	Min. Balanced TCL Belden** (dB)
1.000	30.000	32.000	40.000	42.000
4.000	30.000	32.000	40.000	42.000
8.000	30.000	32.000	40.000	42.000
10.000	30.000	32.000	40.000	42.000
16.000	30.000	32.000	40.000	42.000
20.000	30.000	32.000	40.000	42.000
25.000	30.000	32.000	40.000	42.000
31.250	30.000	32.000	38.100	42.000
62.500	28.100	32.000	32.100	36.100
100.000	24.000	28.000	28.000	32.000
200.000	18.000	22.000	22.000	26.000
250.000	16.000	22.000	20.000	24.000
300.000		18.500		22.500

Materials:

Description	Type	Material
Front Connection	RJ45	Copper Clad Flexible PCB, 50µin Gold plated contacts over Nickel
Rear Connection	REVConnect	Copper alloy, Gold plated contacts over Nickel
Connector Body	N/A	PBT glass reinforced UL94V-0

Termination Interface:

Termination	Connection	Durabilities
Front	Mated Connection	750 cycles
Rear	Mated Connection	20 cycles

Dielectric Strength:	1,000 V RMS @ 60 Hz for 1 minute (Signals to Ground)
Current Rating:	1.300 A
Insulation Resistance:	500 M-Ohm Minimum
Max. Contact Resistance:	20 m-Ohm
Termination Resistance:	2.5 m-Ohm

2.4 TELEPHONE SYSTEM RISER CABLE

- A. Provide one (1) Superior Essex ARMM 50-Pair Riser Cables #02-100-03, or equal between BDF 110 wall mount wiring blocks and each IDF 48-port Voice Patch Panel in Data Equipment Rack to include BDF 48-port Voice Patch Panel in Data Equipment Rack. Each cable shall be shielded twisted-pair 24 AWG solid copper conductors, be riser rated and meet or exceed the specifications for Category 3 cables detailed in the TIA cabling standards for premises horizontal wiring, see copper riser drawing for locations.
- B. Ground each end of 50-Pair Riser Cable Shield to TMGB (BDF) or TGB (IDF) with approved Cable Shield Bond Connector (Mfg. 3M, part number 4460-D) using Two-Hole compression lugs (Mfg. T&B, or equal) with #6WG green insulated, stranded THHN Conductor wire.

2.5 TELEPHONE SYSTEM RISER CABLE 110 WIRING BLOCKS

- A. Provide Belden 300 Pair Field Termination Kit with back panel and 110C5s, Part Number AX100696-S, or equal, in BDF. The wiring blocks shall be fully equipped with five pair 110C-5 connecting blocked, jumper throughs, label designations and rivets.

2.6 TELEPHONE SYSTEM VOICE GRADE PATCH PANELS (FOR RISER CABLES)

- A. Provide one (1) 110 Style Voice Grade Cat5e 48-Port Patch Panel in BDF and each IDF location in Data Equipment Rack. Terminate 50-Pair Copper Riser distributions cables on Patch Panels. Patch Panels shall be Belden part number AX103259, or equal. Patch Panel shall meet ANSI/TIA-568-B and FCC Part 68 requirements, Patch Panels shall be provided with forty-eight (48) 8 Pin RJ45 jacks.
- B. Note: On one end of 50-Pair Riser Cable, at BDF and each IDF in Data Equipment Rack, terminate Cables Pairs 1 through 48 (pair-for-port, pair 1 to port 1, pairs 2 to port 2, up to pair 48 to port 48) on 48-Port Voice Grade Patch Panels, store (coil) pairs 49 and 50 at rear of patch panel. On other end of 50-Pair Riser Cable terminate all pairs on we all mount 110 wiring blocks in BDF.

2.7 TELEPHONE AND DATA SYSTEM FACEPLATES

- A. Provide a flush-mounted modular faceplate to house data and telephone system connectors, capable of housing a maximum of four (4) information connectors. The faceplate shall fit over a standard NEMA electrical outlet box (4S) with a single-gang plaster ring and shall allow information outlets to be snapped into the faceplate with the nose flush to the plate surface. The faceplates shall be Belden KeyConnect Style 4 Port single gang wall plate (AX102249) or equal, (match color of electrical plates), or equal.
- B. Provide modular faceplates suitable for Modular Furniture to support data and telephone system connectors, capable of housing a minimum of three (3) information outlets. The faceplates shall be compatible to fit modular furniture raceway. Provide bezel(s) and all associated hardware as required. The faceplate shall be Belden KeyConnect series triplex outlets (AX104457; AX107029; AX103925; AX102291; AX102292)(match color of electrical plates), or equal.
- C. Blanking Plate. Provide blanking plates to be installed in faceplate outlet positions that are not populated with telephone and/or data system information outlets. Provide blanking plates in sufficient quantities to cover all unused openings in every faceplate. The blanking plate shall be Belden KeyConnect blank module or equal (AX104456; AX107026; AX102261; AX102262; AX102263) (match color of electrical plates), or equal.
- D. At Wall (+42" AFF) Phone Outlet locations. Provide Stainless Steel Faceplate suitable for wall mount phone. Belden AX104126

2.8 TELEPHONE AND DATA SYSTEM MODULAR PATCH PANELS

- A. Telephone and Data System Modular Patch Panels
 - 1. Provide Belden REVConnect RV6PPF2U48BK CAT-6 48 port patch panel for telephone and data cables, or equal, Capable of accepting REVConnect cores
 - a. Features: Universal T568A and T568B wiring Labels
 - b. Labeling areas adjacent to conductors
 - c. Replaceable connectors – supporting 100% port availability
 - d. 24 or 48 ports
 - e. Construction: 16-gauge steel and mountable on 19-inch (483mm) equipment racks.
 - f. Patch Panel must be available in colors Black or White
 - 2. The first 12 ports of the first patch panel of each IDF will be dedicated for Station Outlet analog voice lines. These ports will be populated with the Belden REVConnect Grey Category 6 jack inserts #RV6MJUGY.
 - 3. Patch Panels shall have strain relief (rear wire management bars) for each cable terminated on the connector.
 - 4. Patch Panel shall be UL listed, UL-C certified and ACA approved.
 - 5. Patch Panel 19-inch rack mountable and be able to store cable reserve with no bends sharper than 2" bend radius.
 - 6. Provide sufficient finger space to allow connectors to be mounted and demounted easily.
 - 7. Provide Space for labeling of each individual copper connector.

8. Shall allow any individual cable to be terminated or otherwise handled without disturbing other cables.

Materials:

Description	Material	Color
Panel	Steel	Black/White
Frame	PC/ABS	Black/White
Management Bar	Steel	Black
Clear Window	Polycarbonate	Transparent

Mated Connection Table 1:

Frequency (MHz)	Max. Insertion Loss TIA* (dB)	Max. Insertion Loss Belden** (dB)	Min. NEXT TIA* (dB)	Min. NEXT Belden** (dB)	Min. FEXT TIA* (dB)	Min. FEXT Belden** (dB)
1.000	0.100	0.100	75.000	77.000	75.000	77.000
4.000	0.100	0.100	75.000	77.000	71.100	75.100
8.000	0.100	0.100	75.000	77.000	65.000	69.000
10.000	0.100	0.100	74.000	77.000	63.100	67.100
16.000	0.100	0.100	69.900	72.900	59.000	63.000
20.000	0.100	0.100	68.000	71.000	57.100	61.100
25.000	0.100	0.100	66.000	69.000	55.100	59.100
31.250	0.110	0.100	64.100	67.100	53.200	57.200
62.500	0.160	0.120	58.100	61.100	47.200	51.200
100.000	0.200	0.160	54.000	57.000	43.100	47.100
200.000	0.280	0.240	48.000	51.000	37.100	41.100
250.000	0.320	0.280	46.000	49.000	35.100	39.100
300.000		0.310		44.500		37.600

Mated Connection Table 2

Frequency (MHz)	Min. Return Loss TIA* (dB)	Min. Return Loss Belden** (dB)	Min. Balanced TCL TIA* (dB)	Min. Balanced TCL Belden** (dB)
1.000	30.000	34.100	40.000	42.000
4.000	30.000	34.100	40.000	42.000
8.000	30.000	34.100	40.000	42.000
10.000	30.000	34.100	40.000	42.000
16.000	30.000	34.100	40.000	42.000
20.000	30.000	34.100	40.000	42.000
25.000	30.000	34.100	40.000	42.000
31.250	30.000	34.100	38.100	42.000
62.500	30.000	34.100	32.100	36.100
100.000	28.000	30.000	28.000	32.000
200.000	22.000	24.000	22.000	26.000
250.000	20.000	22.000	20.000	24.000
300.000	18.500	20.500		22.500

Dielectric Strength:	1,000 V RMS @ 60 Hz for 1 minute (Signals to Ground)
Current Rating:	1.300 A
Insulation Resistance:	500 M-Ohm Minimum
Max. Contact Resistance:	20 m-Ohm
Termination Resistance:	2.5 m-Ohm

2.9 DATASYSTEM FIBER OPTIC CLOSET CONNECTOR HOUSING (CCH) AND CONNECTOR PANELS

- A. Provide Belden 19-inch rack mountable (4U) Fiber-Express (ECX-04U) that support inter-connect or cross-connect capabilities between outside plant, riser and/or building distribution cables and opto-electronics as shown on drawings to include the following capabilities:
 - 1. Shall hold 12 Frames, cassettes and/or modules that support a variety of field-termination options: e.g. ST, LC, SC connectors and/or splicing/pigtail assemblies.
 - 2. Removable clear top cover for visibility and ease of access for installation, testing and troubleshooting.
 - 3. Multiple patch cord management and strain-relief options.
 - 4. TIA hole spacing (1.75-in).
 - 5. Removable front and rear housing; field installable lock kit availability for front and rear doors Belden ECX-LOCKKIT.
 - 6. Provide one (1) Belden ECX-04U, or equal, Rack Mountable Fiber-Express Patch Panel in the BDF Telecom Room, Equipment Rack (RR-XX).
 - 7. Provide one (1) Belden ECX-02U, or equal, Rack Mountable Fiber-Express Patch Panel in the IDF Telecom Room, Equipment Rack (RR-XX).

- B. Provide Fiber-Express Frame that support factory installed of field-installable fiber optic connectors as shown on drawings.
 - 1. Provided Fiber-Express FFSX06LA, 12-fiber single-mode LC Duplex Fiber-Express Frames in BDF and each IDF Telecom Rooms for each 12-fiber single-mode cable.

2.10 OPTICAL FIBER RISER CABLE

- A. Provide Optical Fiber Tight-Buffered (OS2) armored Interlocked Plenum-Rated Cable OFNP consisting of twelve (12) Single-mode fibers that shall have enhanced low-loss and bend-improved fiber technologies, Belden Fiber-Express F1SD012A9, or equal, from BDF to each IDF, Riser cable shall be plenum rated OFNP and meet application requirements of the NEC article 770 and the ICEA S-83-596 test criteria to include UL-1666 flame resistance. Riser cable shall be suitable for riser type environments for intra-building back-bone installations. Fabricate system using manufacturer’s standard materials and in sizes, types and performance characteristics as indicated. Factory-fabricated, 900 um tight-buffered , all-dielectric, low-loss, with bend-improved technologies with the following operational and construction features.

Single Multimode Optical Fiber
 Specifications Outer Jacket Color: Yellow
 Flame Rating: OFCP
 Core Diameter: 8.3 μm nominal
 Cladding Diameter: 125.0 (± 0.7) μm

Optical Characteristics

Mode Field Diameter:	9.0
Fiber Core Diameter:	8.3/125μm
Max Attenuation at 1310 nm:	0.5 dB/km
Max Attenuation at 1550 nm:	0.5 dB/km
Wavelength:	1310 nm / 1550 nm
10 Gigabit Ethernet Performance:	10,000 m / 40,000 m
1 Gigabit Ethernet Performance:	5,000 m / -

Min Overfilled Launch (OFL) Bandwidth:	0
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Mechanical Characteristics

Min Bend Radius During Installation:	10x Cable OD
Min Bend Radius During Operation:	20x Cable OD
Max Tensile Strength During Installation:	20 N (900 lbf)
Max Tensile Strength During Operation:	67 N (300 lbf)

Temperature Range

Operating Temp Range:	0C to +70C
Installation Temp Range:	0C to +60C
Storage Temp Range:	-40C to +70C

Standards

UL Rating/Flame Test:	Plenum
CEC/C(UL) Specification:	OFNP
Telecommunications Standards:	ANSI/ICEA S-83-596
RoHS:	Yes

2.11 SINGLE-MODE OPTICAL FIBER CONNECTORS

- A. Provide Belden FX Field-Termination Pigtail, OS2, LC Simplex, Tight Buffer 900 um, Color-Coded FTSLC900PR12, or equal, on each end of all fiber optic cable strand(s). Fiber Optic Field-Termination Pigtail to be spliced into the Belden AX103912 Fiber-Express Ultra 8 inches Splice Tray with splice sleeves (use heat shrink protection sleeves #FXFUS900AB25). LC Connectors shall meet the following specifications:

Mechanical Specifications

Test	GR-326-CORE/1081-CORE (SM)
Intermateability Requirement	Compliant with TIA-604-3 (FOCIS 3)
Operating Temp Range	-40°C to +75°C
Storage Temp Range	-40°C to +60°C
Durability	500 cycles, less than 0.2 dB change, FOTP-21

Mechanical Characteristics

Maximum Insertion Loss:	0.50 dB
Typical Insertion Loss:	0.20 dB
Minimum Reflectance @ 1550nm:	-30 dB
Termination Style:	Mechanical
Interconnection Compatibility:	Compliant with TIA-604-3 (FOCIS 3)
Durabilities@Termination1:	500 cycles, less than 0.2 dB change, FOTP-21

Standards

Telecommunications Standards:	TIA 568-C.3
EU Directive 2011/65/EU (ROHS II):	Yes
EU RoHS Compliance Date (yyyy-mm-dd):	2006-07-01
Mill Order #39 (China RoHS):	EUP 50
Safety Listing:	ACA

2.12 OPTICAL FIBER PATCH CORDS

- A. Provide six (6), 2 Meter duplex single-mode (LC to LC) fiber optic jumpers (patch cords) for use with Optical System Patch Panels. Each fiber optic jumper shall be a duplex Zipcord Cable Both ends shall be terminated with Duplex LC Ceramic single-mode connectors. Fiber Optic Jumpers shall be Belden Fiber-Express FPSLALA002M or equal, and meet the following specifications:

Description	FX OM1	FX OM3	FX OM4	FX SM	FX SM/APC
Cable Performance - LC/SC/ST					
IL Max. 850 nm/1300 nm (dB/Km)	3.5/1.2	3.0/1.2	3.0/1.0	---	
IL Max. 1310 nm/1550 nm (dB/Km)	---			0.5/0.5	
Fire Rating	LC/SC/ST: Riser				
Cable Style	LC: Interconnect Simplex Zip 2 mm LC Uniboot: Interconnect Mini-Round 2 mm SC/ST/Hybrid: Interconnect Duplex Zip 3 mm				
Jacket Color	Orange	Aqua	Erika Violet	Yellow	Yellow
Connector Performance - LC/SC/ST					

IL Max. (dB)	0.25	0.25	0.15	0.35	0.35
Polish - RL Typ. (dB)	PC – 30			UPC - 55 ⁵	APC - 65
Polarity	A-TO-B / B-TO-A ³				
Connector Color	Beige	Aqua	Erika Violet	Blue ² ₁	Green

2.13 TELEPHONE AND DATA SYSTEM PATCH CORDS

A. Provide (1) four-pair Belden CAT6 Modular Patch Cord Small Diameter CAT6 Patch Cord, or equal, for each telephone and data system information outlet installed in the project. Each patch cord shall have eight unshielded twisted-pair 28 AWG Stranded copper conductors (i.e., four pairs), meeting the specifications for Data System Distribution Cabling and as detailed in this specification. Each patch cord shall be terminated with a Category 6 RJ45 data system copper connector on each end and meet the following:

1. Category 6 Patch Cord Requirement:
 - a. All patch cords shall exceed TIA and ISO/IEC Category 6/Class E specifications.
 - b. The patch cords shall incorporate an anti-snag feature that provides maximum protection from snagging during moves and re-arrangements.
 - c. Patch cords shall be UL listed; UL-C certified.
 - d. Patch cords shall support network line speeds in excess of 1 gigabit per second.

**Transmission Characteristics
 (Connectivity)**

Performance Table 1:

Frequency (MHz)	Max. Insertion Loss TIA* (dB)	Max. Insertion Loss Belden (dB)	Min. PSNEXT TIA* (dB)	Min. PSNEXT Belden (dB)	Min. PSACRF TIA* (dB)	Min. PSACRF Belden (dB)
1.000	2.400	2.000	72.300	73.300	64.800	67.800
4.000	4.500	3.700	63.300	64.300	52.800	55.800
8.000	6.400	5.200	58.800	61.300	46.700	49.700
10.000	7.100	5.900	57.300	59.800	44.800	47.800
16.000	9.100	7.400	54.200	56.600	40.700	43.700
20.000	10.200	8.300	52.800	55.100	38.800	41.800
25.000	11.400	9.300	51.300	53.500	36.800	39.800
31.250	12.800	10.400	49.900	52.000	34.900	37.900
62.500	18.500	14.900	45.400	47.100	28.900	31.900
100.000	23.800	19.000	42.300	43.800	24.800	27.800
200.000	34.800	27.500	37.800	38.900	18.800	21.800
250.000	39.400	31.000	36.300	37.300	16.800	19.800
300.000		34.200		36.100		18.300

Performance Table 2:

Frequency (MHz)	Min. Return Loss TIA* (dB)	Min. Return Loss Belden (dB)	Min. Balanced TCL TIA* (dB)	Min. Balanced TCL Belden (dB)
1.000	20.000	20.000	40.000	40.000
4.000	23.000	23.000	40.000	40.000
8.000	24.500	24.500	40.000	40.000
10.000	25.000	25.000	40.000	40.000
16.000	25.000	25.000	38.000	38.000
20.000	25.000	25.000	37.000	37.000
25.000	24.200	24.300	36.000	36.000
31.250	23.300	23.800	35.100	35.100
62.500	20.700	21.500	32.000	32.000
100.000	19.000	20.800	30.000	30.000
200.000	16.400	18.700	27.000	27.000
250.000	15.600	18.000	26.000	26.000
300.000		17.500		

2. Provide the following:
 - a. 50 percent of Patch Cords shall be 1ft. Belden #C6D1106001 Cat6 Patch Cord, or equal, (No Known Equal).
 - b. 25 percent of Patch Cords shall be 3ft. Belden #C6D1106003 Cat6 Patch Cord, or equal, (No Known Equal).
 - c. 25 percent of Patch Cords shall be 6ft. Belden #C6D1106006 Cat6 Patch Cord, or equal, (No Known Equal).

3. Deliver all data system Patch Cords to the University Representative.
 - a. The Contractor is not required to install patch cords.

2.14 TELECOM ROOM DATA SYSTEM EQUIPMENT RACKS, HARDWARE AND GROUNDING

- A. Provide Data System Equipment Rack(s) and associated hardware as shown on the drawings.
1. Provide standard 3” deep channel 19” wide and 84” high Data System Equipment Rack(s) as shown on drawings. Equipment Rack(s) shall be Chatsworth Products Inc. 55053-703 UL Listed, or equal.
 2. Each rack shall have a load-carrying capacity of 1000lbs.
 3. Provide one (1) Chatsworth Products 11729-703, or equal, Double-Sided Wide Vertical Cabling Section on each side of each Data System Equipment Rack.
 4. Provide Chatsworth Products 12100-718, or equal, Cable Runway Radius Drop, two (2) per Data System Equipment Rack.
 5. Provide Chatsworth Products 31472-718, Alternate Space Cable Runway, or equal, over Data System Equipment Rack. Provide all associated hardware as required for a complete installation.
 6. Provide Chatsworth Products 10250-718, Universal Cable Runway, or equal, over Data System Equipment Rack. Provide all associated hardware as required for a complete installation.
 7. Provide two (2) CPI 13239-757 Horizontal Rack-Mount Power Strip with Ten (10) Outlets and NEMA 5-20P Straight Plug with AMP Meter, Surge Protection and Circuit Breaker, or equal, in each Data System Equipment Rack.
 8. Provide one (1) CPI 13622-012 Grounding Busbar (TMGB or TGB), BICSI & ANSI/TIA, or equal in the BDF and in each, using two-hole compression lugs on each end.
 9. Provide #6AWG green insulated, stranded THHN conductor wire, or equal, from each Data Equipment Rack(s), Cable Runway(s) and Cable Sheath(s) to the Main Telecommunications Ground Bus (BDF) or Telecommunications Ground Bus (IDF). Terminate each end of #6 conductor wire with two-hole compression lug: connect lugs to TMGB or TGB.
 10. Data Equipment Rack(s) shall be securely attached to the concrete floor using Chatsworth Products 40604-003 Racks and Frame Installation Kit, or equal. For additional strength solidly attach racks to overhead Cable Runway. When mounted in a row, maintain a minimum of 72 inches from the wall behind and 42 inches in front of the roe of racks (measured from Rack Base Plate). Where racks are shown side by side securely connect together to provide a stable system.
 11. Provide all mounting components and accessories to securely fix racks to floor, overhead cable runway and supporting walls.
 12. Provide all necessary Chatsworth Products, or equal, hardware to make a complete system as required but not limited to:
 - a. 11421-712 Wall Angle Support Kit, Cable Runway
 - b. 11302-701 Junction-Splice Kit
 - c. 40164-001 Cable Runway Ground Strap Kit
 - d. 11301-701 Butt-Splice Kit
 - e. 11310-003 Threaded Ceiling Kit, Cable Runway
 - f. 11312-718 Triangular Support Bracket, Aluminum
 - g. 10642-001 Protective End Caps
 - h. End Closing Kit

2.15 DATA SYSTEM HORIZONTAL PATCH MANAGEMENT

- A. Provide horizontal patch Management panel(s) for each Data System Equipment Rack(s). Provide one (1) CPI #30130-719 (front pathway only) 2U-high horizontal cable manager(s), or equal, above and below each 48-port patch panel and each 10 Outlet power strips (front pathway).
- B. Provide horizontal patch Management panel(s) for each Data System Equipment Rack(s). Provide CPI #30139-719 (front pathway only) 1U-high horizontal cable manager(s), or equal, where shown on the drawings.

2.16 TELEPHONE AND DATA SYSTEM LABELS

- A. Provide labels for telephone and data distribution and feeder cables to include; patch panels, frames, telephone and data outlets.
- B. The lettering on each label shall be as large as practicable. All labels shall be machine produced. Handwritten labels will not be acceptable.
- C. A standard relative orientation shall be adopted for all labels unless otherwise specified.
- D. Labels shall be robust, durable, shall resist abrasion and shall be UV inhibiting, permanent and indelible. Labels shall be proof to 140 degrees Fahrenheit.
- E. Labels shall be readily visible and shall be fixed so that they remain in a visible position wherever practical.
- F. Labels shall carry the full complement of characters to designate the unique identification for the item that they identify.
- G. Horizontal Telephone and Data Cable Labels: Provide Self-Laminating Vinyl (wrap around type) Cables Labels Brady Corporation, or equal. Cable Labels shall have a white printing area with black print. Cables Labels shall be preprinted or computer printed type. Cable Labels shall meet the legibility, defacement, exposure and adhesion requirements of UL 969. Handwritten Labels are not acceptable.
- H. Termination Frame (110 Blocks and Patch Panels) Labels. Provide pre-printed labels on card for 110 blocks. Label each frame on the front, enabling terminations to be clearly identified. Cable terminations on frames shall be uniquely labeled on strict numerical order with the lowest numbered cable to the top left of the allocated portions of the frame.

2.17 TELEPHONE SYSTEM BACK BOARDS – TELECOM ROOM(S)

- A. Provide telephone system plywood backboards (4-foot by 8-foot by $\frac{3}{4}$ -inch) on all walls starting at 6-inch AFF to 8-foot 6-inches AFF. Each plywood backboard shall be fire-retardant plywood, painted with two coats of white fire-retardant intumescent paint with one (1) fire rating stamp per sheet of plywood masked prior to painting and visible after installation. Exposed edges shall be chamfered, with no exposed screws, bolts, washers, or other protruding fastenings.

2.18 TELEPHONE DATA SYSTEM NON-CONTINUOUS J-HOOK CABLE SUPPORTS

- A. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cable; UL Listed. Non-continuous cable supports shall have flared edges to prevent damage while installing cables. Non-continuous cable supports sized 1-5/16-inch and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces. Note: no more than two-inch (2.5") maximum cable bundle diameter will be allowed for any one (1) non-continuous cable support.

2.19 TELEPHONE DATA SYSTEM WIRE BASKET CABLE TRAY SUPPORT PATHWAYS

- A. Except as otherwise indicated, provide wire basket cable tray support system, Cooper B-Line Flex Tray, or equal, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards and with the following additional construction features.
- B. Pre-galvanized Zinc Finish: Straight sections, fitting side rails, rungs and covers shall be made from carbon steel wire meeting the minimum mechanical properties in accordance with ASTM A641 SS for Zinc Coated (Galvanized) Carbon Steel Wire.
- C. Provide wire basket cable tray of types and sizes necessary with connector assemblies, clamp assemblies connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces in compliance with applicable standards.
- D. Wire basket cable tray systems are defined to include but are limited to straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, dropouts, supports and accessories.
- E. All straight section longitude wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
- F. Wire basket cable tray shall be made of high strength steel wires and formed into a standard 2 inch by 4-inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
- G. All fittings shall be field formed from straight sections in accordance with manufacturer's instructions.
- H. Wire Basket cable tray supports shall be trapeze type hangers or wall brackets supplied by manufacture. No center type support hanger will be allowed.
- I. Wire basket cable tray system installation shall be per manufacture directions and shall meet all seismic requirements. Use the proper installation tools: e.g. Cleanshear or Angular Bolt Cutters for cutting tools.
- J. Provide all special accessories (e.g. radius shields, cable dropouts, cable rollers, etc.) and fittings as required to protect, support and install a wire basket cable tray system.

- K. Wire basket sizes shall have 4-inch minimum usable load depth.
- L. All fittings must have a minimum radius of 12 inches.

2.20 GROUNDING AND BONDING

- A. Materials: Comply with NFPA 70, TIA-607, and UL 467.

2.21 IDENTIFICATION PRODUCTS

- A. Manufacturers;
 - 1. Brady Corporation, Inc.
 - 2. Panduit Corp.
 - 3. Hellerman-Tyton.
 - 4. Kroy LLC.
- B. Comply with TIA-606-A Class 3 and University Standards for Telecom Identification.
- C. Cable Labels: Self-Laminating Vinyl Cables Labels, machine printed with alphanumeric cable designations.

2.22 SOURCE QUALITY CONTROL

- A. Each Single-mode Fiber-Optic Cable (all stands) shall be tested at factory before shipping at 1310 and 1550 nm.

PART 3 - EXECUTION

3.1 INSTALLATION STANDARDS

- A. Comply with BICSI Information Technology Systems Installation Methods Manual to include ANSI/TIA-568-B.1, ANSI/TIA-568-B.2, ANSI/TIA-568-B.3, and ANSI/TIA-569-A.
- B. Installation and certification of all unshielded twisted pair (UTP) cabling in accordance with the latest available ANSI/TIA requirements for cabling installations is required.
- C. Cabling Systems and Pathways shall be installed in a “neat and workmanlike manner” as specified by ANSI/NECA/BICSI 568-2001 and National Electrical Code (NEC) Sections 110-12 and 800-6
- D. The Contractor shall adhere to and comply with the latest versions and/or revisions of each applicable standard. Among the various standards, guidelines and practices applicable to this project are the following.
 - 1. Building Industry Consulting Services International (BICSI)

2. BICSI Telecommunications Distribution Methods Manual (TDMM 13th edition)
3. California Building Standards Commission
4. California Electrical Code (2016) Title 24, Part 3
5. Federal Communications Commission (FCC)
6. FCC Part 68.5 Establishment of Telephone Premises Wiring Attestation List
7. Insulated Cable Engineers Association (ICEA)
8. National Electrical Manufacturers Association (NEMA)
9. NEMA WC 66 (2014) Premises Wiring
10. National Fire Protection Association (NFPA)
11. NFPA 70 (2017) National Electric Code
12. American National Standards Institute (ANSI) / Telecommunications Industry Association (TIA)
13. ANSI/TIA-526-14A (2015) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – OFSTP-14
14. ANSI/TIA-568-B.1 (2004) Commercial Building Telecommunications Wiring Standard
15. ANSI/TIA-568-B.2 (2003) Commercial Building Telecommunications Standard
16. ANSI/TIA-568-B.3 (2002) Optical Fiber Cabling Components Standard (ANSI/TIA-568-B.3-2000)
17. ANSI/TIA-569-A 1-7 (R. 2001) Commercial Building Standard for Telecommunications Pathways and Spaces
18. ANSI/TIA-606 (2017) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
19. ANSI/J-STD-607-A (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
20. ANSI/TIA-758 (2012) Customer-Owned Outside Plant Telecommunications Cabling Standard
21. Underwriters Laboratories Inc. (UL)
22. UL 444 (R. 2017) Communications Cables
23. UL 467 (R. 2013) Grounding and Bonding Equipment
24. UL 497 (R. 2001) Safety Protector for Paired Conductor Communication Circuit
25. UL 514C (R. 2014) Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
26. For Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air Please Refer to NFPA 262 (2019) Standard Method of Test for Fire and Smoke Characteristics of Wires and Cables
27. UL 969 (R. 2017) Marketing and Labeling Systems
28. UL 1286 (R. 2008) Office Furnishings
29. UL 1581 (R.2001) Electrical Wires, Cables and Flexible Cords
30. UL 1666 (R. 2012) Flame Propagation Height of Electrical and Optical-Fiber Cables Installed in Vertical Shafts
31. UL 1863 (R. 2004) Communication Circuit Accessories

E. In reviewing the various Contract Documents, the Contractor shall be responsible for noting conflicts between proposed design/concepts and the applicable standards, guidelines and practices provided by the University. A written Request for Information (RFI) shall be developed by the Contractor and submitted to the University representative prior to commencing any work impacted by such conflicts. Such RFI's shall describe the conflict/violation and, if appropriate, recommended alternative solutions with associated costs.

- F. Where the requirements of the Contract Documents are more stringent than applicable codes, rules, regulations, ordinances, standards, guidelines and practice, the Contract Document shall apply. In all other instances, the most current standards, guidelines and practices shall apply.
- G. Federal, state, local codes, rules, regulations and ordinances governing the work shall be incorporated as part of these Technical Specifications.

3.2 EXAMINATION

- A. Examine pathway elements intended for cables.
 - 1. Verify proposed routes of pathways, Check raceways, cable trays, J-Hooks and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation and other conditions affecting installation. Verify that cabling can be installed complying with EMI clearance requirements.
 - 2. Identify plan to support cables in suspended and/or open ceilings from the cable tray, conduit sizes and/or J-Hooks to the workstation locations. Verify that load capacity if cable support structures is adequate for each pathway.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 EXAMINATION

- A. Backbone Fiber Optic Riser Distribution Cable for Data Service: Use 8.3/125 single-mode fiber-optic cable for runs between the BDF and each IDF(s).
- B. Backbone Copper Riser Cable for Voice Service: Use Listed (as required for installation) Category 3 cable for runs between the BDF and each IDF(s).
- C. Horizontal Copper Cable for Data Service: Use UTP Category 6 cable (color blue) for wiring runs between the BDF and IDF(s) to workstations, cameras, lighting control, card access, energy management system or other outlet identified a Data.
- D. Horizontal Copper Cable for Voice Service: Use UTP Category 6 cable (color blue) for wiring runs between the BDF and IDF(s) to workstation outlets.

3.4 TELEPHONE SYSTEM INSTALLATION DETAILS

- A. Telephone System Plywood Backboards, 110 wiring blocks and Patch Panels:
 - 1. Provide telephone system plywood backboards in the BDF Room and in each of the IDF Rooms located on each floor of the building. Securely fix backboards to the walls in the locations as shown on the drawings.
 - 2. Provide Telephone system 110 wiring blocks with patch management in the BDF Room. Securely fix each panel to the telephone system backboard.
 - 3. Provide all sufficient number of Telephone Patch Panels in Data System Equipment Rack to house all Telephone system information outlet connectors.

B. Telephone System Distribution Cables and Connectors:

1. Provide telephone distribution cable(s) running from each telephone outlet to the BDF and/or IDF Patch Panel on that floor. Provide telephone system distribution cable(s) at each combined telephone/data and/or telephone only outlet location.
2. Terminate each telephone system distribution cable(s) with an information outlet connector REVConnect RV6MJKGY at the outlet end and on patch panel in the BDF or IDF end of the cable. Use the TIA-T568B wiring configuration, as defined in the ANSI/TIA-568-A-1995 Commercial Building Telecommunications Cabling Standard as detailed below:

<u>Patch Panel</u>	<u>Conductor Color</u>	<u>Connector Pin</u>
Pair 1	White/Blue	Pin 5
	Blue/White	Pin 4
Pair 2	White/Orange	Pin 1
	Orange/White	Pin 2
Pair 3	White/Green	Pin 3
	Green/White	Pin 6
Pair 4	White/Brown	Pin 8
	Brown/White	Pin 7

C. Telephone System Riser Cables:

1. Provide telephone system riser cables between the telephone system 110 wall mount blocks located in the BDF Telecom Room and each voice grade patch panel located in data equipment rack of the IDF or BDF Room on each floor. Terminate all pairs of feeder cable in sequential order on the 110 blocks with 110C-5's on BDF side and pairs 1 thru 48 on IDF or BDF voice grade patch panel side in data equipment rack.

D. Telephone System Cross-Connects:

1. All Telephone System Cross-Connects will be installed by the University. Coordinate installation needs with University Representative in a timely manner as to not create a scheduling problem.

E. Telephone and /or Data System Faceplates:

1. Provide one (1) 4-port Faceplate at each combination telephone/data and/or telephone only and/or data only outlet location. Fix each faceplate to the electrical back box with its full complement of screws.
2. Provide all Faceplates as shown on drawings.
3. Fix data and telephone connectors in the openings of the faceplate. Locate a blanking plate(s) in all unused openings in each faceplate.
4. Provide one (1) single Port Stainless Steel Faceplate (Wall+42" AFF) at each telephone only outlet.

3.5 DATA SYSTEM INSTALLATION DETAILS

A. Data System Equipment Racks:

1. Provide Data System Equipment Racks in each BDF and/or IDF Telecom Room in the locations shown on the floor plans. Securely fix each rack to the floor and overhead cable runway.

B. Data System Patch Panels:

1. Provide Data System Patch Panels in the equipment racks located in the BDF and/or IDF Telecom Room.
2. Provide a sufficient number of Data Patch Panels to house all Data system information outlet connectors.
3. Provide one 2U horizontal cable manager above and below each patch panel and power strip to allow for the horizontal routing of cables. Provide 1U horizontal cable managers where shown on the drawings.

C. Data System Distribution Cables and Connectors:

1. Provide horizontal data system distribution cable(s) running from each data outlet to the BDF and/or IDF Telecom Room data system patch panel on that floor. Provide data system distribution cable(s) at each combined telephone/data and/or data only outlet location shown on drawings.
2. Terminate each data system distribution cable with an information outlet connector (REVConnect RV6MJKUBK) at outlet end of the cable. Use the TIA-T568B wiring configuration, as defined in the ANSI/TIA cabling standard for premises horizontal wiring shown below.

<u>Patch Panel</u>	<u>Conductor Color</u>	<u>Connector Pin</u>
Pair 1	White/Blue	Pin 5
	Blue/White	Pin 4
Pair 2	White/Orange	Pin 1
	Orange/White	Pin 2
Pair 3	White/Green	Pin 3
	Green/White	Pin 6
Pair 4	White/Brown	Pin 8
	Brown/White	Pin 7

3. Install station cables using the most direct route possible between outlet and patch panel while using the conduit, J-Hooks and/or cable tray. Avoid distribution cables that are in excess of 250 feet in length.

D. Telephone and/or Data System Faceplates:

1. Provide one (1) 4 Port Faceplate at each combination telephone/data and/or telephone only and/or data only outlet location. Fix each faceplate to the electrical back box with its full complement of screws.

2. Provide all Faceplates as shown on drawings.
3. Fix data and telephone connectors in the openings of the faceplate. Locate a blanking plate(s) in all unused openings in each faceplate.

3.6 OPTICAL FIBER RISER CABLE

A. Optical Fiber Riser Cabling:

1. Provide optical fiber riser cabling as shown on drawings running between the BDF Telecom Room fiber termination unit (FTU) connector panel(s) and each IDF Telecom Room FTU connector panel(s).

3.7 INSTALLATION PRACTICE

A. Comply with NECA 1.

- #### **B. Wiring Method:** Install cables in raceway and/or using conduit, J-Hooks and/or cable tray except within consoles, cabinets, desks and counters and in gypsum board partitions where unenclosed wiring method may be used. Use UL-Listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfurnished spaces.

C. Telephone/Data Cable Installation:

1. Install cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
2. Make terminations only at indicated outlets, terminals and cross-connect and/or patch panels.
3. Pulling Cable: Do not exceed manufacturers written recommended pulling tensions. Do not install bruised, kinked, scored, deformed or abraded cable. Do not splice cable between termination, taps, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
4. Secure and support cable at intervals 48" to 60" and not more than 6" from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Keep Cable bundles to no more than two-inch (2") maximum diameter to include being installed in any one (1) non-continuous (J-Hook) cable support.
6. Where Cables enter conduit stub-ups above outlet boxes or surface mounted raceways, provide minimum ten-inch (10") diameter service loop with two (2) wraps.
7. Install UTP cables using techniques, practices, and methods that are consistent with Category 6 rating if components and that ensure Category 6 performance of completed and linked signal paths, end to end.

D. Wiring within Wiring Closets and Enclosures:

1. Use cable strain relief brackets behind all patch panels to prevent straining connections to prevent bending cables to smaller radii than minimum recommended by manufacturer.

E. Separation from EMI Sources: Comply with BISCII TDMM and TIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI

sources, including electrical power lines and equipment. Comply with the following separation distances from possible sources of EMI:

1. Separation between unshielded power lines or electrical equipment in proximity to open cables or cables in nonmetallic raceways is as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: 24 inches.
 2. Separation between unshielded power lines or electrical equipment in proximity to cables in grounded metallic raceways is as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: 12 inches.
 3. Separation between power lines and electrical equipment located in grounded metallic conduits or enclosures in proximity to cables in ground metallic raceways is as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: 6 inches.
 4. Electrical Motors and Transformers, 5kVA or HP and larger: 48 inches.
 5. Fluorescent Fixtures: 5 inches.
- F. Do not untwist more than ¼ inch of Category 6 cables at connector terminations.
- G. Provide grommets and strain-relief for cables terminating on wall-mounted user outlets to ensure durable and robust connections. Leave a 4-inch (4”) slack loop in each cable neatly coiled (no more than twelve-inches 12”) in the outlet back box at each termination location.
- H. Take due account if the minimum bend radius of the all cables installed. No cables shall be installed in a fashion the contravenes the minimum bend radius of the cable.
- I. Provide all cables in straight parallel runs when on cable trays and/or J-Hooks. Hold cables running in vertical direction in place with broad cable ties at not more than 15” centers. Hold cables running in the horizontal direction in place with broad cable ties at no more than 48” centers.
- J. Telephone and data system cables shall run in dedicated cable tray, J-Hooks and/or conduit pathways provided for data and telephone system use only. DO not tie communication system cables to power or other foreign services. All cabling shall run parallel or at right angles to building wall structures.
- K. Reinstate and/or provide mule-tape (pull-wire) in all conduits after use to facilitate future addition of cables.

- L. Provide and install fire-stopping in accordance with all local and NFPA regulations to sustain ratings when passing through (floors, walls or ceiling) with; conduits, sleeves, raceway, cable tray, wire basket cable tray through fire-rated elements.
- M. Install all cables in complete runs from outlet or patch panel to patch panel. In-line joints, splices, distribution points, or other intermediate connections are not permitted.
- N. The Contractor shall individually and properly ground all voice (110) termination frames, data system equipment racks, building entrance terminals, copper riser sheaths and cable runway with #6 AWG green stranded wire to the TMGB or TGB using two-hole compression lugs on each end. Note individual copper riser cable(s) sheaths at BDF backboard location maybe bonded braid with eyelets (3M#25T-BBE3) or approved equal, then with a single #6AWG ground wire to TMGB when more than one riser cable exists. Not every cable sheath has to be bonded with #6AWG to TMGB.

3.8 WIRE BASKET CABLE TRAY INSTALLATION

- A. Install wire basket cable tray in accordance with NEMA VE 2 to ensure that the cable tray equipment complies with the requirements of the NEC, applicable portions of NFPA 70B, and the National Electrical Contractors Association's (NECA) Guide to Quality Electrical Installations pertaining to general electrical installations practices.
- B. Install wire basket cable tray system to meet all current code required Seismic requirements.
- C. Coordinate wire basket tray with other electrical work as necessary to properly interface installation if wire basket cable tray with other work.
- D. Install expansion connectors where recommended by manufacturer.
- E. Support wire basket cable tray and fasten to building structure. Install supports at each connection point, at the end of each run, and at the other points to maintain spacing between supports of eight-foot-zero-inch (8'-0") maximum.
- F. Support wire basket cable tray with three-eighths of an inch (3/8") diameter minimum size all-threaded rod, trapeze style (dual rod attachment) allowed only, no center hung style (single rod attachment) will be allowed, when wire basket cable tray is suspended from the ceiling above.
- G. Provide sufficient space around wire basket cable tray to permit access for installing and maintaining cables.
- H. Install firestopping in accordance with NFPA and Building Code requirements when passing through all fire-rated elements: e.g. walls, floors, ceilings, roofs.
- I. Ground and Bond metal cable tray in accordance with NFPA 70, NEC, Article 392.
 - 1. Provide continuity between wire basket cable tray components.
 - 2. Make connections to tray using mechanical, compression or exothermic connectors.

- J. Comply with the appropriate Division 26 Section for “Grounding and Bonding” and with TIA 607.

3.9 GROUNDING

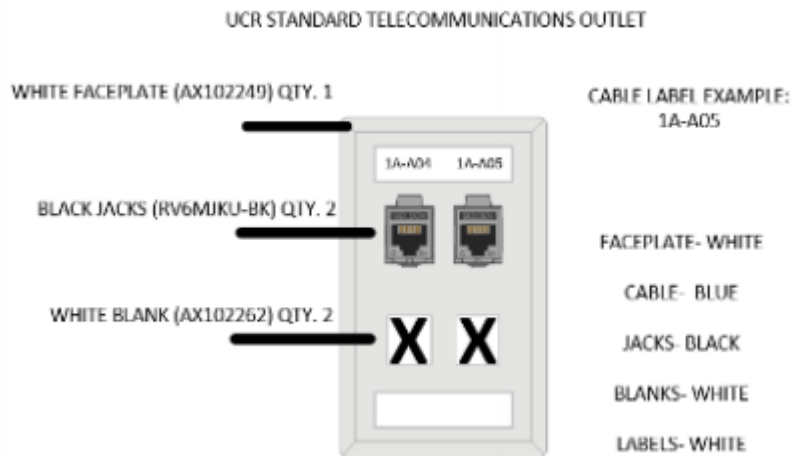
- A. Comply with the appropriate Division 26 Section for “Grounding and Bonding” and with TIA 607.
- B. Grounding Points:
 - 1. Locate grounding busbars (MTGB) in BDF and (TGB) in each IDF Telecom Rooms.
 - 2. Provide a ground connection from all voice termination frames, data system equipment racks, copper riser sheaths and cable runways to the grounding terminals in the MDF/BDF and IDF’s.

3.10 LABELING AND NUMERING CONVENTIONS

- A. General.
 - 1. Outlets, cables, and terminations shall be labeled with a standard identification tag. Tags shall be typewritten or stamped with indelible waterproof ink and mechanically secured in a permanent fashion. Handwritten labels are NOT acceptable. Labels shall be mounted in a manner, which permits easy access and viewing. Receptacles, cables, and terminations shall be identified using the following conventions.
 - a. Outside Plant and Riser Cable:
 - 1) Telephone cable(s) will have cable ID and pair counts, from and to locations clearly marked on each cable and building equipment room punch down blocks.
 - 2) Optical fiber cable will have cable ID and strand count, from and to locations clearly marked on each building equipment room fiber optic patch panel.
 - 2. Label each cable so that the label is visible for inspection.
- B. Station Cable:
 - 1. Label each component of the telephone and data systems with its unique identification number using TIA 606-A Class 3 standards. The labeling and numbering scheme shall be compatible with the labeling and numbering scheme currently used by the University of California, Riverside. The labeling and numbering scheme used by the Contractor shall be approved by the University Representative.
 - 2. All labeling will follow the TIA 606-A Class 3 standard. Each telecommunications room; e.g. BDF or IDF will have a letter (A,B,C, etc.) assigned on each floor.
 - 3. The Station label will follow the format listed in this section. However, the top label indicates both top ports i.e. “1A-A04 1A-A05”. “1” identifies the 1st Floor, “A” identifies IDF/Closet # “A04 and A05” represents the Panel number (“A”) and the port numbers

(“04 and 05”). The first patch panel port number will always be the left face plate port and the second patch panel port number will always be the right face plate port. The bottom label will follow the same guidelines when used. When used the labels will be left blank. The font size will be the largest size that fits the required information but no smaller than 10-point font. Voice jacks shall start at the top left position on the wall plate left to right top to bottom Data jacks shall start at the next open lower row after all voice jack locations are populated. The voice jacks shall be gray for analog, elevators and emergency outlets and the data jacks shall be black. Data and voice cables are blue.

C. Typical 4-Port faceplate (2-Data):



D. The cable serving each receptacle must be labeled at the receptacle and patch panel or 110 wiring blocks with wrap-around label. Label each cable (voice or data) so that the label is within 2” of the end of the cable at the 48-port data system patch panel end or 110 wiring block and at each outlet end.

E. Connectors:

1. Label each connector at each outlet (faceplate) location. The label shall be clearly visible for inspection.

F. Telephone System Termination 110 Block:

1. Termination 110 Block Labels. Provide a full complement of pre-printed cardboard patch frame labels, allowing each pair of each telephone system distribution, feeder and external cable to be clearly identified. Telephone feeder cable pairs at terminal frames shall identify telephone outlet that they are connected to via the telephone station cable.

G. Data System Patch Panels:

1. Provide a full complement of data system patch panel labels, allowing each data system distribution and feeder cable connector to be clearly identified. Both copper and fiber connectors shall be labeled.

3.11 IDENTIFICATION

- A. Cabling Administration Drawings: Show building floor plans with cable administration-point labeling. Identify labeling convention and show labels for telecom rooms, backbone pathways and cables, entrance pathways and cable, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIS-606-A. Furnish electronic record of all drawings.

3.12 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
- B. Category 6 UTP Cabling Tests:
 - 1. Tests shall include all tests of Category 6, conducted from 1 to 300 MHz
 - 2. Channel and permanent link tests shall be performed with a tester that complies with performance requirements in TIA-568-B-2, Level III. Include tests for longitude or transverse conversion loss.
 - 3. Performance shall comply with minimum criteria in TIA-568B.1 & B.2.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table in BICSI TDM, or transferred from the instrument to the computer, saved as test files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. Retest and inspect cabling to determine compliance of replaced or additional work with specified requirements.

3.13 TESTING

- A. General:
 - 1. Acceptance testing by the University Representative shall not occur until all work in the Telecom Room is completed, Including but not limited to mounting and installation of fiber riser cables, Backboards, terminating boxes and cabinets, and grounding blocks, and termination of fiber riser cables, copper riser cables, station wires, or any other work necessary for completion of the installation. Acceptance testing shall be in compliance with TIA-568-B.1, B.2 & B.3.
 - 2. The university Representative shall have the right to schedule acceptance testing at its convenience.
 - 3. A University Representative, at the option of the University Representative, shall be present during testing.
 - 4. Such acceptance testing shall in no way reduce the Contractor's obligations regarding restoration, clean up, or warranty.

5. Contractor shall perform tests necessary prior to acceptance testing to ensure that the installed cables will pass acceptance testing performed in conjunction with University Representative.
6. Contractor shall be responsible for performing, tracking, and recording the results of tests.
7. Contractor shall be responsible for providing equipment and materials necessary for as long a period of time as necessary to complete testing to satisfaction of the University Representative.
8. Test record forms shall be agreed to by the University Representative prior to the commencement of acceptance testing.
9. When testing is completed on cables, the Contractor shall deliver typewritten records of the test results to the appropriate University Representative within 72 hours of completion of such test results.

B. Telephone and Data (copper & fiber) BDF to IDF Riser Cables:

1. A visual inspection shall be made to ensure that the cables have been terminated on the punch down block in proper color code order. An end-to end continuity test is to be made for each pair to insure wire continuity and correct tip and ring polarity. Riser cables will be tested from the BDF 110 frame punch down blocks to each IDF Telecom Room patch panel that the cable serves.
2. Vertical and horizontal riser cables will be tested to ensure that they meet the current requirements of TIA cabling standard for premises horizontal wiring for the category of cable being installed, i.e., Category 3 cable shall meet Category 3 parameters within 25-pair binder group. Documentation will include ID; pair ID, from and to points, pair ID marked on the punch down blocks, results of testing, and as-built information.
3. Bad pairs in copper cables shall be limited to a maximum of 0 percent of the total number of pairs.
4. Measures taken to correct unacceptable test results will be recorded, along with loss measurements taken before and after corrective measures.
5. Acceptance testing shall be completed prior to completion of Contractors contractual obligations.
6. Documentation will include cable ID, from and to points, strand ID, bi-directional attenuation figures in db., OTDR wave forms, and as-built information.
7. Use of an OTDR may require that a "launch reel" be used to overcome the OTDR's dead zone. Include this information in the as-build documentation.
8. Fiber jumpers used with the OTDR, light source, and power meter must be of the same size and type as the fiber being tested.
9. Fiber jumpers used with the light source and attaching the jumper from the light source via a coupler to the jumper from the power meter shall zero power meters out. This reading noted will become the reference level to obtain a true attenuation reading (some power meters can be zeroed to allow reading the attenuation level directly).

C. Horizontal Station Cables:

1. Visual inspection will be made to ensure that all cables have been terminated on the punch down block and on the eight-position station jack in proper color code order.
2. Four-pair station cables attached between station voice jacks and floor equipment room punch down blocks will be link tested with a cable analyzer to ensure compliance with current TIA cabling standard Category 6 parameters. Four-pair station cables attached

between data station jacks and floor equipment room jack fields will be link tested with a cable analyzer to ensure compliance with TIA cabling standard Category 6 parameters. All pairs shall test good and meet Category 6 parameters. Open, split, miss-terminated pairs, deviations from the manufacturer's installation specifications, defective connections, and bad installation practices will not be accepted and must be corrected. Test 100% of station wire in both directions with a certified Category 6 handheld tester, such as the Fluke Networks Versiv DSX-8000 Cable Analyzer with Linkware Management Software, and other test equipment as necessary to assure proper termination sequences, continuity, and Category 6 compliance. Station cables shall have NO bad pairs.

3. When station wire is determined to be acceptable, University Representative may spot test the plan using a certified Category 6 handheld tester, such as the Fluke Networks Versiv DSX-8000 Cable Analyzer test set with Linkware Management Software.
4. Test results shall meet or exceed the Category 6 test requirements as specified in the TIA cabling standard for premises horizontal wiring specifications. The approved Category 6 handheld tester will have the capacity to be programmed with current Category 6 requirements as specified in the TIA cabling standard for premises horizontal wiring.
5. Documentation will include cable ID (same as jack ID) to be marked on the punch down block in the communication closet, station jack ID to be marked on the station jack, and results of Category 6 channel testing done with the cable analyzer. Analyzer documentation of testing shall consist of test results recorded in a ".txt" or ".csv" file on a USB drive and on hard copy installed in a ring binder. The designated University Representative as part of the inspection and acceptance procedure shall verify test results.

D. Test Equipment:

1. It will be the Contractor's responsibility to provide the test equipment necessary and document to the University Representative the test equipment available for testing and the last date of certification.
2. Testing equipment:
 - a. Continuity tester.
 - b. Power meter/source.
 - c. OTDR (Optical Time Domain Reflectometer).
 - d. Appropriate types of fiber jumpers.
 - e. Equipment for two testers to communicate.
 - f. Fluke Networks Versiv DSX-8000 Cable Analyzer with LinkWare Management Software.

E. Documentation:

1. The contractor shall submit three copies (drawings hard copy 24"x36" and USB drive) of the following as-built record drawings and documentation in a 3-ring binder following completion of testing (and re-certification, as necessary):
 - a. Construction Drawings: The as-built documentation shall be in AutoCAD min R2018 dwg or dxf equal and shall consist of the construction drawings with the station location numbers (faceplate identification numbers, e.g. 1A-V12, 1A-C15, etc.) inserted next to the symbol for each location. Also, Equipment Rack and Wall elevations to include to include Copper and Fiber riser diagrams shall be provided.

- b. Fiber Optic riser Test reports (OTDR and Power Meter).
- c. Copper riser Test reports (Cable No. and pair counts, open, shorts, grounds, etc.).
- d. Cat-6 Test reports to be provided in pdf file format and shall include and be arranged in:
 - 1) Overall Summary Page (numerical order)
 - 2) Telecom Room (BDF/IDF), Patch Panel (A thru Z)(numerical order)

- F. The documentation format (Test reports) will be agreed upon between the University Representative and the Contractor. The Contractor may be required to furnish licensed system software if the University is unable to view any of the Test reports submitted.

END OF SECTION 27 15 00

SECTION 271619 - COMMUNICATION PATCH CORDS, STATION CORDS, AND CROSS CONNECT WIRE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provides specifications for Category 6 and optical fiber horizontal cable patching to distribute network signals.
2. Copper Category 6 Patch Cords UTP.
3. Optical Fiber Patch Cords.

1.2 RELATED DOCUMENTS

- A.** Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B.** Architectural, mechanical, electrical, and all technology drawings.
- C.** Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.3 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.4 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected

telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.1 OPTICAL FIBER PATCH CORDS

- A. Basis-of-Design Product: Subject to compliance with requirements:
 - 1. Belden
- B. Product Options:
 - 1. The indicated manufacturers shall be the basis of the design and each assembly selected shall address the particular infrastructure requirements.
- C. Description:
 - 1. All optical fiber patch cords shall conform to the requirements of the EIA/TIA 568C.3- 1 standard performance parameters for the multimode or single-mode optical fiber and shall have the same manufacturer, cable type, connector and polish as noted for the backbone fiber.
 - 2. All optical patch cords shall have push-pull strain relief boot and duplex clip.
 - 3. All optical fiber patch cord lengths are to be provided appropriate to patching from network equipment ports to the optical fiber patch panels ports within the Data Center and IDF.
 - 4. It is the responsibility of the contractor to verify lengths and counts of optical fiber patch cords with the owner prior to purchase.
 - 5. All single-mode patch cord colors are to be industry standard yellow and provided in a duplex configuration.
 - 6. All multi-mode patch cord colors are to be industry standard aqua and provided in a duplex configuration.
 - 7. Any optical fiber patch cords purchased without written authorization by the Owner are purchased at the contractor's own risk.
- D. Accessory Products:
 - 1. Provide any accessory products related to the optical fiber connectors required to provide a complete and functional infrastructure system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation

or use of products specified in this section. Examples of work which must be checked include, but are not limited to:

1. Electrical requirements (conduit installation and capacity)
2. The telecommunications rooms are the size shown on the project drawings.
3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.2 INSTALLATION

A. Process:

1. Install all horizontal cable per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA 568 C and BICSI.
2. Category 6 equipment Patch cords: Provide (2) copper patch cords (one for each end of the cable termination) for every Category cable installed.
3. Fiber Optic Equipment Patch cords: Provide (2) fiber optic LC duplex patch cords (one for each end of fiber termination) for every pair of fiber strands installed.
4. All patch cord lengths are to be provided appropriate to patch from rack mounted network equipment ports to the rack mounted horizontal station outlet patch panel ports within the Data Center/IDF and from the workstation outlet to the computer/or other IP end device NIC card/RJ45 port.
5. Provide new, sealed patch cords in lengths, colors and counts approved in writing by the owner.
6. It will be the responsibility of the communication contractor to provide install all Category 6 and Fiber patch cords per direction and coordination of owner IT dept.

3.3 RE-INSTALLATION

- #### A.
- No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

3.4 CLOSEOUT ACTIVITIES

- #### A.
- Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- #### B.
- Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION 271619