BIDDING AND CONTRACT DOCUMENTS

FOR

SKYE HALL HVAC REPLACEMENT
PROJECT NO. 950583
CONTRACT NO. 950583-LF-2022-36

City of Riverside, County of Riverside
California

October 18, 2021
# TABLE OF CONTENTS

- Cover Page
- Table of Contents
- Certification
- Advertisement for Bids
- Project Directory
- Instructions to Bidders
- Supplementary Instructions to Bidders
- Information Available to Bidders
- Bid Form
- Bid Bond
- Agreement
- General Conditions
- Supplementary Conditions
- Exhibits
- List of Drawings
- Drawings (Under Separate Cover)
- Specifications
CERTIFICATION

Skye Hall HVAC Replacement

Bidding Documents Prepared By:

Company Name: Goss Engineering, Inc

255 E Rincon St., Suite 301
(Street Address)

Corona, CA 92879
(City, State & Zip Code)

Signed: ____________________________ Date: 10/18/21
(Signature of an Officer of the Firm Named Above)

Nicholas Ubrun, Principal
(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:

SKYE HALL HVAC REPLACEMENT
PROJECT NO. 950583
CONTRACT NO. 950583-LF-2020-100
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CALIFORNIA

Project Description: Replacement of seventeen (17) existing roof-mounted RTUs, replacement of ten (10) existing 10 VVT boxes with replacement of actuators on eighty-seven (87) existing VVT boxes, upgrade of existing controls to ALC [Automated Logic Controls] standard, new thermostats throughout the building.

Bidding and Contract Documents will be available on Monday, October 18, 2021 upon request by sending an email to kara.longtin@ucr.edu. Interested parties must use the following in the subject header:

950583 Skye Hall HVAC Replacement – Request for Bid Documents

PRE-BID CONFERENCE & SITE VISIT

A mandatory Pre-Bid Zoom conference call will take place on Wednesday, October 27, 2021 beginning promptly at 2:00 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 joins the Pre-Bid Conference after 2:05 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 Tuesday, November 16, 2021 at 2:00 PM 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
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: **C-20, Warm-Air Heating, Ventilating and Air Conditioning Contractor**.

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: **$1,600,000.00**

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA  
University of California, Riverside  
Publication Dates: October 11, 2021 – October 26, 2021
PROJECT DIRECTORY

Project Name: Skye Hall HVAC Replacement

Project Number: 950583

Location: University of California, Riverside

University: The Regents of the University of California

University’s Representative:

Tameesha D. Hayes
Project Manager
Planning, Design & Construction
University of California, Riverside
1223 University Avenue, Suite 240
Riverside, CA 92507

Tel: (951) 827-4706
Email: Scott.donnell@ucr.edu

Kara Longtin
Contract Administrator
Planning, Design & Construction
University of California, Riverside
1223 University Avenue, Suite 240
Riverside, CA 92507

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

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

Tel: (951) 827-1535
Email: Charles.blumer@ucr.edu

Design Professional:

Nick Ubrun
Principal Engineer
Goss Engineering
255 E. Main Street, Suite 301
Corona, CA. 92879

Tel: 951-363-4797
Email: nurbrun@goss-eng.com

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

TABLE OF CONTENTS

ARTICLE 1 - DEFINITIONS

ARTICLE 2 - BIDDER’S REPRESENTATIONS

ARTICLE 3 - BIDDING DOCUMENTS
  3.1 COPIES
  3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS
  3.3 PRODUCT SUBSTITUTIONS
  3.4 SUBCONTRACTORS
  3.5 ADDENDA
  3.6 BUILDER’S RISK PROPERTY INSURANCE

ARTICLE 4 - PRE-BID CONFERENCE

ARTICLE 5 - BIDDING PROCEDURES
  5.1 FORM AND STYLE OF BIDS
  5.2 BID SECURITY
  5.3 SUBMISSION OF BIDS
  5.4 MODIFICATION OR WITHDRAWAL OF BID

ARTICLE 6 - CONSIDERATION OF BIDS
  6.1 OPENING OF BIDS
  6.2 REJECTION OF BIDS
  6.3 AWARD

ARTICLE 7 - BID PROTEST
  7.1 FILING A BID PROTEST
  7.2 RESOLUTION OF BID CONTROVERSY
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 responsible 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 Wednesday, November 3, 2021.

4. A mandatory Pre-Bid Zoom conference call will take place on Wednesday, October 27, 2021 beginning promptly at 2:00 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.

   Due to COVID-19 restrictions, there will be no mandatory site visit. However, if a contractor would like to visit the site, it will be by appointment only; please contact Kara Longtin to schedule a time.

5. Bids must be received on or before the Bid Deadline and only at the location specified in the ADVERTISEMENT FOR BIDS.

6. Bids will be opened at the same location specified in the ADVERTISEMENT FOR BIDS for the receipt of bids. Apparent Low Bidder must deliver to the University, the original bid and bid bond (if required in the bid) within 24 hours of being determined as the low bidder.

7. Contractor will be assessed as liquidated damages the sum of $500.00 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 $250.00 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.

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 One original of the Agreement signed by Bidder.

.2 One original of the Payment Bond required under Article 11 of the General Conditions.

.3 One original 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](http://www.dir.ca.gov) or at [http://www.dir.ca.gov/DLSR/PWD](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: http://www.ucop.edu/procurement-services/for-suppliers/ucop-designated-construction-agreements.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:

   Surge Building Record Drawings

END OF INFORMATION AVAILABLE TO BIDDERS
### Architectural Abbreviations

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>

### Architectural General Notes

1. The following special notes apply to all architectural drawings:
   - **NOTES**: Contains special instructions, warnings, or other important information relevant to the project.
   - **CONTRACTIONS**: Contains contractions and abbreviations used throughout the project.
   - **REFERENCES**: Lists other drawings or documents that are referenced in the current drawing.
   - **APPENDIX**: Contains additional information or references not included in the main body of the drawing.

### Architectural Dimensioning Conventions

1. **NOTES**: Contains special instructions, warnings, or other important information relevant to the project.
   - **CONTRACTIONS**: Contains contractions and abbreviations used throughout the project.
   - **REFERENCES**: Lists other drawings or documents that are referenced in the current drawing.
   - **APPENDIX**: Contains additional information or references not included in the main body of the drawing.

### Symbols as Abbreviations

<table>
<thead>
<tr>
<th>S</th>
<th>T</th>
</tr>
</thead>
</table>

### General Notes & Abbreviations

- **SHEET**: Indicates the sheet number of the drawing.
- **SCALE**: Indicates the scale of the drawing.
- **NOT TO SCALE**: Indicates that the drawing is not to scale.
- **PROJECT NUMBER**: Indicates the project number associated with the drawing.
- **CONTRACTOR**: Indicates the contractor responsible for the work.
- **NOT TO SCALE**: Indicates that the drawing is not to scale.
- **PROJECT NUMBER**: Indicates the project number associated with the drawing.
- **CONTRACTOR**: Indicates the contractor responsible for the work.
<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>PLUMBING SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>1-2</td>
<td>PLUMBING DETAILS AND WATER SUPPLY</td>
</tr>
<tr>
<td>1-3</td>
<td>PLUMBING SERVICE PLUMBING</td>
</tr>
<tr>
<td>1-4</td>
<td>PLUMBING SERVICE PLUMBING</td>
</tr>
<tr>
<td>1-5</td>
<td>PLUMBING SERVICE PLUMBING</td>
</tr>
<tr>
<td>1-6</td>
<td>PLUMBING SERVICE PLUMBING</td>
</tr>
<tr>
<td>1-7</td>
<td>PLUMBING SERVICE PLUMBING</td>
</tr>
<tr>
<td>1-8</td>
<td>PLUMBING SERVICE PLUMBING</td>
</tr>
<tr>
<td>1-9</td>
<td>PLUMBING SERVICE PLUMBING</td>
</tr>
<tr>
<td>2-1</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>2-2</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>2-3</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>2-4</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>2-5</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>2-6</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>2-7</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>2-8</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>2-9</td>
<td>WATER SYSTEMS AND WATER SUPPLY</td>
</tr>
<tr>
<td>3-1</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>3-2</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>3-3</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>3-4</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>3-5</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>3-6</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>3-7</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>3-8</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>3-9</td>
<td>STRUCTURAL SUPPORTS AND CONSTRUCTION</td>
</tr>
<tr>
<td>4-1</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>4-2</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>4-3</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>4-4</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>4-5</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>4-6</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>4-7</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>4-8</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>4-9</td>
<td>ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>5-1</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>5-2</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>5-3</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>5-4</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>5-5</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>5-6</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>5-7</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>5-8</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>5-9</td>
<td>MECHANICAL SYSTEMS</td>
</tr>
</tbody>
</table>

**ARCHITECTURAL W pisc**
<table>
<thead>
<tr>
<th>FLOOR LEVEL</th>
<th>ROOM NAME</th>
<th>FLOOR</th>
<th>BASE</th>
<th>NORTH</th>
<th>EAST</th>
<th>SOUTH</th>
<th>WEST</th>
<th>CORES</th>
<th>FINISH SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### FINISH SCHEDULE

<table>
<thead>
<tr>
<th>FLOOR LEVEL</th>
<th>ROOM NAME</th>
<th>FLOOR</th>
<th>BASE</th>
<th>NORTH</th>
<th>EAST</th>
<th>SOUTH</th>
<th>WEST</th>
<th>CORES</th>
<th>REMARKS (SEE FINISH NOTES)</th>
<th>FINISH SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### FINISH LEGEND

1. SHEET 10 OF 15 OF SHEET FINISH SCHEDULE. AND FINISH SCHEDULE (SURGE)
2. FINISH SCHEDULE (SHEETS 10 -15) IS AVAILABLE FROM THE PROJECT OFFICE.
3. FOR ADDITIONAL INFORMATION AND DETAILED SPECIFICATIONS, SEE ATTACHED SHEETS.
4. SHEET 10 OF 15 OF SHEET FINISH SCHEDULE. AND FINISH SCHEDULE (SURGE)
5. SHEET 10 OF 15 OF SHEET FINISH SCHEDULE. AND FINISH SCHEDULE (SURGE)
6. SHEET 10 OF 15 OF SHEET FINISH SCHEDULE. AND FINISH SCHEDULE (SURGE)

### DRAWINGS

- SHEET A9.1.1
- SHEET A9.1.2
- SHEET A9.1.3
- SHEET A9.1.4
- SHEET A9.1.5
- SHEET A9.1.6
- SHEET A9.1.7
- SHEET A9.1.8
- SHEET A9.1.9
- SHEET A9.1.10
- SHEET A9.1.11
- SHEET A9.1.12
- SHEET A9.1.13
- SHEET A9.1.14
- SHEET A9.1.15

### ABBREVIATION

- A.C.T.: ADJUSTMENT TUBE
- C.D.: CONCRETE
- E.: ELECTRICAL
- M.E.: MECHANICAL
- P.S.: PLUMBING
- S.C.: STRUCTURAL
- T.S.: THERMAL
- V.S.: VIABILITY

### RECORD DRAWINGS

- SHEET 10 OF 15 OF SHEET FINISH SCHEDULE. AND FINISH SCHEDULE (SURGE)
<table>
<thead>
<tr>
<th>ROOM NAME</th>
<th>FLOOR</th>
<th>BASE</th>
<th>NORTH</th>
<th>EAST</th>
<th>SOUTH</th>
<th>WEST</th>
<th>CEIL</th>
<th>REMARKS (SEE FINISH NOTES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>GYM</td>
<td>2</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>*</td>
</tr>
<tr>
<td>101</td>
<td>HALL</td>
<td>3</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>*</td>
</tr>
<tr>
<td>102</td>
<td>ROOM</td>
<td>4</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>*</td>
</tr>
<tr>
<td>103</td>
<td>ROOM</td>
<td>5</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>*</td>
</tr>
</tbody>
</table>

### ABBREVIATION

- A: ALUMINUM
- B: BASE
- C: CEMENT
- D: DRY墙
- G: GLASS
- H: HEAVY FRAMING
- I: INSULATION
- K: KEYS
- L: LIGHT FRAMING
- M: METAL
- O: OSMOTIC
- P: POWDER
- R: RUBBER
- S: SHEET METAL
- T: THERMOPlastic
- U: UNITS
- V: VACUUM
- W: WOOD

### RECORD DRAWINGS

- Finish Schedule (Surge + Auditorium)
- NOT TO SCALE
### Door Schedule

<table>
<thead>
<tr>
<th>Level</th>
<th>Orientation</th>
<th>Door Type</th>
<th>Width</th>
<th>Height</th>
<th>Wall Type</th>
<th>Specification</th>
<th>Finish</th>
<th>Swing</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd</td>
<td>Left</td>
<td>1</td>
<td>60</td>
<td>80</td>
<td>Wood</td>
<td>M121</td>
<td>A</td>
<td>In</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>1</td>
<td>60</td>
<td>80</td>
<td>Wood</td>
<td>M121</td>
<td>A</td>
<td>In</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>2</td>
<td>60</td>
<td>80</td>
<td>Wood</td>
<td>M121</td>
<td>A</td>
<td>In</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>2</td>
<td>60</td>
<td>80</td>
<td>Wood</td>
<td>M121</td>
<td>A</td>
<td>In</td>
<td></td>
</tr>
</tbody>
</table>

### Sheet Notes

- **Abbreviations**
  - A: Aluminum
  - W: Wood
  - S: Steel
  - G: Glass
  - C: Curtain Wall
  - P: Panel
  - M: Metal
  - R: Rock
  - O: Other

- **Schedule Key Notes**
  - A: Alloy G100
  - B: Blown-in Insulation
  - C: Curtain Wall
  - D: Door Set
  - E: Exterior Weather Strip
  - F: Frosted Glass
  - G: Glazing
  - H: Header
  - I: Interior Weather Strip
  - J: Jamb
  - K: Kick Plate
  - L: Lever Handle
  - M: Mortise Lock
  - N: Nosing
  - O: Panic Bar
  - P: Passage
  - Q: Push Plate
  - R: Rebate
  - S: Strike Plate
  - T: Threshold
  - U: Transom
  - V: Vandal Resistant Lock
  - W: Walkthrough
  - X: Exit Device
  - Y: Fire Door
  - Z: Special Purpose

- **Record Drawings**
  - Scale: 1/4" = 1'-0"
  - Sheet No.: 003000
  - Sheet Size: 297x420

- **Security**
  - 1st Floor: Card Reader
  - 2nd Floor: Card Reader & Magnetic Strip
  - 3rd Floor: Magnetic Strip

- **Project Information**
  - Project Name: SmithGroup
  - Version: 3.16.2019
  - Sheet No.: A9.4.1

- **Notes**
  - For additional information, see the attached schedule for exterior doors.
  - Fire doors are marked with the appropriate international symbols.
  - All doors with glass are marked with the type of glass used.

- **Door Schedule**
  - See schedule key notes and schedule of exterior doors.

- **Third Floor**
  - See schedule key notes and schedule of exterior doors.
NOTE:
1. USE SHEET S.3.1A FOR GENERAL NOTES.
2. SHEET D.1.8.A FOR SPECIFIC CONCRETE DETAILS.
3. SHEET D.1.8.B FOR SPECIFIC CONCRETE DETAILS.
4. SHEET D.1.8.C FOR SPECIFIC CONCRETE DETAILS.
5. SHEET D.1.8.D FOR SPECIFIC CONCRETE DETAILS.

TYPICAL MESH REINFORCEMENT
<table>
<thead>
<tr>
<th>REF</th>
<th>MANUFACTURER</th>
<th>OPERATIVE SIZE</th>
<th>FT. NO.</th>
<th>INSIDE W.</th>
<th>INSIDE HT.</th>
<th>INSIDE D</th>
<th>ins. R</th>
<th>ins. T</th>
<th>AUDIT</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>16</td>
<td>2</td>
<td>3250</td>
<td>760</td>
<td>475</td>
<td>500</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>2</td>
<td>3250</td>
<td>760</td>
<td>475</td>
<td>500</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>2</td>
<td>3250</td>
<td>760</td>
<td>475</td>
<td>500</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>2</td>
<td>3250</td>
<td>760</td>
<td>475</td>
<td>500</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**VARIABLE AIR VOLUME BOX SCHEDULE**
LIGHTING THIRD FLOOR PLAN

REFERENCE NOTES:
1. Drawings reflect field conditions as of last update with no incorporation of field
   changes. Final drawings are subject to change.
2. See cover for project/program and site circuit map.
3. TP to light on roof see dial no. 21-2.

Scale: 1" = 1'-0"
### PLUMBING GENERAL NOTES

1. The plumbing systems shall comply with the following:
   - California Health and Safety Code, Section 113800 and 113810, and Title 8, Division 2.5, Department of Industrial Relations Safety Orders.
   - California Building Code (CBC), Sections 1616.10.1, 1616.2.1, and 1616.2.2.
   - California Health Care Facilities Standards.
   - California Accessibility Code.
   - The plumbing systems shall be designed and installed in accordance with the Plumbing Code of the City of Riverside.

2. All plumbing fixtures shall be furnished and installed in accordance with the Plumbing Code of the City of Riverside.

3. All plumbing systems shall be installed in accordance with the Plumbing Code of the City of Riverside.

4. All plumbing fixtures shall be installed in accordance with the Plumbing Code of the City of Riverside.

5. All plumbing systems shall be installed in accordance with the Plumbing Code of the City of Riverside.

6. All plumbing fixtures shall be installed in accordance with the Plumbing Code of the City of Riverside.

7. All plumbing systems shall be installed in accordance with the Plumbing Code of the City of Riverside.

8. All plumbing fixtures shall be installed in accordance with the Plumbing Code of the City of Riverside.

9. All plumbing systems shall be installed in accordance with the Plumbing Code of the City of Riverside.

10. All plumbing fixtures shall be installed in accordance with the Plumbing Code of the City of Riverside.

### PLUMBING fixture SCHEDULE

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Size</th>
<th>IN</th>
<th>O.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WATER CLOSET</td>
<td>4&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>WATER CLOSET (OP)</td>
<td>4&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>URINAL</td>
<td>3&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>URINAL (OP)</td>
<td>3&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>LAVATORY</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>LAVATORY (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>LAUNDRY</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>LAUNDRY (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>LAVATORY (DSC)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>LAVATORY (DSC) (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>SANITARY TANK</td>
<td>4&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>SANITARY TANK (OP)</td>
<td>4&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>SANITARY TANK (CUT-OFF)</td>
<td>4&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>SANITARY TANK (CUT-OFF) (OP)</td>
<td>4&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>SANITARY TANK (CUT-OFF) (DSC)</td>
<td>4&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>SANITARY TANK (CUT-OFF) (DSC) (OP)</td>
<td>4&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>TOILET</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>TOILET (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>WASH BASKET</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>WASH BASKET (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>WASH BASKET (DSC)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>WASH BASKET (DSC) (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>23</td>
<td>WASH BASKET (DSC) (CUT-OFF)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>WATER HEATER</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>WATER HEATER (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>26</td>
<td>WATER HEATER (DSC)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>WATER HEATER (DSC) (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>WATER HEATER (DSC) (CUT-OFF)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>WATER HEATER (DSC) (CUT-OFF) (OP)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### LEGEND

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>GRV</td>
<td>General</td>
</tr>
<tr>
<td>GRP</td>
<td>GRP</td>
<td>General</td>
</tr>
<tr>
<td>L</td>
<td>LAU</td>
<td>Launary</td>
</tr>
<tr>
<td>S</td>
<td>STH</td>
<td>Stair hall</td>
</tr>
<tr>
<td>O</td>
<td>ORC</td>
<td>Optional</td>
</tr>
</tbody>
</table>

### WATER CALCULATIONS

<table>
<thead>
<tr>
<th>Pipe</th>
<th>Flow Rate (gpm)</th>
<th>Flow Rate (lpm)</th>
<th>Pressure Drop (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>10</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>2&quot;</td>
<td>20</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>3&quot;</td>
<td>30</td>
<td>120</td>
<td>30</td>
</tr>
</tbody>
</table>

### RECORD DRAWINGS

- Sheet 1: Piping Schedules
- Sheet 2: Piping Schedules
**Tree and Ground Cover Schedule**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>QTY.</th>
<th>NAME</th>
<th>BOTTLE</th>
<th>CONV NAME</th>
<th>DETAIL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
<td>PLANTING MATURE</td>
<td>LONDON PLAN TREE</td>
<td>3.4-7.5</td>
<td>4&quot;X4&quot;</td>
<td>6-12&quot;</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>PLANTING YOUNG</td>
<td>LONDON PLAN TREE</td>
<td>3.4-7.5</td>
<td>4&quot;X4&quot;</td>
<td>6-12&quot;</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>PLANTING YOUNG</td>
<td>CALIFORNIA YEW</td>
<td>3.4-7.5</td>
<td>4&quot;X4&quot;</td>
<td>6-12&quot;</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>PLANTING YOUNG</td>
<td>AUSTRALIAN ROSE</td>
<td>3.4-7.5</td>
<td>4&quot;X4&quot;</td>
<td>6-12&quot;</td>
</tr>
</tbody>
</table>

**Shrub and Vine Schedule**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>QTY.</th>
<th>NAME</th>
<th>BOTTLE</th>
<th>CONV NAME</th>
<th>DETAIL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>113</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>3</td>
<td>426</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>2</td>
<td>63</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>2</td>
<td>29</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>270</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>118</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>171</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>56</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>HEDERA HELIX</td>
<td>DAHLIA</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
<td>2-2,2-6</td>
</tr>
</tbody>
</table>

**Irrigation Notes**

- Contractor is responsible for providing size irrigation coverage of all planting areas.
- Slope areas have been assumed. Contractor shall verify all slopes in field and provide low head irrigation equipment if required.
- Irrigation heads have been assumed. Contractor shall verify all heads in field and provide low head irrigation equipment if required.
- Contractor shall submit a written watering schedule for each area to the landscape architect for approval prior to completion of project.
- Contractor shall verify all heads in field for proper performance, according to drawings, and to prevent overwatering onto valves and streets.
- All values shall be located in size planting areas. Valve boxes shall be installed far enough from planting or irrigation heads to prevent damage to planting or irrigation system.
- Irrigation systems shall be installed in plantings less than 24" in size and shall be designed to meet the requirements of the landscape architect.
- Contractor is responsible for connection of new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
- Contractor is responsible for providing new system to existing water system and to provide Low Head Irrigation equipment if required.
BID FORM

FOR:  SKYE HALL HVAC REPLACEMENT
PROJECT NUMBER: 950583
CONTRACT NUMBER: 950583-LF-2020-100
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CALIFORNIA

October 18, 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.
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 105 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

$   ,   ,   ,   ·   

(Place figures in appropriate boxes.)

5.0 SELECTION OF APPARENT LOW BIDDER

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

6.0 UNIT PRICES - NOT USED
BIDDER’S NAME: ____________________________________________________________

7.0 DAILY RATE OF COMPENSATION FOR COMPENSABLE DELAYS

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 parentheticals { } and in grey highlight:

$ ___________ , ___________ · ___________ x 20 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-NOT USED
9.0 LIST OF SUBCONTRACTORS

Bidder will use Subcontractors for the Work:

☐ No  ☐ Yes

If “yes”, provide in the spaces below (a) the name, the location of the place of business, and the California contractor license number of each subcontractor who will perform work or labor or render service to the prime contractor in or about the construction of the work or improvement, or a subcontractor licensed by the state of California who, under subcontract to the prime contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of 1 percent of the prime contractor's total bid, (b) the portion of the work which will be done by each subcontractor. The prime contractor shall list only one subcontractor for each such portion as is defined by the prime contractor in its bid.

<table>
<thead>
<tr>
<th>Portion of the Work Activity (e.g. electrical, mechanical, concrete)</th>
<th>Subcontractor</th>
<th>Name of Business</th>
<th>Location of Business (City)</th>
<th>License No.</th>
<th>DIR Registration No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Note: Add additional pages if required.)
BIDDER’S NAME: ____________________________________________

10.0  NOT USED

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 __________________________ of ________________________________, 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 __________________________, on __________________________.

________________________________________

(Signature)
BID BOND

KNOW ALL PERSONS BY THESE PRESENTS:

That we, __________________________________________________________________________ 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: Skye Hall HVAC Replacement
Project Number: 950583, Contract Number: 950583-LF-2022-36
Location: 900 University Avenue, Riverside, CA. 92521

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: __________________________________________________________________________
(Signature) __________________________________________________________________________
(Printed Name) __________________________________________________________________________
(Title) __________________________________________________________________________

SURETY: __________________________________________________________________________
(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: 

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

for the Project: SKYE HALL HVAC REPLACEMENT
Project Number: 950583
University of California, Riverside
County of Riverside
Riverside, California 92521

University's Responsible Administrator: Blythe R. Wilson, 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: Nick Ubrun
Goss Engineering
255 E. Main Street, Suite 301
Corona, CA. 92879
Tel: 951-363-4797
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, $________, the “Contract Sum”.

**ARTICLE 4  CONTRACT TIME**

Contractor shall commence the Work on the date specified in the Notice to Proceed and fully complete the work within 105 calendar 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 $500.00 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 $250.00 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 $________ 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:

(Name of Company) California Contractor’s License(s):

a (Type of Organization) (Name of Licensee)

By: (Signature) (Classification and License Number)

(Print Name) (Expiration Date)

(Print Name) (Employer Identification Number)

Recommended:  Funds Sufficient:

By University’s Representative: By Financial Administrative Officer:

(Signature & Date) (Signature & Date)

Tameesha Hayes Susan McFadden
Project Manager Senior Financial Analyst
Planning, Design & Construction Planning, Design & Construction

(Print Name & Title) (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.
GENERAL CONDITIONS – LONG FORM
TABLE OF CONTENTS

ARTICLE 1. GENERAL PROVISIONS

1.1 Basic Definitions
1.2 Ownership and Use of Contract Documents
1.3 Interpretation

ARTICLE 2. UNIVERSITY

2.1 Information and Services Provided by University
2.2 Access to Project Site
2.3 University's Right to Stop the Work
2.4 University's Right to Carry Out the Work
2.5 University's Right to Replace University's Representative

ARTICLE 3. CONTRACTOR

3.1 Review of Contract Documents and Field Conditions by Contractor
3.2 Supervision and Construction Procedures
3.3 Labor and Materials
3.4 Contractor's Warranty
3.5 Taxes
3.6 Permits, Fees, and Notices
3.7 Applicable Code Requirements
3.8 Superintendent
3.9 Schedules Required of Contractor
3.10 As-Built Documents
3.11 Documents and Samples at Project Site
3.12 Shop Drawings, Product Data, Samples, and Environmental Product Declarations
3.13 Use of Site and Clean Up
3.14 Cutting, Fitting, and Patching
3.15 Access to Work
3.16 Royalties and Patents
3.17 Differing Site Conditions
3.18 Concealed, Unforeseen, or Unknown Conditions or Events
3.19 Hazardous Materials
3.20 Information Available to Bidders
3.21 Liability for and Repair of Damaged Work
3.22 Indemnification

ARTICLE 4. ADMINISTRATION OF THE CONTRACT

4.1 Administration of the Contract by University's Representative
4.2 Contractor Change Order Requests
4.3 Claims
4.4 Assertion of Claims
4.5 Decision of University's Representative on Claims
4.6 Mediation
4.7 Litigation and Arbitration
4.8 Waiver

ARTICLE 5. SUBCONTRACTORS

5.1 Award of Subcontracts and Other Contracts for Portions of the Work
5.2 Subcontractual Relations
5.3 Contingent Assignment of Subcontracts

ARTICLE 6. CONSTRUCTION BY UNIVERSITY OR BY SEPARATE CONTRACTORS
6.1 University's Right to Perform Construction and to Award Separate Contracts
6.2 Mutual Responsibility
6.3 University's Right to Clean Up

ARTICLE 7. CHANGES IN THE WORK

7.1 Changes
7.2 Definitions
7.3 Change Order Procedures
7.4 Field Orders
7.5 Variation in Quantity of Unit Price Work
7.6 Waiver

ARTICLE 8. CONTRACT TIME

8.1 Commencement of the Work
8.2 Progress and Completion
8.3 Delay
8.4 Adjustment of the Contract Time for Delay
8.5 Compensation for Delay
8.6 Waiver

ARTICLE 9. PAYMENTS AND COMPLETION

9.1 Cost Breakdown
9.2 Progress Payment
9.3 Application For Payment
9.4 Certificate For Payment
9.5 Deposit of Securities in Lieu of Retention and Deposit of Retention Into Escrow
9.6 Beneficial Occupancy
9.7 Substantial Completion
9.8 Final Completion and Final Payment

ARTICLE 10. PROTECTION OF PERSONS AND PROPERTY

10.1 Safety Precautions and Programs
10.2 Safety of Persons and Property
10.3 Emergencies

ARTICLE 11. INSURANCE AND BONDS

11.1 Contractor's Insurance
11.2 Builder's Risk Property Insurance
11.3 Performance Bond and Payment Bond

ARTICLE 12. UNCOVERING AND CORRECTION OF WORK

12.1 Uncovering of Work
12.2 Correction of Defective Work and Guarantee to Repair Period

ARTICLE 13. TERMINATION OR SUSPENSION OF THE CONTRACT

13.1 Termination by Contractor
13.2 Termination by University for Cause
13.3 Suspension by University for Convenience
13.4 Termination by University for Convenience

ARTICLE 14. STATUTORY AND OTHER REQUIREMENTS

14.1 Patient Health Information
14.2 Nondiscrimination
14.3 Prevailing Wage Rates
14.4 Payroll Records
14.5 Apprentices
14.6 Work Day

ARTICLE 15. MISCELLANEOUS PROVISIONS

15.1 Governing Law
15.2 Successors and Assigns
15.3 Rights and Remedies
15.4 Survival
15.5 Complete Agreement
15.6 Severability of Provisions
15.7 University's Right to Audit
15.8 Methods of Delivery for Specified Documents
15.9 Time of the Essence
15.10 Mutual Duty to Mitigate
15.11 UC Fair Wage
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:
1.3.2 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
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;

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.

January 6, 2020 17 General Conditions
LF:GC Table of Contents
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’s 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
7.3.2 Cost of Extra Work 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](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.
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. 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
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...
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.
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 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 therefrom 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:

11.1.2.1 Commercial General Liability Insurance-Limits of Liability

| Each Occurrence-Combined Single Limit for Bodily Injury and Property | $1,000,000.00 |
| Products-Completed Operations Aggregate | $1,000,000.00 |
| Personal and Advertising Injury | $1,000,000.00 |
| General Aggregate | $2,000,000.00 |

11.1.2.2 Business Automobile Liability Insurance-Limits of Liability

| Each Accident-Combined Single Limit for Bodily Injury and Property Damage | $1,000,000.00 |

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:

Total Number of days – 5 days

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:

<table>
<thead>
<tr>
<th>Change Orders approved in previous months:</th>
<th>Additions</th>
<th>Deductions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total: ___________________</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Change Orders approved this month:

<table>
<thead>
<tr>
<th>Number:</th>
<th>Date Approved:</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____</td>
<td>______________</td>
</tr>
<tr>
<td>_____</td>
<td>______________</td>
</tr>
<tr>
<td>_____</td>
<td>______________</td>
</tr>
<tr>
<td>_____</td>
<td>______________</td>
</tr>
<tr>
<td>_____</td>
<td>______________</td>
</tr>
<tr>
<td>Total:</td>
<td>$-</td>
</tr>
</tbody>
</table>

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 ____________________________, of Contractor submitting this Application For 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)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERST 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):

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.

<table>
<thead>
<tr>
<th>INSR</th>
<th>LTR</th>
<th>TYPE OF INSURANCE</th>
<th>ADDL SUBR</th>
<th>INSR WVD</th>
<th>POLICY NUMBER</th>
<th>POLICY EFF (MM/DD/YYYY)</th>
<th>POLICY EXP (MM/DD/YYYY)</th>
<th>LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GENERAL LIABILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>COMMERCIAL GENERAL LIABILITY CLAIMS-MADE OCCUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AGGREGATE LIMIT APPLIES PER-POLICY PROJECT LOC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AUTOMOBILE LIABILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ANY AUTO ALL OWNED AUTOS SCHEDULED AUTOS NON-OWNED AUTOS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>HIRED AUTOS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>UMBRELLA LIABILITY OCCUR EXCESS LIABILITY CLAIMS-MADE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DED RETENTION $</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>WORKERS COMPENSATION AND EMPLOYERS' LIABILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>if yes, describe under DESCRIPTION OF OPERATIONS below</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OCCUR CLAIMS-MADE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Special Provisions:
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 Representatives' 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 Skye hall HVAC Replacement, Project No. 950583, Contract No. 950583-LF-2022-36.
2. 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 92507

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

© 1988-2010 ACORD CORPORATION. All rights reserved. ACORD 25 (2010/05) The ACORD name and logo are registered marks of ACORD
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

__________________________________________  ________________________________
Tameesha Hayes                                Drew Hecht, Architect
Project Manager                                Director of Project Management
Planning, Design & Construction               Planning, Design & Construction

(Student & Date)                                (Signature & Date)

UNIVERSITY:

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

__________________________________________  ________________________________
(Student & Date)                                (Student & Date)

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): ___________________________ (Days)

Adjustment of the Contract Sum (Total from Line 18, Col. 4 of Cost Proposal Summary): $ __________

Submitted: CONTRACTOR

(Company Name)

(Signature & Date)

(Print Name & Title)

Received: UNIVERSITY’S REPRESENTATIVE

(Signature & Date)

Tameesha Hayes
Project Manager
Planning, Design & Construction

(Print Name & Title)

cc: Executive Director, Architects & Engineers, Capital Programs
## COST PROPOSAL SUMMARY

**Contractor:** 

<table>
<thead>
<tr>
<th></th>
<th>(1) Contractor</th>
<th>(2) 1st Tier Subs</th>
<th>(3) 2nd &amp; Lower Tier Subs</th>
<th>(4) Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Straight Time Wages/Salaries-Labor</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>2. Fringe Benefits and Payroll Taxes-Labor</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>3. Overtime Wages/Salaries-Labor</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>4. Fringe Benefits &amp; Payroll Taxes-Overtime</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>5. Materials &amp; Consumable Items</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>6. Sales Taxes (On Line 5)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>7. Rental Charges</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>8. Royalties</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>9. Permits</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>10. Total Direct Expense (Sum of Lines 1-9)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11. Insurance &amp; Bonds (up to 2% of Line 10)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### ACTUAL COSTS

<table>
<thead>
<tr>
<th></th>
<th>(1) Contractor</th>
<th>(2) 1st Tier Subs</th>
<th>(3) 2nd &amp; Lower Tier Subs</th>
<th>(4) Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Sub-Sub (15% of Line 10, Col. 3)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>13. Subcontractor (5% of Line 10, Col. 3)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>14. Subcontractor (15% of Line 10, Col. 2)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>15. Contractor (5% of Line 10, Col. 2 &amp; 3)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>16. Contractor (15% of Line 10, Col. 1)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>17. Contractor Fee (Sum of Lines 12-16)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### CONTRACTOR FEE

<table>
<thead>
<tr>
<th></th>
<th>(1) Contractor</th>
<th>(2) 1st Tier Subs</th>
<th>(3) 2nd &amp; Lower Tier Subs</th>
<th>(4) Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. Sum of Lines 10, 11, &amp; 17</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>COST ITEM</th>
<th>DESCRIPTION</th>
<th>COST(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Straight Time Wages/Salaries-Labor</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Fringe Benefits &amp; Payroll Taxes-Labor: __% of Line 1</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Overtime Wages/Salaries-Labor (Attach University's Representative's written authorization.)</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Materials &amp; Consumable Items</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Sales Taxes: __% of Line 5</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Rental Charges (Attach CalTrans' Schedule.)</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Royalties</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Permits</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Total Direct Expense (Sum of Lines 1-9)</td>
<td>$-</td>
</tr>
<tr>
<td>11.</td>
<td>Insurance &amp; Bonds __% of Line 10 (up to 2% of Line 10)</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12. Sum of Lines 10 &amp; 11</td>
<td>$-</td>
</tr>
</tbody>
</table>

**Prepared By:**

(Company Name)

(Signature & Date)

(Print Name & Title)

**CONTRACTOR:**

(Company Name)

(Signature & Date)

(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

**Project Name:** Skye Hall HVAC Replacement  
**Project Number:** 950583  
**Contract Number:** 950583-LF-2022-36

## DESCRIPTION OF CHANGE: (Reference attachments)

<table>
<thead>
<tr>
<th></th>
<th>Contract Sum</th>
<th>Contract Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjustment</td>
<td>Adjustment</td>
</tr>
</tbody>
</table>

1.  

2.  

- Description of Change continued on Page 2. Subtotal from Page 2: $0.00  

**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:  
- Prior Adjustments:  
- Contract Time before this Change:  
- Adjustment for this Change:  
- Revised Contract Time:  

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

**Recommended:**  
By: University’s Representative

**Funds Sufficient:**  
By: Financial Administrative Officer

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

---

<table>
<thead>
<tr>
<th>Account No.:</th>
<th>Activity Code:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fund:</th>
<th>Function:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost Center:</th>
<th>Project Code:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### DESCRIPTION OF CHANGE - CONTINUED

<table>
<thead>
<tr>
<th></th>
<th>Contract Sum Adjustment</th>
<th>Contract Time Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 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: Skye Hall HVAC Replacement, Project No. 950583
Owner: 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: Skye Hall HVAC Replacement, Project No. 950583
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

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

Skye Hall HVAC Replacement

Project Number 950583, 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.


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 ___________________________, 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 ___________________________ of ___________________________, 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:

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)

On behalf of Contractor:

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:**

By: ________________________________
(Signature)

Blythe R. Wilson, Architect
Director of Project Management
Planning, Design & Construction

(Print Name & Title)

951.827.1485
(Telephone Number)

**Contractor:**

By: ________________________________
(Signature)

By: ________________________________
(Signature)

Bobbi McCracken
Associate Vice Chancellor and Controller
Business and Financial Services

(Print Name & Title)

951.827.3303
(Telephone Number)

**Escrow Agent:**

By: ________________________________
(Signature)

(Print Name & Title)

(Telephone Number)
FIELD ORDER

Contract Date: ___________________________  Field Order No. ______

To Contractor: _______________________________

Attn: ______________________________________
Address: ____________________________________

<table>
<thead>
<tr>
<th>Description of Work</th>
<th>Estimated Adjustment, Contract Sum</th>
<th>Estimated Adjustment, Contract Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

By University’s Representative:

__________________________________________
Tameesha Hayes
Project Manager
Planning, Design & Construction

(Signature & Date)

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 DISTRIBUTION OF CONTRACT DOLLARS

Completed By:  
(Signature)  (Printed Name)  (Title)  
Date:  

Provide the following information for each contracting party including the prime Contractor and each subcontractor/subconsultant regardless of tier.* Attach additional sheets if necessary.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7a</th>
<th>7b</th>
<th>7c</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full Name of Business</strong></td>
<td><strong>Street Address</strong></td>
<td><strong>Telephone # &amp; Fax #</strong></td>
<td><strong>Contact Name</strong></td>
<td><strong>Type of Ownership</strong></td>
<td><strong>Business Categories</strong> (Check all that apply [X])</td>
<td><strong>Portion of the Work</strong></td>
<td><strong>Amount $</strong></td>
<td><strong>Percent %</strong></td>
</tr>
<tr>
<td>Prime:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SBE</td>
<td>DVBE</td>
<td>DBE</td>
<td>WBE</td>
</tr>
<tr>
<td>Sub:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Contract Amount:** $ ______________________

<table>
<thead>
<tr>
<th>Column 5 – Type of</th>
<th>Column 6 – Business Categories</th>
<th>Subtotals</th>
</tr>
</thead>
<tbody>
<tr>
<td>C = Corporation</td>
<td>SBE = Small Business Enterprise</td>
<td></td>
</tr>
<tr>
<td>JV = Joint Venture</td>
<td>DVBE = Disabled Veteran Business Enterprise</td>
<td></td>
</tr>
<tr>
<td>P = Partnership</td>
<td>DBE = Disadvantaged Business Enterprise</td>
<td></td>
</tr>
<tr>
<td>SP = Sole Proprietorship</td>
<td>WBE = Women-Owned Business Enterprise</td>
<td></td>
</tr>
<tr>
<td>O = Other</td>
<td>N/A = Not Applicable</td>
<td></td>
</tr>
</tbody>
</table>

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

**If a prime Contractor, refer to the Report of Subcontractor Information for license and other information.
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  ____________________

Name ____________________________  (Signature & Date)

Senior Construction Inspector
Planning, Design & Construction
(Print Name & Title)

By: University’s Representative  ____________________  By: University’s Responsible Administrator  ____________________

Name ____________________________  (Signature & Date)

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

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

KNOW ALL PERSONS BY THESE PRESENTS:

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

[Name of Principal] as Principal

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

Project Name: Skye Hall HVAC Replacement
Project No. 950583, Contract No. 950583-LF-2022-36

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:

______________________________________________
(Name of Company)

By: _____________________________
(Signature)

______________________________________________
(Print Name)

______________________________________________
(Title)

SURETY:

______________________________________________
(Name of Company)

By: _____________________________
(Signature)

______________________________________________
(Print 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.
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: Skye Hall HVAC Replacement 
Project No. 950583, Contract No. 950583-LF-2020-100

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:

(Name of Company)

By: ________________________________

(Signature)

(Print Name)

(Title)

SURETY:

(Name of Company)

By: ________________________________

(Signature)

(Print 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.
**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*. Attach additional sheets if necessary.

<table>
<thead>
<tr>
<th>Column 1 – Full Name of Business</th>
<th>Column 2 – Street Address City, State &amp; Zip Code</th>
<th>Column 3 – Telephone # &amp; Fax #</th>
<th>Column 4 – Contact Name</th>
<th>Column 5 – Type of Ownership</th>
<th>Column 6 – Business Categories*</th>
<th>Column 7 – Portion of the Work</th>
<th>Column 8 – Amount $</th>
<th>License Information**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Column 5 – Type of Ownership</th>
<th>Column 6 – Business Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>C = Corporation</td>
<td>SBE = Small Business Enterprise</td>
</tr>
<tr>
<td>JV = Joint Venture</td>
<td>DVBE = Disabled Veteran Business Enterprise</td>
</tr>
<tr>
<td>P = Partnership</td>
<td>DBE = Disadvantaged Business Enterprise</td>
</tr>
<tr>
<td>SP = Sole Proprietorship</td>
<td>WBE = Women-Owned Business Enterprise</td>
</tr>
<tr>
<td>O = Other</td>
<td>N/A = Not Applicable</td>
</tr>
</tbody>
</table>

*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
University will withhold retention. __________________________________ Initial and date here for OPTION 1

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

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

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

By: __________________________ (Signature)
(Print Name & Title)

On Behalf of University:
Acknowledged and Approved

By: __________________________ (Signature)
(Print Name & Title)

Blythe R. Wilson, Architect
Director of Project Management
Planning, Design & Construction

* 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):

- **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](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 at [http://www.dgs.ca.gov/pd/Programs/OSDS/SBEligibilityBenefits.aspx](http://www.dgs.ca.gov/pd/Programs/OSDS/SBEligibilityBenefits.aspx). The University may rely on written representation by the vendors regarding their status.

- **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.

- **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.

- **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.

- **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 ________________________________

(Inset 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/sbdmgr.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: ______________________

<table>
<thead>
<tr>
<th>Event</th>
<th>Scheduled Completion Date</th>
<th>Actual Completion Date</th>
<th>Calendar Days Required to Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Received by Contractor and Time for Checking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. First Delivered to University's Representative and Time for Checking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Return to Contractor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Corrections Completed and Time for Corrections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Next Delivered (1st Resubmission) to University's Representative and Time for Checking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Return to Contractor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Approval for Job Information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Approval for Fabrication and Time for Fabrication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Fabrication Completed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Shipping Date and Time In Route</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Delivery to Job</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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) entered into an Agreement (Contract Number 950583-LF-2022-36) for the construction of Skye Hall HVAC Replacement, Project No. 950583, 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

________________________________________________________, as

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 __________________________, at __________________________, California.

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

________________________________________________________, as

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:  UNIVERSITY:

By: ________________________________ (Signature)       By: ________________________________ (Signature)

________________________________________________________

(Typed or Printed Name & Title)  (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.
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/TERRMINATION

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/TERRMINATION: 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.
DEDUCTIBLES

(Basis for determining deductible is the total project contract value for all construction phases, estimated through project completion.)

<table>
<thead>
<tr>
<th>Deductible</th>
<th>All Other Perils</th>
<th>Water Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10,000</td>
<td>• All ≤$1,000,000 projects</td>
<td>• All ≤$1,000,000 projects</td>
</tr>
<tr>
<td></td>
<td>• &gt;$1,000,000 and ≤$25,000,000 Fire Resistive, Non-Combustible, Masonry Non-Combustible and Joisted Masonry projects</td>
<td>• All Job Order Contracts (JOCs)</td>
</tr>
<tr>
<td></td>
<td>• All Job Order Contracts (JOCs)</td>
<td>• All Site Work Only (Outdoor Infrastructure / Utility / Hardscape / Landscape) projects</td>
</tr>
<tr>
<td></td>
<td>• All Site Work Only (Outdoor Infrastructure / Utility / Hardscape / Landscape) projects</td>
<td></td>
</tr>
<tr>
<td>$25,000</td>
<td>• All projects &gt;$25,000,000</td>
<td>• &gt;$1,000,000 and ≤$25,000,000 Fire Resistive, Non-Combustible, Masonry Non-Combustible and Joisted Masonry projects</td>
</tr>
<tr>
<td>$50,000</td>
<td>• Wood Frame projects &gt;$1,000,000 and ≤$10,000,000</td>
<td>• All projects &gt;$25,000,000 and ≤$50,000,000</td>
</tr>
<tr>
<td>$75,000</td>
<td>• All projects &gt;$50,000,000 and ≤$150,000,000</td>
<td></td>
</tr>
<tr>
<td>$100,000</td>
<td>• Wood Frame projects &gt;$1,000,000 and ≤$10,000,000</td>
<td></td>
</tr>
</tbody>
</table>

**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.
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 damaged; 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  
Master Builder's Risk Program 
Coverage Summary 

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.
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.
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.
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.
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
(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.
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:
(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 damage 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.
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.
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.
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.
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.
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.
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.
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.
EXCLUDED PROJECT TYPES

Examples of projects that may require separate underwriting, including (but not limited to):

- Wood Frame construction where the values are estimated to exceed $10,000,000 by project completion date
- Joisted Masonry construction where values are estimated to exceed $25,000,000 by project completion date
- Any Fire Resistive; Non-Combustible; or Masonry Non-Combustible construction where the values are estimated to exceed $100,000,000 by project completion date
- Structural / Seismic Renovation construction where the values are estimated to exceed $50,000,000 by project completion date
- Power generation, Utility plants, Co-Generation facilities, Waste water and Waste treatment facilities, etc.
- Stadiums
- Bridges
- Cleanroom construction (both new and renovation) of any size
- Directional drilling
- Gas turbines
- Any project involving prototypical design or the use of unproven technology
- Any project with hot-testing where the values are estimated to exceed $100,000,000 by project completion date
- 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: Skye hall HVAC Replacement, Project No. 950583
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: Skye Hall HVAC Replacement, Project No. 950583 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 # 

UC July 6, 2012 Exhibit, Unconditional Waiver and Release on Progress Payment UCR 2012-07-29 Page 1 of 1
**LIST OF DRAWINGS**

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>TITLE</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0.1</td>
<td>TITLE SHEET, INDEX OF DRAWINGS, GENERAL NOTES, AND LOCATION MAP</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M0.1</td>
<td>SYMBOLS, DESIGNATIONS, AND ABBREVIATIONS</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M0.2</td>
<td>MECHANICAL EQUIPMENT SCHEDULES</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M1.1</td>
<td>1ST FLOOR DEMOLITION HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M1.2</td>
<td>2ND FLOOR DEMOLITION HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M1.3</td>
<td>3RD FLOOR DEMOLITION HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M1.4</td>
<td>ROOF LEVEL DEMOLITION HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M2.1</td>
<td>1ST FLOOR RECONSTRUCTION HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M2.2</td>
<td>2ND FLOOR RECONSTRUCTION HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M2.3</td>
<td>3RD FLOOR RECONSTRUCTION HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M2.4</td>
<td>ROOF LEVEL RECONSTRUCTION HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M3.1</td>
<td>1ST FLOOR ZONE PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M3.2</td>
<td>2ND FLOOR ZONE PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M3.3</td>
<td>3RD FLOOR ZONE PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M5.0</td>
<td>MECHANICAL DETAILS</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M5.1</td>
<td>MECHANICAL DETAILS</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M6.0</td>
<td>VAV BOX AND RTU CONTROL DIAGRAM</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>M6.1</td>
<td>NETWORK ARCHITECTURE AND SEQUENCE OF OPERATION</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E0.1</td>
<td>ELECTRICAL SYMBOLS, LEGEND, AND GENERAL NOTES</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E1.0</td>
<td>FIRST FLOOR DEMOLITION POWER PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E1.1</td>
<td>SECOND FLOOR DEMOLITION POWER PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E1.2</td>
<td>ROOF DEMOLITION POWER PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E2.0</td>
<td>FIRST FLOOR RECONSTRUCTION POWER PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E2.1</td>
<td>SECOND FLOOR RECONSTRUCTION POWER PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E2.2</td>
<td>THIRD FLOOR RECONSTRUCTION POWER PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E2.3</td>
<td>ROOF RECONSTRUCTION POWER PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>E3.0</td>
<td>ELECTRICAL SCHEDULES AND DETAILS</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>S0.1</td>
<td>GENERAL NOTES</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>S1.4</td>
<td>ROOF LEVEL DEMO HVAC PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>S2.4</td>
<td>ROOF LEVEL RECONSTRUCTION PLAN</td>
<td>02/25/2020</td>
</tr>
<tr>
<td>S5.1</td>
<td>STRUCTURAL DETAILS</td>
<td>02/25/2020</td>
</tr>
</tbody>
</table>

END OF LIST OF DRAWINGS
UNIVERSITY OF CALIFORNIA, RIVERSIDE
SKYE HALL
ROOFTOP REPLACEMENT
PROJECT NO. 950583
CAAN NO. P5380

LOCATION MAP

VICINITY MAP

APPLICABLE CODES

NFPA 72, 2019 EDITION - NATIONAL FIRE ALARM AND SIGNALING CODE (AS AMENDED BY CSFM)

NFPA 25, (2019 CALIFORNIA EDITION, BASED ON NFPA 25, 2011 EDITION) - INSPECTION, TESTING & MAINTENANCE OF WATER-BASED FIRE PROTECTION SYSTEMS

NFPA 13, 2019 EDITION - INSTALLATION OF SPRINKLER SYSTEMS (AS AMENDED BY CSFM)

NFPA 17A, 2019 EDITION - WET CHEMICAL EXTINGUISHING SYSTEMS

NFPA 24, 2016 EDITION - INSTALLATION OF PRIVATE FIRE SERVICE MAINS (AS AMENDED BY CSFM)

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT RULE 1146

REFERENCE STANDARDS

2019 CALIFORNIA REFERENCED STANDARD CODE, PART 12, TITLE 24

2019 CALIFORNIA FIRE CODE (CFC) PART 9, TITLE 24

2019 CALIFORNIA PLUMBING CODE (CPC) PART 5, TITLE 24

2019 CALIFORNIA ELECTRICAL CODE (CEC) PART 3, TITLE 24

[BASED ON 2015 UNIFORM PLUMBING CODE]

[BASED ON 2015 UNIFORM MECHANICAL CODE]

[BASED ON 2014 NATIONAL ELECTRICAL CODE]

2019 CALIFORNIA BUILDING CODE (CBC)

BUILDING CODE ANALYSIS


code:


type:


desc:


date:


text:


table:


diagram:


INDEX OF DRAWINGS

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>SYMBOLS, DESIGNATIONS, AND ABBREVIATIONS</td>
</tr>
<tr>
<td>0.2</td>
<td>MECHANICAL EQUIPMENT SCHEDULES</td>
</tr>
<tr>
<td>0.3</td>
<td>MECHANICAL DETAILS</td>
</tr>
<tr>
<td>1.1</td>
<td>1ST FLOOR ZONE PLAN</td>
</tr>
<tr>
<td>1.2</td>
<td>2ND FLOOR DEMOLITION HVAC PLAN</td>
</tr>
<tr>
<td>1.3</td>
<td>3RD FLOOR DEMOLITION HVAC PLAN</td>
</tr>
<tr>
<td>2.1</td>
<td>1ST FLOOR RECONSTRUCTION HVAC PLAN</td>
</tr>
<tr>
<td>2.2</td>
<td>2ND FLOOR RECONSTRUCTION HVAC PLAN</td>
</tr>
<tr>
<td>2.3</td>
<td>3RD FLOOR RECONSTRUCTION HVAC PLAN</td>
</tr>
<tr>
<td>3.1</td>
<td>1ST FLOOR ZONE PLAN</td>
</tr>
<tr>
<td>3.2</td>
<td>2ND FLOOR ZONE PLAN</td>
</tr>
<tr>
<td>3.3</td>
<td>3RD FLOOR ZONE PLAN</td>
</tr>
<tr>
<td>4.1</td>
<td>VICINITY MAP</td>
</tr>
<tr>
<td>4.2</td>
<td>GENERAL NOTES</td>
</tr>
<tr>
<td>4.3</td>
<td>PROJECT SITE</td>
</tr>
<tr>
<td>4.4</td>
<td>SKYE HALL</td>
</tr>
<tr>
<td>4.5</td>
<td>UNIVERSITY OF CALIFORNIA RIVERSIDE CAMPUS</td>
</tr>
<tr>
<td>4.6</td>
<td>PENNSYLVANIA AVE</td>
</tr>
</tbody>
</table>
| 4.7  | 7. WHEN REQUIRED TO DEMOLISH EXISTING WALLS, CEILINGS, ETC. TO FACILITATE THE INSTALL OF THE NEW SYSTEM, THE CONTRACTOR AND THE INSTALLER SHALL DESIGN AND PROVIDE PIPE SUPPORTS, SEISMIC SWAY BRACING AND RESTRAINT OF ALL NEW PIPING, CONDUIT, AND PANELS TO MINIMIZE THE EFFECT OF SEISMIC ACTIVITY. THE CONTRACTOR AND THE INSTALLER SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.
| 4.8  | 6. CONTRACTOR SHALL DESIGN AND PROVIDE PIPE SUPPORTS, SEISMIC SWAY BRACING AND RESTRAINT OF ALL NEW PIPING, CONDUIT, AND PANELS TO MINIMIZE THE EFFECT OF SEISMIC ACTIVITY. THE CONTRACTOR AND THE INSTALLER SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.
| 4.9  | 5. THE CONTRACTOR SHALL PROVIDE AND BE RESPONSIBLE FOR PROTECTION AND REPAIR OF ADJACENT EXISTING SURFACES, DUCTS, PANELS, CONDUIT, AND EQUIPMENT WHICH MAY BE DAMAGED AS A RESULT OF DEMOLITION AND/OR NEW WORK. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.
| 4.10 | 4. THE CONTRACTOR SHALL VISIT THE JOB SITE PRIOR TO BID IN ORDER TO THOROUGHLY FAMILIARIZE THEMSELVES WITH THE EXISTING CODES, NFPA STANDARDS, LOCAL CODES, AND REQUIREMENTS SPECIFIED HEREIN.
| 4.11 | 3. THE CONTRACTOR SHALL PROVIDE THE SYMBOLS, LEGEND, AND GENERAL NOTES WHICH WILL BE USED ON THE DRAWINGS TO INDICATE THE DIFFERENT COMPONENTS OF THE SYSTEM. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.
| 4.12 | 2. THE ARRANGEMENT OF THE SYSTEM SHOWN ON THESE DRAWINGS IS BASED UPON INFORMATION AVAILABLE TO THE ENGINEER AT THE TIME OF DESIGN. THE DRAWINGS ARE NOT INTENDED TO SHOW EXACT DIMENSIONS. THESE DRAWINGS ARE IN PART DIAGRAMMATIC, AND THE CONTRACTOR AND THE INSTALLER SHALL PROVIDE THE SYMBOLS, LEGEND, AND GENERAL NOTES WHICH WILL BE USED ON THE DRAWINGS TO INDICATE THE DIFFERENT COMPONENTS OF THE SYSTEM. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.
| 4.13 | 1. IN BRIEF, THIS PROJECT INVOLVES THE REPLACEMENT OF SEVENTEEN (17) DX ROOF TOP UNITS (RTU) ON THE ROOF OF UCR'S SKYE HALL. THE CONTRACTOR SHALL PROVIDE THE SYMBOLS, LEGEND, AND GENERAL NOTES WHICH WILL BE USED ON THE DRAWINGS TO INDICATE THE DIFFERENT COMPONENTS OF THE SYSTEM. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.

PENNSYLVANIA AVE

7. WHEN REQUIRED TO DEMOLISH EXISTING WALLS, CEILINGS, ETC. TO FACILITATE THE INSTALL OF THE NEW SYSTEM, THE CONTRACTOR AND THE INSTALLER SHALL DESIGN AND PROVIDE PIPE SUPPORTS, SEISMIC SWAY BRACING AND RESTRAINT OF ALL NEW PIPING, CONDUIT, AND PANELS TO MINIMIZE THE EFFECT OF SEISMIC ACTIVITY. THE CONTRACTOR AND THE INSTALLER SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.

6. CONTRACTOR SHALL DESIGN AND PROVIDE PIPE SUPPORTS, SEISMIC SWAY BRACING AND RESTRAINT OF ALL NEW PIPING, CONDUIT, AND PANELS TO MINIMIZE THE EFFECT OF SEISMIC ACTIVITY. THE CONTRACTOR AND THE INSTALLER SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.

5. THE CONTRACTOR SHALL PROVIDE AND BE RESPONSIBLE FOR PROTECTION AND REPAIR OF ADJACENT EXISTING SURFACES, DUCTS, PANELS, CONDUIT, AND EQUIPMENT WHICH MAY BE DAMAGED AS A RESULT OF DEMOLITION AND/OR NEW WORK. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.

4. THE CONTRACTOR SHALL VISIT THE JOB SITE PRIOR TO BID IN ORDER TO THOROUGHLY FAMILIARIZE THEMSELVES WITH THE EXISTING CODES, NFPA STANDARDS, LOCAL CODES, AND REQUIREMENTS SPECIFIED HEREIN.

3. THE CONTRACTOR SHALL PROVIDE THE SYMBOLS, LEGEND, AND GENERAL NOTES WHICH WILL BE USED ON THE DRAWINGS TO INDICATE THE DIFFERENT COMPONENTS OF THE SYSTEM. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.

2. THE ARRANGEMENT OF THE SYSTEM SHOWN ON THESE DRAWINGS IS BASED UPON INFORMATION AVAILABLE TO THE ENGINEER AT THE TIME OF DESIGN. THE DRAWINGS ARE NOT INTENDED TO SHOW EXACT DIMENSIONS. THESE DRAWINGS ARE IN PART DIAGRAMMATIC, AND THE CONTRACTOR AND THE INSTALLER SHALL PROVIDE THE SYMBOLS, LEGEND, AND GENERAL NOTES WHICH WILL BE USED ON THE DRAWINGS TO INDICATE THE DIFFERENT COMPONENTS OF THE SYSTEM. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.

1. IN BRIEF, THIS PROJECT INVOLVES THE REPLACEMENT OF SEVENTEEN (17) DX ROOF TOP UNITS (RTU) ON THE ROOF OF UCR'S SKYE HALL. THE CONTRACTOR SHALL PROVIDE THE SYMBOLS, LEGEND, AND GENERAL NOTES WHICH WILL BE USED ON THE DRAWINGS TO INDICATE THE DIFFERENT COMPONENTS OF THE SYSTEM. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS OF THE EXISTING SYSTEM TO BE ACCURATE AND TO CORRECT ANY ERRORS OR OMISSIONS.
**GENERAL NOTES**

1. All drawings are considered to be part of the specifications, unless otherwise noted. Additional specifications, engineering reports and other documents may also be required. Any discrepancies that occur shall be clarified by the Architect. Any work performed in lieu of any written specifications, engineering reports or other documentation, shall be made at the architect's discretion and at the cost of the contractor.

2. The project should be consistent with the applicable codes required by the City of Santa Maria. Any modification of any plans or specifications by the contractor or sub contractor must be submitted to the architect for approval before the modified plans or specifications are used in the construction phases.

3. The contractor shall be responsible for the accuracy and completeness of all calculations, equipment and material specified. All calculations shall be checked by a licensed professional engineer and noted on the plans. The calculations shall indicate all pressures, temperatures, and flows, and shall include all necessary details to complete the systems.

4. The contractor shall be responsible for the proper operation and maintenance of the HVAC systems. All systems shall be tested and adjusted to the specifications of the engineer.

5. The contractor shall provide and be responsible for all necessary permits and approvals. Any work performed in-lieu-of any permits or approvals shall be made at the contractor's expense and at no expense to the owner.

6. All work shall be consistent with the applicable building codes and standards. Any exceptions to the building codes and standards shall be noted on the plans.

7. The contractor shall provide all necessary administrative documents to the owner and all administrative departments of the city of Santa Maria.

8. The contractor shall provide all necessary administrative documents to the owner and all administrative departments of the city of Santa Maria.

9. All work shall be consistent with the applicable building codes and standards. Any exceptions to the building codes and standards shall be noted on the plans.

10. The contractor shall provide all necessary administrative documents to the owner and all administrative departments of the city of Santa Maria.

11. All work shall be consistent with the applicable building codes and standards. Any exceptions to the building codes and standards shall be noted on the plans.

12. The contractor shall provide all necessary administrative documents to the owner and all administrative departments of the city of Santa Maria.

13. All work shall be consistent with the applicable building codes and standards. Any exceptions to the building codes and standards shall be noted on the plans.

14. The contractor shall provide all necessary administrative documents to the owner and all administrative departments of the city of Santa Maria.

15. All work shall be consistent with the applicable building codes and standards. Any exceptions to the building codes and standards shall be noted on the plans.

16. The contractor shall provide all necessary administrative documents to the owner and all administrative departments of the city of Santa Maria.

17. All work shall be consistent with the applicable building codes and standards. Any exceptions to the building codes and standards shall be noted on the plans.

18. The contractor shall provide all necessary administrative documents to the owner and all administrative departments of the city of Santa Maria.

19. All work shall be consistent with the applicable building codes and standards. Any exceptions to the building codes and standards shall be noted on the plans.

20. The contractor shall provide all necessary administrative documents to the owner and all administrative departments of the city of Santa Maria.
**Notes:**

- Provide with Belimo TBF120 (or approved equal) damper actuator, 24VAC.
- Furnish with Provent PEHCPRDLCDB46MS modulating combination economizer/power exhaust.
- 11.

### AIR TERMINAL SCHEDULE

<table>
<thead>
<tr>
<th>TASK</th>
<th>FLOOR SERVING</th>
<th>MANUFACTURER</th>
<th>MODEL</th>
<th>AIRFLOW (CFM)</th>
<th>AREA SERVED</th>
<th>REVTD</th>
<th>BLOWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTU 1</td>
<td>101</td>
<td>YORK</td>
<td>ZJ150N18R4A1</td>
<td>170</td>
<td>5,7,11</td>
<td>0.099,475</td>
<td>481</td>
</tr>
<tr>
<td>RTU 2</td>
<td>102</td>
<td>YORK</td>
<td>ZT240N30R4C1</td>
<td>240</td>
<td>5,7,8</td>
<td>10.6</td>
<td>192</td>
</tr>
<tr>
<td>RTU 3</td>
<td>103</td>
<td>YORK</td>
<td>ZT240N30P4C1</td>
<td>240</td>
<td>5,7,8</td>
<td>10.6</td>
<td>192</td>
</tr>
</tbody>
</table>

### AIR TERMINAL SCHEDULE

<table>
<thead>
<tr>
<th>TASK</th>
<th>MANUFACTURER</th>
<th>MODEL</th>
<th>AREA SERVED</th>
<th>BLOWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTU 1</td>
<td>YORK</td>
<td>ZJ150N18R4A1</td>
<td>5,7,11</td>
<td>V</td>
</tr>
<tr>
<td>RTU 2</td>
<td>YORK</td>
<td>ZT240N30R4C1</td>
<td>5,7,8</td>
<td>V</td>
</tr>
<tr>
<td>RTU 3</td>
<td>YORK</td>
<td>ZT240N30P4C1</td>
<td>5,7,8</td>
<td>V</td>
</tr>
</tbody>
</table>
1. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE AND DO NOT SHOW ALL PIPES, DUCTS, FITTINGS, EQUIPMENT, AND OBSTACLES. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CLEARANCES BEFORE BEGINNING WORK. IF THERE ARE ANY DISCREPANCIES, THE CONTRACTOR SHALL NOTIFY THE UNIVERSITY'S REPRESENTATIVE.

2. DEMOLISH DAMPER AND ASSOCIATED DUCTING AS NEEDED TO FACILITATE DEMOLITION.

3. ALL VVT BOXES MARKED FOR DEMOLITION HAVE BEEN FIELD VERIFIED AS BEING DAMAGED OR UNABLE TO FUNCTION PROPERLY. DEMOLISH THERMOSTAT, PATCH AND PAINT WALL TO MATCH EXISTING FINISH. DEMOLISH THERMOSTAT AND ASSOCIATED VAV BOX ACTUATOR. PROTECT REMAINING VVT BOX IN PLACE.

4. CONTRACTOR SHALL MEASURE THE CFM OF EACH SUPPLY DIFFUSER NOT MARKED FOR DEMOLITION AS A REFERENCE FOR RE-BALANCING DURING RECONSTRUCTION.

5. REMOVE T-BAR GRID AS NECESSARY TO FACILITATE DEMOLITION. SALVAGE CEILING TILES IF POSSIBLE.

6. CONTRACTOR SHALL REPLACE ANY DUCTWORK OR INSULATION DAMAGED DURING DEMOLITION AT NO ADDITIONAL COST TO THE UNIVERSITY. ADDITIONAL DAMAGED INSULATION TO BE REPLACED AT NO ADDITIONAL COST TO THE UNIVERSITY.

7. ALL REMAINING VVT BOXES NOT MARKED FOR DEMOLITION SHALL HAVE ITS ACTUATOR CONTROLLER AND ASSOCIATED DUCTING REMOVED OR PATCHED AS NEEDED TO FACILITATE REPLACEMENT DURING RECONSTRUCTION.

T-STAT REMOVED TO FACILITATE REPLACEMENT DURING RECONSTRUCTION.
ADDITIONAL CONST TO THE UNIVERSITY.

DEMOLISH SUPPLY DIFFUSER.

REFERENCE FOR RE-BALANCING DURING RECONSTRUCTION.


Corona, CA 92879

DEMOLISH MANUAL VOLUME DAMPER. CAP, RE-INSULATE, AND PATCH ASSOCIATED DUCT TO PROVIDE ADEQUATE CFM.

4. CONTRACTOR SHALL MEASURE THE CFM OF EACH SUPPLY DIFFUSER NOT MARKED FOR DEMOLITION AS A

DEMO LISH THERMOSTAT. PATCH AND PAINT WALL AS NEEDED TO MATCH EXISTING FINISH.

2. CONTRACTOR SHALL COORDINATE ANY UTILITY SHUTDOWN AT LEAST THIRTY (30) DAYS IN ADVANCE WITH THE UNIVERSITY'S REPRESENTATIVE.

1. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE AND DO NOT SHOW ALL PIPES, DUCTS, FITTINGS, EQUIPMENT, FACILITIES, ETC. (SHOWN FOR CONSTRUCTION PURPOSES) AND MAY NOT BE COMPLETE OR CORRECT IN ALL RESPECTS.

DEMOLISH VAV BOX AND ASSOCIATED DUCTING AS NEEDED TO FACILITATE WORK. IF THERE ARE ANY DISCREPANCIES, THE CONTRACTOR SHALL NOTIFY THE UNIVERSITY'S REPRESENTATIVE.

DEMOLISH SUPPLY DUCTWORK UP TO POINT OF DISCONNECT. PATCH AND CAP TO SEAL REMAINING DUCTING IN PLACE.

3. ALL VAV BOXES MARKED FOR DEMOLITION HAVE BEEN FIELD VERIFIED AS BEING DAMAGED OR UNABLE TO FUNCTION.}

FILE NO.:119-09-08

Building Permit B19-308

Reviewed for Code Compliance

03/10/20
DEMOLITION SHEET NOTES:

DEMOLISH RTU, CONDENSATE/GAS PIPING, AND ASSOCIATED ROOF CURB.
DEMOISH BYPASS DAMPER AND ASSOCIATED DUCTWORK UP TO THE POINT NECESSARY TO FACILITATE RECONSTRUCTION. PROTECT REMAINING DUCTWORK IN PLACE.

GENERAL NOTES:

1. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE AND DO NOT SHOW ALL PIPES, DUCTS, FITTINGS, EQUIPMENT, AND OBSTACLES. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CLEARANCES BEFORE BEGINNING WORK. IF THERE ARE ANY DISCREPANCIES, THE CONTRACTOR SHALL NOTIFY THE UNIVERSITY'S REPRESENTATIVE.

2. CONTRACTOR SHALL PROVIDE ALL TRANSITION FITTINGS REQUIRED TO FACILITATE CONSTRUCTION.

3. CONTRACTOR SHALL COORDINATE ANY UTILITY SHUT DOWN AT LEAST THIRTY (30) DAYS IN ADVANCE WITH THE UNIVERSITY'S REPRESENTATIVE.

FILE NO.: 119-09-08

SCALE: 04'8" 16'

5/8" = 1'-0"
RE-BALANCE AS NEEDED TO MATCH THE CFM MEASURED DURING DEMOLITION.

6. REFER TO DETAIL 03/M5.0 FOR TYPICAL DUCT HANGER INSTALLATION REQUIREMENTS.

4. REFER TO DETAIL 01/M5.0 FOR GENERAL DUCTWORK INSTALLATION REQUIREMENTS.

3. CONTRACTOR SHALL PROVIDE ALL TRANSITION FITTINGS NEEDED TO FACILITATE RECONSTRUCTION.

SHEET M0.2 FOR ADDITIONAL THERMOSTAT REQUIREMENTS.
7. REFER TO DETAIL 05/M5.1 FOR ALL FIRE RATED WALL PENETRATIONS.

6. REFER TO DETAIL 03/M5.0 FOR TYPICAL DUCT HANGER INSTALLATION REQUIREMENTS.

5. REFER TO DETAIL 02/M5.0 FOR NEW AND SALVAGED SUPPLY DIFFUSER INSTALLATION REQUIREMENTS.

4. Re-Balance existing supply diffusers to the CFM indicated.

3. CONTRACTOR SHALL PROVIDE ALL TRANSITION FITTINGS NEEDED TO FACILITATE RECONSTRUCTION.

2. ANY DISCREPANCIES, THE CONTRACTOR SHALL NOTIFY THE UNIVERSITY'S REPRESENTATIVE.

1. CONTRACTOR SHALL VERIFY THE FLOW OF ALL DIFFUSERS NOT TOUCHED OR BALANCED DURING RECONSTRUCTION AND

8. CONTRACTOR SHALL CLEAN ALL DIFFUSERS AND GRILLES AFTER CONSTRUCTION IS COMPLETE.
1. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE AND DO NOT SHOW ALL PIPES, DUCTS, FITTINGS, EQUIPMENT, AND OBSTACLES. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CLEARANCES BEFORE BEGINNING WORK.

2. CONTRACTOR SHALL PROVIDE ALL DUCTING NEEDED TO FACILITATE RECONSTRUCTION.

3. CONTRACTOR SHALL PROVIDE ALL TRANSITION FITTINGS NEEDED TO FACILITATE RECONSTRUCTION SHEET NOTES:

4. REFER TO DETAIL 02/M5.1 FOR CONDENSATE PIPE INSTALLATION REQUIREMENTS.

5. REINSTALL ROOF SCREEN ONCE RTU INSTALLATION IS COMPLETE. ENSURE A MINIMUM 3' OF CLEARANCE IS MAINTAINED POST CONSTRUCTION BETWEEN RTU-16 AND RTU-17.

6. SMOKE DUCT DETECTOR FURNISHED AND WIRED BY DIVISION 26. MECHANICAL CONTRACTOR SHALL PROVIDE 10' OF CLEARANCE FROM ANY OUTSIDE AIR INTAKE PER CMC. ROUTE CONDENSATE PIPE FROM THE RTU'S BOTTOM CONNECTION TO THE CONDENSATE DRAIN AS SHOWN.

7. REFER TO DETAIL 04/M5.1 PROVIDE DUCTWORK AND EXTEND TO SERVE THE ASSOCIATED RTU. SUPPORT PER DETAIL 04/M5.1.

8. REFER TO DETAIL 06/M5.1 FOR SIDE SHOT UNIT INSTALLATION REQUIREMENTS.

9. REFER TO STRUCTURAL PLANS FOR RTU MOUNTING REQUIREMENTS.
NOTE:
FOR SINGLE PIPE APPLICATIONS USING STEEL PIPE OR COPPER TUBING, PROVIDE A MAXIMUM OF 6'-0" BETWEEN SUPPORT BLOCKS. ADDITIONALLY, PROVIDE SUPPORT BLOCK WITHIN 2'-0" OF ANY CHANGE IN DIRECTION. REFER TO MANUFACTURER'S DATA FOR BLOCK SPACING OF MULTIPLE PIPES & PIPES OF DIFFERENT COMPOSITION THAN LISTED ABOVE.

TOP VIEW
SECURE COPPER B-LINE DURA-BLOK TO ROOF DECK WITH ADHESIVE.

SIDE VIEW
PROVIDE GAP BETWEEN INTEGRAL STRUT CHANNEL & HARDWARE USED TO SECURE PIPE TO ALLOW FOR MOVEMENT OF SYSTEM.

PROVIDE COPPER B-LINE DURA-BLOK WITH INTEGRAL CHANNEL AND PIPE BRACKETS, SIZED FOR INSULATED PIPING.

NOTES:
1. REFER TO DETAIL 02/M5.1 FOR CONDENSATE TRAP REQUIREMENTS.
2. REFER TO STRUCTURAL PLANS FOR ADDITIONAL INSTALLATION REQUIREMENTS.

SOUNDLINING IN SUPPLY & RETURN DUCTWORK

OSA INTAKE WITH ECONOMIZER CONTROLS

PROVIDE BIRD SCREEN
FLEXIBLE CONNECTION (TYP.)
VIBRATION ISOLATION ROOF CURB BY MANUFACTURER
LAY IN 4 LAYERS OF 1/2" GYPSUM UNDER UNIT WITHIN ENTIRE CURB BASE. FILL REMAINDER OF SPACE WITH ACOUSTICAL LINER, ALL AROUND DUCTS.

ROOF CONDENSATE & GAS PIPING BY PLUMBING CONTRACTOR.

FLOW CONNECTION (TYP.)
DRAIN LINE SHALL BE MINIMUM SAME SIZE AS CONNECTION ON THE UNIT.
DIELECTRIC UNION
VENT SAME SIZE AS DRAIN

ABC

TONS DRAIN SIZE
3/4" 1" 1-1/4" 1-1/2" 2" 0-20 21-40 41-90 91-125 126-250

NOTES:
1. REFER TO DETAIL 02/M5.1 FOR CONDENSATE TRAP REQUIREMENTS.
2. REFER TO STRUCTURAL PLANS FOR ADDITIONAL INSTALLATION REQUIREMENTS.
1. Insert BT485 terminator to the controllers at the beginning and end of the network segment. (Located near the BACnet (Cmnet) connector). The BT485 has no polarity associated with it.

2. Each segment must be wired in a ‘daisy chain’ fashion. Branching requires the use of a REP485 or an ARCnet to ARCnet Router (AAR).

3. Network ‘ends’ must be terminated with TERM485 plugins or BT485 plugins (where applicable). When using TERM485 plugins each segment must have at least one DIAG485 installed on the net to supply bias.

4. CAT5e Ethernet network runs should not exceed 100 meters or 328ft maximum length.

5. Reference page BAS 0.20 for cable schedule.

6. Place a REP485 after every 31 devices or after 2000 feet (whichever is reached first), and at each branch of a hybrid network. Each repeater begins a new network segment. You can wire a maximum of four REP485s in series. Power REP485 from next closest controller 24vac power source.

### Device Instance Addressing

- **R** = PROT485 Device
- **T** = BT485 Device
- **E** = 120 ohm Resistor
- **D** = DIAG485 Diagnostic Board

### Ethernet - Customers Wide Area Network

- **SERVER IP#:** [__.___.____.____]
- **SUBNET MASK:** [__.___.____.____]
- **DEFAULT GW:** [__.___.____.____]
GENERAL NOTES:
1. ELECTRICAL ENGINEERING FOR THIS PROJECT IS BASED ON EXISTING DRAWINGS, DATED 3-7-2002 AND A FIELD VISIT OF THE ELECTRICAL SYSTEM. IN CASE OF ANY DISCREPANCIES WITH EXISTING FIELD CONDITIONS, ELECTRICAL CONTRACTOR SHALL VERIFY THE EXACT DIFFERENCES AND NOTIFY THE UNIVERSITY'S REPRESENTATIVE FOR POSSIBLE REVISION TO THESE DOCUMENTS.
2. ENSURE THAT THE CONTRACTOR COORDINATES ALL ELECTRICAL WORK REGARDING LO/TO WITH THE UNIVERSITY'S REPRESENTATIVE PRIOR TO ANY EXHAUST FAN TO BE DISCONNECTED.
3. PROPERLY REMOVE AND DISPOSE OF ALL MATERIALS IN A PROPER AND COMPLIANT METHOD WITH ALL PERTINENT REGULATORY AGENCIES AND THEIR REQUIREMENTS.
DEMO/ENHANCEMENT:
- Disconnect and remove existing power and/or control connections of existing VAV. All associated conduits shall be demolished back to nearest J-box at ceiling space. Maintain circuit continuity of equipment/devices to remain. Reuse existing circuit as shown in reconstruction drawings.

GENERAL NOTES:
- Electrical engineering for the project is based on existing drawings, dated 3-7-2002, and a field visit of the electrical system. In case of any discrepancies with existing field conditions, electrical contractor shall verify the exact differences and notify the university's representative for possible revision to these documents.
- Ensure that the compressor for condenser is located on the upper floor.
- Properly remove and dispose of all asbestos in proper and compliant method with all pertinent regulatory agencies and their requirements.

CHECKS:
- Reviewed for code compliance: 03/10/20
LEGEND:

DEMOLISH/REMOVE
EXISTING

DEMOLITION SHEET NOTES:
DISCONNECT AND REMOVE ALL EXISTING ASSOCIATED POWER AND/OR CONTROL CONNECTIONS FROM EXISTING MECHANICAL EQUIPMENTS BACK TO ROOF STUB-UPS. EXISTING CIRCUITS INCLUDING ALL CONDUITS AND WIRING BELOW ROOF SHALL BE REUSED AND BE PROTECTED IN-PLACE. MAINTAIN CIRCUIT CONTINUITY OF EQUIPMENTS TO REMAIN. COORDINATE ALL DEMOLITION WORKS WITH MECHANICAL DRAWINGS.

EXISTING ROOF TOP RECEPTACLE (WP) GFCI TYPE TO BE PROTECTED IN-PLACE. DISCONNECT AND REMOVE ALL EXISTING ASSOCIATED POWER AND/OR CONTROL CONNECTIONS FROM EXISTING MECHANICAL EQUIPMENTS BACK TO SOURCE. COORDINATE ALL DEMOLITION WORKS WITH MECHANICAL DRAWINGS. SEE SHEET E1.0 FOR PANEL LOCATION.

GENERAL NOTES:
1. ELECTRICAL ENGINEERING FOR THIS PROJECT IS BASED ON EXISTING DRAWINGS, DATED 3-7-2002 AND A FIELD VISIT OF THE ELECTRICAL SYSTEM. IN CASE OF ANY DISCREPANCIES WITH EXISTING FIELD CONDITIONS, ELECTRICAL CONTRACTOR SHALL VERIFY THE EXACT DIFFERENCES AND NOTIFY THE UNIVERSITY'S REPRESENTATIVE FOR POSSIBLE REVISION TO THESE DOCUMENTS.

2. ENSURE THAT THE CONTRACTOR COORDINATES ALL ELECTRICAL WORK REGARDING LO/TO WITH THE UNIVERSITY'S REPRESENTATIVE PRIOR TO ANY EXHAUST FAN TO BE DISCONNECTED.

3. PROPERLY REMOVE AND DISPOSE OF ALL MATERIALS IN A PROPER AND COMPLIANT METHOD WITH ALL PERTINENT REGULATORY AGENCIES AND THEIR REQUIREMENTS.

SCALE:
01 ROOF DEMOLITION POWER PLAN
01/8" = 1'-0"

FILE NO.:119-09-08

FILE NO.:119-09-08 UCR - Surge Bldg Rooftop Unit Replacement\CAD\Electrical\_E1.2.dwg, 2/26/2020 4:01:54 PM, AutoCAD PDF (General Documentation).pc3

Building Permit B19-308
Reviewed for Code Compliance
03/10/20
GENERAL NOTES:
1. THE EXISTING BUILDING INCLUDING PORTIONS OF THE RECONSTRUCTION AREA SHALL REMAIN IN
SERVICE DURING THE CONSTRUCTION PHASE OF THIS PROJECT. ANY MODIFICATIONS TO THE
EXISTING ELECTRICAL SYSTEMS THAT MAY REQUIRE THE TEMPORARY INTERRUPTION OF
EXISTING SERVICES SHALL BE COORDINATED AND PRE-SCHEDULED WITH THE UNIVERSITY'S
REPRESENTATIVE PRIOR TO STARTING ANY WORK.

LEGEND:
NEW
EXISTING

RECONSTRUCTION SHEET NOTES:
PROVIDE NEW POWER CONNECTION/S AND LOCAL REMOTE DISCONNECT SWITCH FOR
MECHANICAL UNIT/S. EXTEND CONDUIT AND WIRING TO NEW SWITCH AS REQUIRED. REUSE
EXISTING CIRCUIT.
APPROXIMATE LOCATION OF EXISTING J-BOX, CIRCUIT AS SHOWN. EXTEND CONDUIT AND
WIRE AS SHOWN. FIELD VERIFY EXACT LOCATIONS.
PROVIDE 120V CONNECTION TO NEW MECHANICAL CONTROL PANEL. CIRCUIT AS SHOWN.
COORDINATE ALL EFFORTS WITH MECHANICAL DRAWINGS. VERIFY AVAILABILITY OF
CIRCUITS.
**GENERAL NOTES:**

- **SD** Indicates the location of the Roof Reconstruction Power Plan.
- **CC** Indicates the location of the HVAC System.
- **GFCI** Indicates the location of the Ground Fault Circuit Interrupter.
- **RTU** Indicates the location of the Rooftop Unit.
- **3P(WP)** Indicates the location of the 3-Phase (Wye-Polygon) Power.
- **50AF** Indicates the location of the 50-Amp Fuse.
- **60AS** Indicates the location of the 60-Amp Screw Terminal.
- **100AS** Indicates the location of the 100-Amp Screw Terminal.
- **70AF** Indicates the location of the 70-Amp Screw Terminal.
- **30AF** Indicates the location of the 30-Amp Screw Terminal.
- **15AF** Indicates the location of the 15-Amp Screw Terminal.
- **45AF** Indicates the location of the 45-Amp Screw Terminal.
- **80AF** Indicates the location of the 80-Amp Screw Terminal.
- **110AF** Indicates the location of the 110-Amp Screw Terminal.

**RECONSTRUCTION SHEET NOTES:**

1. All views shown in this drawing are for the existing building. All new electrical installation shall be per the approved electrical plan and the NEC (National Electric Code).
2. The existing building shall remain in use throughout the construction phase of this project. Any modifications to the existing electrical system that may require the temporary interruption of service during the construction phase shall be coordinated in advance with the university's representative and the campus fire marshal.
3. All electrical equipment/devices on the roof shall be weatherproof, NEMA-3R rated, and +18" above finished roof level.
4. Existing services shall be coordinated and pre-scheduled with the university's representative prior to starting any work.
5. All fuses to be "time-delay" rejection type. Equipment nameplate fuse rating shall supersede design value.
6. Provides (1) 3/4" C-3#/12 & 1#/12 GRD. for power exhaust. Coordinate all efforts with mechanical drawings.
7. Duct smoke detector located in the supply duct on roof. Duct smoke detector shall be 100% compatible with the existing fire alarm system. Provide local remote disconnect switch for mechanical unit/s. Extend conduit and wiring from roof stub-up to new switch as required. Reuse existing circuit.
8. The existing building, including portions of the reconstruction area, shall remain in use throughout the construction phase of this project. Any modifications to the existing electrical system that may require the temporary interruption of service during the construction phase shall be coordinated in advance with the university's representative and the campus fire marshal.
9. All efforts with mechanical drawings. Required to be reviewed and approved by the campus fire marshal. Coordinate re-program into existing FACP as needed. All fire alarm works shall be installed by the division 23. Furnished and wired by division 26. Ensure the duct smoke detector located in the supply duct on roof. Duct smoke detector shall be 100% compatible with the existing fire alarm system. Provide local remote disconnect switch for mechanical unit/s. Extend conduit and wiring from roof stub-up to new switch as required. Reuse existing circuit.
10. Provide (1) 3/4" C-3#/12 & 1#/12 GRD. for power exhaust. Coordinate all efforts with mechanical drawings.
11. All necessary conduits and wiring to connect to existing fire alarm system. Duct smoke detector located in the supply duct on roof. Duct smoke detector shall be 100% compatible with the existing fire alarm system. Provide local remote disconnect switch for mechanical unit/s. Extend conduit and wiring from roof stub-up to new switch as required. Reuse existing circuit.

**LEGEND:**

- **SD** Indicates the location of the Roof Reconstruction Power Plan.
- **CC** Indicates the location of the HVAC System.
- **GFCI** Indicates the location of the Ground Fault Circuit Interrupter.
- **RTU** Indicates the location of the Rooftop Unit.
- **3P(WP)** Indicates the location of the 3-Phase (Wye-Polygon) Power.
- **50AF** Indicates the location of the 50-Amp Fuse.
- **60AS** Indicates the location of the 60-Amp Screw Terminal.
- **100AS** Indicates the location of the 100-Amp Screw Terminal.
- **70AF** Indicates the location of the 70-Amp Screw Terminal.
- **30AF** Indicates the location of the 30-Amp Screw Terminal.
- **15AF** Indicates the location of the 15-Amp Screw Terminal.
- **45AF** Indicates the location of the 45-Amp Screw Terminal.
- **80AF** Indicates the location of the 80-Amp Screw Terminal.
- **110AF** Indicates the location of the 110-Amp Screw Terminal.

**SCALE:**

- 018" = 1'-0"
**SPECIFICATIONS**

**TABLE OF CONTENTS**

Division 01 – General Requirements

<table>
<thead>
<tr>
<th>Initial Issue</th>
<th>Revision</th>
<th>Section #</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>01 1100</td>
<td>Summary of Work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 1400</td>
<td>Work Restrictions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 2500</td>
<td>Product Options, Requirements &amp; Substitution Procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 2613</td>
<td>Requests for Information &amp; Instructions (RFI) Procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3113</td>
<td>Coordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3119</td>
<td>Project Meetings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3200</td>
<td>Document Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3216</td>
<td>Schedules</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3280</td>
<td>Electronic Data Transfer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3300</td>
<td>Submittals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3329.08</td>
<td>Buy Clean California Reporting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3543</td>
<td>Environmental Procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 3546</td>
<td>Indoor Air Quality Procedures &amp; Requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 4100</td>
<td>Regulatory Requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 4200</td>
<td>References</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 4300</td>
<td>Inspection of Work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 4500</td>
<td>Quality Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 4516</td>
<td>Contractor’s Quality Control Program</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 5100</td>
<td>Temporary Utilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 5400</td>
<td>Construction Aids</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 5500</td>
<td>Vehicular Access and Parking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 5600</td>
<td>Temporary Barriers and Enclosures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 5700</td>
<td>Temporary Controls</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 5800</td>
<td>Temporary Signage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 6000</td>
<td>Product Requirements</td>
</tr>
<tr>
<td>Initial Issue</td>
<td>Revision</td>
<td>Section #</td>
<td>Title</td>
</tr>
<tr>
<td>---------------</td>
<td>----------</td>
<td>-----------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 7100</td>
<td>Examination and Preparation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 7123</td>
<td>Field Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 7329</td>
<td>Cutting and Patching</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 7400</td>
<td>Cleaning and Waste Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 7700</td>
<td>Contract Closeout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 7839</td>
<td>As-Built Documents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 8113</td>
<td>Sustainable Design Requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 9113</td>
<td>General Commissioning Requirements</td>
</tr>
</tbody>
</table>
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 the replacement of seventeen (17) existing roof-mounted RTUs, replacement of ten (10) existing 10 VVT boxes with replacement of actuators on eighty-seven (87) existing VVT boxes, upgrade of existing controls to ALC [Automated Logic Controls] standard, new thermostats throughout the building.

B. The Contract Time to complete the Work of this Contract is specified in the Supplemental Instructions to Bidders.

C. Project Location: Skye Hall - University of California, Riverside.

1.3. WORK SEQUENCE

A. The work shall be sequenced to occur on successive weekends, or as may be determined by the University’s Representative based upon the prevailing conditions at the time of mobilization.

1.4. WORK BY UNIVERSITY

A. The University shall manage the HVAC systems in-hand, and or as needed

1.5. UNIVERSITY FURNISHED PRODUCTS

A. None

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION
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.
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. 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 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 three working days 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
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 ______________
LEFT BLANK

INTENTIONALLY
SECTION 01 2500
PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes:

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 foregoing, 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)
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 RFIs 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
REQUEST FOR INFORMATION

DATE: mm/dd/yy

TO:

FROM:

Cc:

Subject/Title: ____________________________

☐ Architectural  ☐ Civil  ☐ Mechanical  ☐ Plumbing  ☐ Structural
☐ Fire Protection  ☐ Landscape  ☐ Other: ______

Reason(s) for RFI:

☐ Clarification/Interpretation  ☐ Conflict in CD’s
☐ Coordination Issue  ☐ Information Not Shown on CD’s
☐ Cost Impact: ______  ☐ Safety
☐ Work/Time Impact: ______

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: ____________
LEFT BLANK

INTENTIONALLY
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.
7. Submittal of Shop Drawings, Product Data, and Samples.
8. Preparation of record documents.
9. Use of the premises.
11. Office, work, and storage areas.
12. Equipment deliveries and priorities.
13. Safety procedures, including emergency notification procedures.
14. First Aid.
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
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 RFI's 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 RFI’s 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 RFI’s 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
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 Primavera Scheduling Software (P6 or the latest version for Windows, MS Project (latest version for Windows), or equal which is 100% importable into Primavera.

3. Contractor shall use Primavera Scheduling Software 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.

   b. Other Campus Closure Days: None

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 or 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, spreadsheet, scheduling, database 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
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. 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 it’s 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 43 39 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
LEFT BLANK

INTENTIONALLY
## SUBMITTAL SCHEDULE

<table>
<thead>
<tr>
<th>Section</th>
<th>Shop Dwgs</th>
<th>Prod. Data/List</th>
<th>Samples Mock-ups</th>
<th>Extend. Guarantee</th>
<th>Op/Maint. Manuals</th>
<th>Tests</th>
<th>Extra Mat'l</th>
<th>Certs.</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 1100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 1400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 2300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 2500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 2613</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 3119</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 3200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 3300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 3520</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 3540</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 4100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 4200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 4300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 4339</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 4500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 4520</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 5000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 5739</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 6000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 7123</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 7329</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 7419</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 7423</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 7700</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 7836</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 7839</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 8113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 9113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02 4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 3000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 3600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 3816</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 4816</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 4819</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 4830</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 4900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 5415</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Submittals, Submittal Schedule Form
01 3300
<table>
<thead>
<tr>
<th>Section</th>
<th>Shop Dwgs</th>
<th>Prod. Data/List</th>
<th>Samples Mock-ups</th>
<th>Extend. Guarantee</th>
<th>Op/Maint. Manuals</th>
<th>Tests</th>
<th>Extra Mat'l</th>
<th>Certs.</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>03 5600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04 2113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04 2200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 1200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 1213</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 5000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 5010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 5100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 5813</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 7000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 1643</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 4023</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 4100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 6420</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 1416</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 1716</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 1900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 2114</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 2129</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 2616</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 2620</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4646</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 5300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 5400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 5565</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 6113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 6200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 6500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 7723</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 8400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 8720</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 9200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 9513</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 1113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 1216</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 1316</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Submittals, Submittal Schedule Form
UCR 2014-03-20
01 3300
<table>
<thead>
<tr>
<th>Section</th>
<th>Shop Dwgs</th>
<th>Prod. Data/List</th>
<th>Samples Mock-ups</th>
<th>Extend. Guarantee</th>
<th>Op/Maint. Manuals</th>
<th>Tests</th>
<th>Extra Mat'l</th>
<th>Certs.</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 1400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 3213</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 3323</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 3816</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 4213</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 4313</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 4330</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 4413</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 4500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 5113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 6200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 7100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 7113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 9110</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 2116</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 2216</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 2400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 2900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 3000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 5113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 5426</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 6453</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 6500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 6813</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 6816</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 7200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 8200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 9000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 1400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 2213</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 2226</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 2813</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 4400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 5113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 5500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 7113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 8214</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Shop Dwgs</td>
<td>Prod. Data/List</td>
<td>Samples Mock-ups</td>
<td>Extend. Guarantee</td>
<td>Op/Maint. Manuals</td>
<td>Tests</td>
<td>Extra Mat'l</td>
<td>Certs.</td>
<td>Other</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
<td>----------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>-------</td>
<td>------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>11 1200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 1300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 1630</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 5200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 8226</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 2116</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 2400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 3623</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 3661</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 5219</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 9300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 9313</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 1101</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 1102</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 1103</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 1104</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 1105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 1106</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 1107</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 1108</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 2100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 2400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 9182</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 0548</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 0517</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 0518</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 0548</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 1313</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 0553</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 0719</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 0800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 1116</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 1119</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 1123</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 1316</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 1319</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 1323</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Shop Dwgs</td>
<td>Prod. Data/List</td>
<td>Samples Mock-ups</td>
<td>Extend. Guarantee</td>
<td>Op/Maint. Manuals</td>
<td>Tests</td>
<td>Extra Mat'l</td>
<td>Certs.</td>
<td>Other</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
<td>----------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>-------</td>
<td>-------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>22 1413</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 1423</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 3400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 3450</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 4613</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0510</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0514</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0516</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0519</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0523</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0529</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0548</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0563</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0593</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0713</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0719</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0993</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 2113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 2123</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 2300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 2500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 2516</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 3113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 3300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 3416</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 3423</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 3433</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 3713</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 3723</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 4100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 5100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 5216</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 6500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 8119</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 8126</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Shop Dwgs</td>
<td>Prod. Data/List</td>
<td>Samples Mock-ups</td>
<td>Extend. Guarantee</td>
<td>Op/Maint. Manuals</td>
<td>Tests</td>
<td>Extra Mat'l</td>
<td>Certs.</td>
<td>Other</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
<td>----------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>-------</td>
<td>------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>23 8127</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 8128</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 8146</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0501</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0519</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0524</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0526</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0529</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0533</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0543</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0553</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0570</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0573</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 1219</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2213</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2413</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2416</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2716</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2726</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2811</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2816</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 3214</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 3623</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 5110</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 5610</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 2333</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 0513</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 1100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 1216</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 1300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 1316</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 1413</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 1723</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SUBMITTAL SCHEDULE

<table>
<thead>
<tr>
<th>Section</th>
<th>Shop Dwgs</th>
<th>Prod. Data/List</th>
<th>Samples Mock-ups</th>
<th>Extend. Guarantee</th>
<th>Op/Maint. Manuals</th>
<th>Tests</th>
<th>Extra Mat'l</th>
<th>Certs.</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 3210</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 3236</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 3400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 8200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 9000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 9010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 9020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 9030</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 9040</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 1100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Should a discrepancy arise between this schedule's requirements and individual requirements, the most stringent requirement shall prevail.

END OF SECTION
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
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.
   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
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) as well as a hazardous material consultant chosen from the "EH&S Approved Hazardous Materials Consultant List" to conduct an on-site assessment of the material and if it is found to be hazardous then the chosen consultant 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
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.

<table>
<thead>
<tr>
<th>TSDF name</th>
<th>Street</th>
<th>City</th>
<th>State</th>
<th>Zip phone</th>
<th>EPA ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altamont Landfill</td>
<td>10840 Altamont Pass Road</td>
<td>Livemore</td>
<td>CA</td>
<td>94550</td>
<td>CAD981382732</td>
</tr>
<tr>
<td>AERC INC. (MTI)</td>
<td>30677 Huntwood Avenue</td>
<td>Hayward</td>
<td>CA</td>
<td>94544</td>
<td>CAD962411993</td>
</tr>
<tr>
<td>Azusa Land Reclamation Co.</td>
<td>1201 W. Glendora Road</td>
<td>Azusa</td>
<td>CA</td>
<td>91702</td>
<td>CAD960307626</td>
</tr>
<tr>
<td>Bethlehem Apparatus</td>
<td>890 Front Street</td>
<td>Hellertown</td>
<td>PA</td>
<td>18055</td>
<td>PADO2390961</td>
</tr>
<tr>
<td>Chemical Waste Management (CWM) - Kettleman Hills</td>
<td>3525 Old Skyline Road</td>
<td>Kettleman</td>
<td>CA</td>
<td>93239</td>
<td>CAT006646117</td>
</tr>
<tr>
<td>Chemical Waste Management (CWM) - TWI</td>
<td>7 Mobile Drive</td>
<td>Staughton</td>
<td>IL</td>
<td>62201</td>
<td>ILL069842242</td>
</tr>
<tr>
<td>Chem-Nuclear Systems, Inc. (Barnawa)</td>
<td>140 Stoneridge Drive</td>
<td>Columbia</td>
<td>SC</td>
<td>29210</td>
<td>SCDO40372425</td>
</tr>
<tr>
<td>Clean Harbors (Aragonite), LOC Inc.</td>
<td>P.O. Box 22890</td>
<td>Aragonite</td>
<td>UT</td>
<td>84112</td>
<td>UTDO8155217</td>
</tr>
<tr>
<td>Clean Harbors (Chicago)</td>
<td>11800 S. Stony Island Ave.</td>
<td>Chicago</td>
<td>IL</td>
<td>60617</td>
<td>ILL00608471</td>
</tr>
<tr>
<td>Clean Harbors (Deer park), Inc.</td>
<td>2027 Battleground Road</td>
<td>Deer Park</td>
<td>TX</td>
<td>77536</td>
<td>TXDO05141378</td>
</tr>
<tr>
<td>Clean Harbors (Kimball, Inoculator Facility)</td>
<td>2247 S. Highway 71</td>
<td>Kimball</td>
<td>NE</td>
<td>69145</td>
<td>NED98173513</td>
</tr>
<tr>
<td>Clean Harbors (Lomax)</td>
<td>2500 West Lomax Rd.</td>
<td>Buttolphua</td>
<td>CA</td>
<td>93206</td>
<td>CAD98067526</td>
</tr>
<tr>
<td>Clean Harbors (Los Angeles), Inc.</td>
<td>5756 Alba Street</td>
<td>Los Angeles</td>
<td>CA</td>
<td>90058</td>
<td>CAD50806850</td>
</tr>
<tr>
<td>Clean Harbors (Phoenix)</td>
<td>1340 West Lincoln Street</td>
<td>Phoenix</td>
<td>AZ</td>
<td>85007</td>
<td>AZDO49381608</td>
</tr>
<tr>
<td>Clean Harbors (Sacramento)</td>
<td>6000 - 88th Street</td>
<td>Sacramento</td>
<td>CA</td>
<td>95829</td>
<td>CAD00084517</td>
</tr>
<tr>
<td>Clean Harbors (San Jose)</td>
<td>1040 Commercial St. Suite 109</td>
<td>San Jose</td>
<td>CA</td>
<td>95112</td>
<td>CAD059494310</td>
</tr>
<tr>
<td>Clean Harbors (Spring Grove Resources Recovery)</td>
<td>4829 Spring Grove Ave.</td>
<td>Cincinnati</td>
<td>OH</td>
<td>45232</td>
<td>OHDO00816629</td>
</tr>
<tr>
<td>Crosby &amp; Overton, Inc.</td>
<td>1630 W 17th Street</td>
<td>Long Beach</td>
<td>CA</td>
<td>90803</td>
<td>CAD280490019</td>
</tr>
<tr>
<td>DeFronzo/Kentro, Inc.</td>
<td>2280 North Central Street</td>
<td>Columbus</td>
<td>OH</td>
<td>43201</td>
<td>CAD90313352</td>
</tr>
<tr>
<td>Diversified Scientific Services (DSSI)</td>
<td>P.O. Box 863</td>
<td>Kinston</td>
<td>TN</td>
<td>37831</td>
<td>TND982019142</td>
</tr>
<tr>
<td>Duratek</td>
<td>1560 Bear Creek Road</td>
<td>Oak Ridge</td>
<td>TN</td>
<td>37831</td>
<td>TND982155707</td>
</tr>
<tr>
<td>ENSCO</td>
<td>309 American Circle</td>
<td>El Dorado</td>
<td>AR</td>
<td>71730</td>
<td>ARDO69748192</td>
</tr>
<tr>
<td>ENSCO West</td>
<td>1737 East Devlin Street</td>
<td>Devlin</td>
<td>OH</td>
<td>44311</td>
<td>CAD44429835</td>
</tr>
<tr>
<td>Envirocare of Utah, Inc.</td>
<td>US I-80, Exit 49</td>
<td>Clive</td>
<td>UT</td>
<td>84029</td>
<td>UTDO82586988</td>
</tr>
<tr>
<td>Environmental Management &amp; Controls (EMC)</td>
<td>3106 South Fair Home Road</td>
<td>Turlock</td>
<td>CA</td>
<td>95380</td>
<td>Radioactive Material License # 3546-5C</td>
</tr>
<tr>
<td>Envirosafe</td>
<td>hwy 78 Missle Base Road</td>
<td>Grand View</td>
<td>UT</td>
<td>82624</td>
<td>IDD07314654</td>
</tr>
<tr>
<td>Heritage Environmental Services, Inc.</td>
<td>7935 West Main Street</td>
<td>Indio</td>
<td>CA</td>
<td>86261</td>
<td>IND9190012</td>
</tr>
<tr>
<td>Heritage Environmental Services, LLC</td>
<td>5122 East Story Road</td>
<td>Coolidge</td>
<td>AZ</td>
<td>85229</td>
<td>AZDO81705402</td>
</tr>
<tr>
<td>Heritage Landfill</td>
<td>4370 WCR 1275N</td>
<td>Roachdale</td>
<td>IN</td>
<td>46712</td>
<td>IND980353890</td>
</tr>
<tr>
<td>Kingsbury Brothers Incorporated</td>
<td>1314 Lemon Street</td>
<td>Anaheim</td>
<td>CA</td>
<td>92801</td>
<td>CAD088504861</td>
</tr>
<tr>
<td>Mercury Waste Solutions, Inc.</td>
<td>5318 61st Avenue</td>
<td>Union Grove</td>
<td>WI</td>
<td>53182</td>
<td>WIO8000000 0356</td>
</tr>
<tr>
<td>Merry X-Ray</td>
<td>131 South Main #1</td>
<td>S. San Fran</td>
<td>CA</td>
<td>94080</td>
<td>CAL00512055</td>
</tr>
<tr>
<td>ONYX (formerly AETS)</td>
<td>1125 Hensley Street</td>
<td>Richmond</td>
<td>CA</td>
<td>94801</td>
<td>CAT08041079</td>
</tr>
<tr>
<td>Onyx (formerly CWM OSCO)</td>
<td>1704 W. First Street</td>
<td>Azusa</td>
<td>CA</td>
<td>91702</td>
<td>CAD083026003</td>
</tr>
<tr>
<td>Onyx (Superior Special Services, Inc.)</td>
<td>5736 8th Ave.</td>
<td>Phoenix</td>
<td>AZ</td>
<td>85043</td>
<td>AZDO83473539</td>
</tr>
<tr>
<td>Perma-Fix (Quadrex)</td>
<td>1940 NW 67th Street</td>
<td>Gainsville</td>
<td>FL</td>
<td>32653</td>
<td>FLD980711071</td>
</tr>
<tr>
<td>Philip Environmental (Burlington)</td>
<td>20245 - 77th Avenue, south</td>
<td>Kent</td>
<td>WA</td>
<td>98032</td>
<td>WA991281767</td>
</tr>
<tr>
<td>Philip Environmental (Georgetown)</td>
<td>734 Licnite Street</td>
<td>Seattle</td>
<td>WA</td>
<td>98106</td>
<td>WA008129090</td>
</tr>
<tr>
<td>Philip Environmental (Rho-Chem)</td>
<td>425 Ids Avenue</td>
<td>Inglewood</td>
<td>CA</td>
<td>90301</td>
<td>CAD063648342</td>
</tr>
<tr>
<td>Photo Waste Recycling Co., Inc.</td>
<td>2980 Kerner Boulevard</td>
<td>San Rafael</td>
<td>CA</td>
<td>94901</td>
<td>CAD98142673</td>
</tr>
<tr>
<td>Photo Waste Recycling Co., Inc.</td>
<td>12898 Bradley Avenue, Suite B</td>
<td>Sylmar</td>
<td>CA</td>
<td>91342</td>
<td>CAD000121946</td>
</tr>
<tr>
<td>Ramos Environmental Services Inc.</td>
<td>1515 South River Road</td>
<td>W. Sacramento</td>
<td>CA</td>
<td>95691</td>
<td>CAD44036556</td>
</tr>
<tr>
<td>Ronic Environmental Technologies Corp</td>
<td>2081 Bay Road</td>
<td>East Palo Alto</td>
<td>CA</td>
<td>94303</td>
<td>CAD09452957</td>
</tr>
<tr>
<td>Ronic Environmental Technologies Corp (Southwest)</td>
<td>6750 West Allison Road</td>
<td>Chandler</td>
<td>AZ</td>
<td>85226</td>
<td>UTDO90015389</td>
</tr>
<tr>
<td>Ross Environmental Services</td>
<td>36790 Giles Road</td>
<td>Grafton</td>
<td>OH</td>
<td>44040</td>
<td>OHDO4815665</td>
</tr>
<tr>
<td>Stericycle, Inc. (Formerly BFI)</td>
<td>4135 West Swift Avenue</td>
<td>Fresno</td>
<td>CA</td>
<td>93722</td>
<td>CAD2596275991</td>
</tr>
<tr>
<td>Stericycle, Inc. (Formerly BFI)</td>
<td>901 North 1000 North Salt Lake</td>
<td>UT</td>
<td>84054</td>
<td>UTDO980741570</td>
<td></td>
</tr>
<tr>
<td>Systech Environmental Corp.</td>
<td>South Creek Road</td>
<td>Fedonia</td>
<td>KS</td>
<td>66736</td>
<td>KS06033259</td>
</tr>
<tr>
<td>SET Environmental INC. (Treatment One)</td>
<td>5743 Chestwood Road</td>
<td>Houston</td>
<td>TX</td>
<td>77077</td>
<td>TXDO5735388</td>
</tr>
<tr>
<td>U.S. Filter Recovery Services (North Environmental)</td>
<td>5375 South Boyle Ave.</td>
<td>Los Angeles</td>
<td>CA</td>
<td>90056</td>
<td>CAD976590909</td>
</tr>
<tr>
<td>Von Roll America (WFT)</td>
<td>1250 West Broadway</td>
<td>East Cleveland</td>
<td>OH</td>
<td>44120</td>
<td>OHDO97943888</td>
</tr>
<tr>
<td>Waste Control Specialists (WCS)</td>
<td>1710 West Broadway</td>
<td>Andrews</td>
<td>TX</td>
<td>79714</td>
<td>TXDO8808464</td>
</tr>
</tbody>
</table>

Pacific Resource Recovery Services

Yellow Highlight indicates TSDF pending approval.
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."


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.
   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 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 recirculated 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 of 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.
   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. Permit 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.

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 state fire marshal, 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
Regulatory Requirements

Skye Hall HVAC Replacement
Project Number: 950583
Contract Number: 950583-LF-2022-36

f. Title 22, Environmental Health
g. Title 24: Building Standards Code
   (1) Part 2, California Building Code
   (2) Part 3, California Electric Code
   (3) Part 4, California Mechanical Code
   (4) Part 5, California Plumbing Code
   (5) Part 6, California Energy Code
   (6) Part 7, California Elevator Safety Construction Code
   (7) Part 9, California Fire Code
   (8) Part 11, California Green Building Standards Code
   (9) Part 12, California State Reference Standards

2. In addition to the above, work shall comply with the following:

   a. California Environmental Quality Act (CEQA).
   c. California Occupational Safety and Health Act Standards (Cal-OSHA).
   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
   g. Part 7, California Elevator Safety Construction Code
   h. Part 9, California Fire Code
   i. Part 11, California Green Building Standards Code
   i Part 12, California Referenced Building Standards Code

1. CAL/OSHA Construction Safety Orders.
2. City of Riverside "Department of Public Works Standards and Specifications.
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
10. Uniform Mechanical Code
11. Uniform Plumbing Code
12. Standard Specifications for Public Works, (Greenbook), with local agency amendments.

UCR 2013-02-11 LF

01 4100-2
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. 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. PERMIT REQUIREMENTS, NOTIFICATIONS, AND CERTIFICATES

A. Permits, Licenses, and Certificates: For the University’s records, submit copies of permits, licenses, certifications, 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.

B. 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.

C. 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.

D. 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.

E. Fire Department and Additional Notifications, Manifests, and Requirements: As required by University and coordinated by Contractor with the University’s Representative.

1.5. FEES

A. None

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)
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 report to University’s Representative. The IOR shall observe construction in progress and shall have the following responsibilities and limitations on authority.

   1. Act under the direction of 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. Contractor shall submit a request for inspection using University's Inspection Request Form 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 Form 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

INSPECTION REQUEST INSTRUCTIONS USING CFORMS


2. Complete Automated Inspection Request Form

3. Select your Permit # from the drop down menu and request the inspection you are in need of

4. An e-mail will be sent to the IOR for that project, advising them that you are requesting inspection

5. Once that inspection is conducted, the IOR will input the disposition into CForms (approved, disapproved, corrections, etc.) and may add photos, documents, etc.

6. Results of the inspection is known immediately by those assigned to the project via email. Inspectors can also upload photos and other documents and attach them to the inspection file in CForms

7. Completed "As-Built" plans of project shall be provided to Inspector of Record (IOR) prior to final inspection signature

8. 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.

*Access to CForms must be granted by Inspection Group prior to accessing CForms.
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
LEFT BLANK

INTENTIONALLY
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 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. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

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 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 inspection and testing activities.

1.2 DEFINITIONS

A. The term "University's Testing Laboratory" means a 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, 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 inspections are to be made and/or required regardless whose Testing Laboratory will perform the tests and inspections.

D. If such procedures for testing, 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, 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 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 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 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 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 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 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 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 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
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 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
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.

   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.
      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.


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 distribution 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: Not required

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
PART 1 – GENERAL

1.1. SUMMARY

A. This Section Includes:

1. Temporary Cranes

1.2. TEMPORARY ELEVATORS – Not Used

1.3. TEMPORARY LIFTS AND HOISTS – Not Used

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 Lift and Rigging Plans for UCR Authority Having Jurisdiction [AHJ] review and approval.

1.5. TEMPORARY SWING STAGING – Not used

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

A. N/A

1.3. HAUL ROUTES

A. To be discussed with the University's Representative prior to mobilization. The University's Representative shall coordinate with Campus entities and shall provide guidance and coordination.

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. TEMPORARY ROADS

A. 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 at 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
A. N/A

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. Temporary staging shall be subject to change due to existing conditions at the time of mobilization. It is intended that certain aspects of the Contractors work shall require Lift-staging, and that certain aspects of day-to-day access shall also require staging. The University shall provide for Lift-staging and for the day-to-day drop-off of materials and equipment, Privately Owned Vehicles and the required permitting, if such vehicles are parked on University Property, shall be the responsibility of the Contractor or vehicle owner, and may be at some distance from the jobsite.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION
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.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
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.


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

N/A

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION
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 section23114 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. 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. 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.
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.

4. Scheduling: Noisy operations shall be scheduled so as to minimize the disturbance and duration to adjacent neighborhoods and nearby student Housing complexes.

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 gullying 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. 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.

E. 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. 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
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
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:


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.
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, 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.
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.


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
# Contractor Green Waste Monitoring Form

**Project Name & No.:**

**Contractor:**

**Prepared by:**

<table>
<thead>
<tr>
<th>Date/Time of Pick up</th>
<th>Size of Bin</th>
<th>R/L¹</th>
<th>Grass Clippings</th>
<th>Small Tree</th>
<th>Tree Trunks</th>
<th>Branches</th>
<th>Tree Trimmings</th>
<th>Wood</th>
<th>Mulch</th>
<th>Brush</th>
<th>Leaves</th>
<th>Flowers</th>
<th>Shrubs</th>
<th>Palm Fronds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bin Makeup: Recycled or Landfill Materials (Provide quantity of each in Tons.)**

**Column Totals:**

- Total Green Waste to Landfill:
- % of Green Waste Recycled:

¹ Indicate whether R=Recycled or L=Landfill.
# Contractor C&D Waste Monitoring Form

**Project Name & No.:**

**Contractor:**

**Prepared by:**

<table>
<thead>
<tr>
<th>Date/Time of Pick up</th>
<th>Size of Bin</th>
<th>R/L&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Concrete</th>
<th>Metals</th>
<th>Wood</th>
<th>Glass</th>
<th>Clay/Brick</th>
<th>Paper</th>
<th>Gypsum</th>
<th>Paint</th>
<th>Insulation</th>
<th>Green Waste&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Dirt&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Column Totals:**

**Total C&D Waste to Landfill:**

**% of C&D Waste Recycled:**

<sup>1</sup> Indicate whether R=Recycled or L=Landfill.

<sup>2</sup> For waste diversion numbers, Green Waste and dirt are not included. Complete Green Waste Monitoring Form.
LEFT BLANK

INTENTIONALLY
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.
5. Safety procedures.
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 though 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. Contractor shall in advance of delivering any such materials notify the University’s Representative for approval to receive.

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. Restatement 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 reuse 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 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,
complete, 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: __________________________________________________________________
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

_________________________________

Signature of General Contractor

Address

_________________________________

Phone Number

_________________________________

State License Number

_________________________________

Name of Manufacturer

_________________________________

Signature of Manufacturer

Name of Subcontractor

_________________________________

Signature of Subcontractor

Address

_________________________________

Phone Number

_________________________________

State License Number

_________________________________

Manufacturer Phone Number
LEFT BLANK

INTENTIONALLY
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.
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.
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
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.


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.


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 scrap 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 scan 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).


C. CARB - California Air Resources Board Suggested Control Measures for Architectural Coatings

D. Environmental Protection Agency (EPA): Energy Star - Program Requirements for Roof Products


F. Forest Stewardship Council (FSC) “Principles and Criteria.”

G. Green Seal (GS) Environmental Standards.


I. South Coast Air Quality Management District (SCAQMD).

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.

<table>
<thead>
<tr>
<th>LEED® Certification</th>
<th>Reference</th>
<th>Point Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSp1: PTC</td>
<td>MR 4.1 – 4.2: PTC</td>
<td>Construction Activity Pollution Prevention</td>
</tr>
<tr>
<td>MR 4.1 – 4.2: PTC</td>
<td>MR 5.1 – 5.2: PTC</td>
<td>Recycled Content Material</td>
</tr>
<tr>
<td>MR 6.0: PTC</td>
<td>MR 7.0: PTC</td>
<td>Local/Regional Materials</td>
</tr>
<tr>
<td>MR 6.0: PTC</td>
<td>MR 7.0: PTC</td>
<td>Rapidly Renewable Materials</td>
</tr>
<tr>
<td>MR 6.0: PTC</td>
<td>MR 7.0: PTC</td>
<td>Certified Wood</td>
</tr>
<tr>
<td>EQ 3.1 – 3.2: PTC</td>
<td>EQ 4.1 – 4.4: PTC</td>
<td>Construction IAQ Management Plan</td>
</tr>
<tr>
<td>EQ 3.1 – 3.2: PTC</td>
<td>EQ 4.1 – 4.4: PTC</td>
<td>Low-Emitting Materials</td>
</tr>
</tbody>
</table>

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 or FSC certified wood can count towards this credit.


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:


   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 Flush0ut 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.
c. Single-ply Roof Membrane Sealants: 450 g/L.
d. Other Sealants: 420 g/L.
e. Sealant Primers for Nonporous Substrates: 250 g/L.
f. Sealant Primers for Porous Substrates: 775 g/L.
g. 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.


c. Clear wood finishes, floor coatings, stains, primers, sealers and sealants 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:

- Acrolein.
- Acrylonitrile.
- Antimony.
- Benzene.
- Butyl benzyl phthalate.
- Cadmium.
- Di (2-ethylhexyl) phthalate.
- Di-n-butyl phthalate.
- Di-n-octyl phthalate.
- 1,2-dichlorobenzene.
- Diethyl phthalate.
- Dimethyl phthalate.
- Ethylbenzene.
- Formaldehyde.
- Hexavalent chromium.
- 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.

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Referenced Standard</th>
<th>VOC Limit (g/L minus water)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Flat Coating or Primer</td>
<td>Green Seal GS-11, 1993</td>
<td>50</td>
</tr>
<tr>
<td>Interior Non-Flat Coating or Primer</td>
<td>Green Seal GS-11, 1993</td>
<td>150</td>
</tr>
<tr>
<td>Anti-Corrosive/ Anti-Rust Paint</td>
<td>Green Seal GC-03, 2nd Edition, 1997</td>
<td>250</td>
</tr>
<tr>
<td>Clear Wood Finish: Lacquer</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>550</td>
</tr>
<tr>
<td>Clear Wood Finish: Sanding Sealer</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>350</td>
</tr>
<tr>
<td>Clear Wood Finish: Varnish</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>350</td>
</tr>
<tr>
<td>Clear Brushing Lacquer</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>680</td>
</tr>
<tr>
<td>Floor Coatings</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>100</td>
</tr>
<tr>
<td>Sealers and Undercoaters</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>200</td>
</tr>
<tr>
<td>Shellac: Clear</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>730</td>
</tr>
<tr>
<td>Shellac: Pigmented</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>550</td>
</tr>
<tr>
<td>Stain</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>250</td>
</tr>
<tr>
<td>Concrete Curing Compounds</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>350</td>
</tr>
<tr>
<td>Japans/ Faux Finishing Coatings</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>350</td>
</tr>
<tr>
<td>Magnesite Cement Coatings</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>450</td>
</tr>
<tr>
<td>Pigmented Lacquer</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>550</td>
</tr>
<tr>
<td>Waterproofing Sealers</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>250</td>
</tr>
<tr>
<td>Waterproofing Concrete/ Masonry Sealers</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>400</td>
</tr>
<tr>
<td>Wood Preservatives</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>350</td>
</tr>
<tr>
<td>Low-Solids Coatings</td>
<td>SCAQMD Rule 1113, 2004</td>
<td>120*</td>
</tr>
</tbody>
</table>

*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 Label program. All hard surface flooring must be certified as compliant with the FloorScore 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.

<table>
<thead>
<tr>
<th>IEQc4.3: LOW-EMITTING MATERIALS—FLOORING SYSTEMS REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1</strong></td>
</tr>
<tr>
<td>Carpet</td>
</tr>
<tr>
<td>Meet testing and product requirements of the Carpet and Rug Institute’s Green Label Plus program.</td>
</tr>
<tr>
<td>Carpet cushion</td>
</tr>
<tr>
<td>Meet requirements of the Carpet and Rug Institute Green Label program.</td>
</tr>
<tr>
<td>Carpet adhesives</td>
</tr>
<tr>
<td>Meet VOC limit of 50 g/L (Same as for EQc4.1).</td>
</tr>
<tr>
<td>Hard surface flooring (see exceptions below)</td>
</tr>
<tr>
<td>Meet the testing and product requirements of FloorScore certification.</td>
</tr>
<tr>
<td>Floor finishes</td>
</tr>
<tr>
<td>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).</td>
</tr>
<tr>
<td>Tile setting adhesives and grout</td>
</tr>
<tr>
<td>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).</td>
</tr>
<tr>
<td>Tile, masonry, terrazzo, cut stone, and solid-wood flooring without coatings or sealants</td>
</tr>
<tr>
<td>Qualifies for credit without testing.</td>
</tr>
</tbody>
</table>

| **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.

<table>
<thead>
<tr>
<th>Composite wood and agrifiber products:</th>
<th>No added urea-formaldehyde resins</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Particleboard</td>
<td></td>
</tr>
<tr>
<td>• Medium density fiberboard (MDF)</td>
<td></td>
</tr>
<tr>
<td>• Plywood</td>
<td></td>
</tr>
<tr>
<td>• Wheatboard</td>
<td></td>
</tr>
<tr>
<td>• Strawboard</td>
<td></td>
</tr>
<tr>
<td>• Panel substrates</td>
<td></td>
</tr>
<tr>
<td>• Door cores</td>
<td></td>
</tr>
<tr>
<td>• Plywood sections of I-beams</td>
<td></td>
</tr>
</tbody>
</table>

| 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).


(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 CONCRETE TRACKING FORM

**PROJECT NAME:** ________________________________

**CONTRACTOR:** __________________________________

**SPEC SECTION:** __________________________________

**CONTACT NAME:** ________________________________  **Tel. no:** _______________  **SUBMITTAL NO:** ____________

<table>
<thead>
<tr>
<th>A. Mix Number</th>
<th>B. Supplier</th>
<th>C. Total Materials Cost of Concrete ($)</th>
<th>D. Mass of recycled SCMs (lbs.)</th>
<th>E. Mass of total cementitious materials only (lbs.)¹</th>
<th>F. SCMs as a percentage of total cementitious materials only (%) [D/E]</th>
<th>G. Dollar value of all cementitious materials only ($) [from concrete supplier]</th>
<th>H. Recycled content value per yard ($) [(F/2) x G]</th>
<th>I. Distances from both harvesting AND manufacturing point to project site (miles)²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
LEFT BLANK
INTENTIONALLY
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: ____________

Example:
LEFT BLANK
INTENTIONALLY
**LEED DATA SHEET**

Shall be submitted with each submittal along with cut sheets supporting the data below:

### ENVIRONMENTAL MATERIALS REPORTING FORM

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Contractor:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEC SECTION:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTACT NAME:</th>
<th>REQUIRED for ALL products identified in Spec CIB 2004 Edition 2.25, 31.80 Firestops, 31.10 Spray, 33.10 Site Improvements, and 33.80 Paneling, MEP excluded.</th>
<th>TEL NO:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBMITTAL NO.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Vendor or Manufacturer</th>
<th>Percentage of the product salvaged, refurbished or reused</th>
<th>Recycled Content² (for concrete, use separate form)</th>
<th>Location and distances from manufacturing point to project site AND raw material harvesting point to project site (miles)⁴</th>
<th>Percentage of product that is rapidly renewable¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td>Harvest: Manufacture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td>Harvest: Manufacture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td>Harvest: Manufacture.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONTRACTOR CERTIFICATION:**

I, [Authorized Representative], 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 changes in such qualifications during the purchasing period will require prior written approval from the Construction Manager and Owner.

SIGNATURE OF AUTHORIZED REPRESENTATIVE: ____________________________  DATE: ____________

---

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 **Pre-Consumer Recycled Content**: Portion of material or product which derives from recycled industrial and mfr. materials that are diverted from municipal solid waste for use in a different mfr. process, prior to use by a consumer (e.g., fly-ash in concrete or synthetic gypsum board, both of which are byproducts of coal-burning power plants). Note that spills and scraps from the original mfr. process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product do not qualify.

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)

² **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 manufacturer.

Composite Wood & Agrifiber Products: Any wood based products must not contain added urea-formaldehyde.
LEFT BLANK
INTENTIONALLY
# VOC REPORTING FORM

**PROJECT NAME:**

**CONTRACTOR:**

**SECTION:**

**CONTACT NAME:**

**TEL. NO:**

**SUBMITTAL NO:**

<table>
<thead>
<tr>
<th>Product type or application</th>
<th>Product name</th>
<th>Vendor or Manufacturer</th>
<th>Greenguard or SCS Certified (Y/N) (provide certificate): Systems Furniture and Seating Only</th>
<th>REQUIRED for ALL field-applied adhesives, sealants, paints &amp; coatings identified in Specs (including those related to MEP work)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VOC content ¹ (grams per liter)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Corresponding LEED VOC limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Backup documentation ²</td>
</tr>
</tbody>
</table>

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:**

---

**UCR 2014-03-20**

**Sustainable Design Requirements, LEED VOC Reporting Form**

**01 8113**
LEFT BLANK
INTENTIONALLY
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.


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.
4. 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.


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.
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.

<table>
<thead>
<tr>
<th>System</th>
<th>Equipment</th>
<th>Note</th>
<th>Req’d by LEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC System</td>
<td>Chillers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boilers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pumps</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooling towers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variable frequency drives</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Air handlers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Packaged AC units</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terminal units for Court Rooms and other high occupancy rooms</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terminal units for Office areas</td>
<td>2</td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System</th>
<th>Equipment</th>
<th>Note</th>
<th>Req’d by LEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC System</td>
<td>Unit heaters</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heat exchangers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exhaust fans</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply fans</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Return fans</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chilled beams</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Building Energy Management System (EMS)</td>
<td>Sequences of Operation, Monitored Points, Control Points, and Alarms</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metering/Monitoring Devices and Equipment</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Software Commissioning, GUI presentation commissioning, system access performance criteria, software tools/source code commissioning, instrument data sheets, middleware commissioning, Internet Protocol commissioning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting and Shade Control System</td>
<td>Sequences of Operation, Monitored points, control points, user controls</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Electrical System</td>
<td>Sweep or scheduled lighting controls 2</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Daylight dimming controls</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lighting occupancy sensors</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical grounding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plumbing System</td>
<td>Domestic water heaters</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Security Alarm Systems</td>
<td>Security cameras and monitoring system personal duress alarm system; Intercom system; Paging System.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security Electronics</td>
<td>Security plumbing fixture water management system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seminar/Conference Rooms</td>
<td>Door Controls.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire alarm system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Distributed radio antenna system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Access control system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Room acoustics.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire/Life Safety Systems</td>
<td>Sound masking system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assisted listening</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Video projection</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Audio system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lighting and lighting controls.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication System</td>
<td>Alarm drivers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HVAC/Fire System Integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Event Notifying and Reporting Systems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>Division</th>
<th>Section Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIVISION 22 - PLUMBING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 0500</td>
<td>Common Work Results For Plumbing</td>
<td>5</td>
</tr>
<tr>
<td>22 0529</td>
<td>Hangers And Supports For Plumbing Piping And Equipment</td>
<td>7</td>
</tr>
<tr>
<td>22 0553</td>
<td>Identification For Plumbing</td>
<td>5</td>
</tr>
<tr>
<td>22 1616</td>
<td>Natural Gas Piping</td>
<td>8</td>
</tr>
<tr>
<td><strong>DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 0500</td>
<td>Common Work Results For HVAC</td>
<td>5</td>
</tr>
<tr>
<td>23 0529</td>
<td>Hangers And Supports For HVAC</td>
<td>6</td>
</tr>
<tr>
<td>23 0548</td>
<td>Vibration And Seismic Controls For HVAC</td>
<td>6</td>
</tr>
<tr>
<td>23 0553</td>
<td>Identification For HVAC</td>
<td>6</td>
</tr>
<tr>
<td>23 0593</td>
<td>Testing, Adjusting, And Balancing For HVAC</td>
<td>17</td>
</tr>
<tr>
<td>23 0700</td>
<td>HVAC Insulation</td>
<td>11</td>
</tr>
<tr>
<td>23 0800</td>
<td>Commissioning Of HVAC</td>
<td>16</td>
</tr>
<tr>
<td>23 0900</td>
<td>Instrumentation And Controls</td>
<td>77</td>
</tr>
<tr>
<td>23 0910</td>
<td>Facility Monitoring System</td>
<td>16</td>
</tr>
<tr>
<td>23 3113</td>
<td>Metal Ducts</td>
<td>16</td>
</tr>
<tr>
<td>23 3300</td>
<td>Air Duct Accessories</td>
<td>18</td>
</tr>
<tr>
<td>23 3600</td>
<td>Air Terminal Units</td>
<td>6</td>
</tr>
<tr>
<td>23 3713</td>
<td>Diffusers, Registers, And Grilles</td>
<td>5</td>
</tr>
<tr>
<td>23 7413</td>
<td>Rooftop Air Conditioners</td>
<td>9</td>
</tr>
<tr>
<td><strong>DIVISION 26 - ELECTRICAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0500</td>
<td>Common Work Results For Electrical</td>
<td>7</td>
</tr>
<tr>
<td>26 0501</td>
<td>Minor Electrical Demolition</td>
<td>7</td>
</tr>
<tr>
<td>26 0519</td>
<td>Low-voltage Electrical Power Conductors And Cables</td>
<td>6</td>
</tr>
<tr>
<td>26 0526</td>
<td>Grounding And Bonding For Electrical Systems</td>
<td>10</td>
</tr>
<tr>
<td>26 0529</td>
<td>Hangers And Supports For Electrical Systems</td>
<td>9</td>
</tr>
<tr>
<td>26 0533</td>
<td>Raceway And Boxes For Electrical Systems</td>
<td>10</td>
</tr>
<tr>
<td>26 0548</td>
<td>Vibration And Seismic Controls For Electrical Systems</td>
<td>7</td>
</tr>
<tr>
<td>26 0553</td>
<td>Identification For Electrical Systems</td>
<td>13</td>
</tr>
<tr>
<td>26 2726</td>
<td>Wiring Devices</td>
<td>8</td>
</tr>
<tr>
<td>26 2813</td>
<td>Fuses</td>
<td>4</td>
</tr>
<tr>
<td>26 2816</td>
<td>Enclosed Switches And Circuit Breakers</td>
<td>7</td>
</tr>
</tbody>
</table>
DIVISION 28 – FIRE ALARM

28 3112 ..... Fire alarm system .................................................................................................................. 7

END OF TABLE OF CONTENTS
SECTION 22 0500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Plumbing demolition.
   4. Supports and anchorages.

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, space above ceilings, unexcavated spaces, crawlspace, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical 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.

1.03 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.

B. Welding certificates: Certificates shall be applicable for materials to be joined at the job-site.

1.04 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.

1.05 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.

1.06 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate with other sections of the specifications for the applicability of materials specified in this section. Not every product or material listed may be used.

C. Coordinate requirements of this section with actual work to be performed. This section is general in scope for basic materials and methods, some of which may not actually apply to this project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 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.

2.03 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, BCup3 or BCUp4, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
2.04 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:
   b. Dresser Industries, Inc.; DMD Div.
   c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.
   g. Or equal.

2. Aboveground Pressure Piping: Pipe fitting.

PART 3 - EXECUTION

3.01 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 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 where specified.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Mounting hardware, including nuts, bolts and washers for outdoor applications and below grade applications must be of stainless steel materials.
L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.02 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. Oxyacetylene torch welding and cutting of structural steel or bolt holes is prohibited.

F. Install main and branch piping using specified fittings.

G. “T-drill”, “welded nozzles”, or “Side-Tap” or similar fitting substitution style connections are prohibited.


I. 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: Pipe or pipe fittings with threads that are corroded or damaged are prohibited for use. Pipe sections that have cracked or open welds are prohibited for use.

J. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

### 3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install shut-off valves at final connection to each piece of equipment.
2. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric couplings or nipples and flanges to connect piping materials of dissimilar metals.
3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

B. Field Welding: Comply with AWS D1.1.

C. Outdoor Applications: Outdoor support assemblies and accessories shall be of “stainless steel material”, or “hot-dip galvanized carbon steel with high-performance coatings”, as noted below:

   1. Stainless steel: Mounting hardware such as bolts, nuts, washers, straps, brackets, fastening hardware etc., shall be stainless steel.

   2. Coated galvanized steel: Carbon steel support assemblies, including metal fabrications for use outdoors shall comply with each paragraph listed below:

      a. Assemblies must be shop-fabricated and pre-assembled for one-piece hot-dip galvanized coating process

      b. Touch-up and repair per manufacturer’s recommendations after field installation.

D. Rooftop Applications: Rooftop support assemblies and accessories shall be fabricated for outdoor applications as noted above, and shall be designed per SMACNA design requirements.

   1. SMACNA Clearances: Pipes, pipe racks, and equipment shall be installed high enough above roofing surfaces to allow roofing access for maintenance and repair. Install piping and equipment at a minimum height as shown in Table 4-1 of SMACNA Architectural Sheet Metal Manual – 5th Edition.

   2. SMACNA Support Systems: Piping systems and equipment supports, unless otherwise shown, use round column supports to tie-in to structure with lead jacks for built-up roofs, and single-ply preformed jacks for single-ply roofs, lead flashing, and lead umbrellas with stainless steel draw band per Figure 4-16A, or Figure 4-16B, of SMACNA Architectural Sheet Metal Manual – 5th Edition.

3.05 SHEET METAL

A. Exposed edges shall be completely deburred and smooth or folded over (hemmed)

B. Eliminate sharp corners through rounding, folding over, trimming, or other acceptable means.

C. Sheet metal ducting shall not “oil can” or visibly deflect in service. Add additional reinforcement(s) as needed to eliminate these issues if observed.

END OF SECTION
SECTION 22 0529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following hangers and supports for plumbing system piping and equipment:
   1. Fastener systems.
   2. Pipe stands.

1.02 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.
B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
C. Design seismic-restraint hangers and supports shop drawing for piping and equipment in accordance with CBC.

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
   1. Pipe stands. Include Product Data for components.
C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
   3. ASME Boiler and Pressure Vessel Code: Section IX.
B. Seismic Engineering: Seismic bracing and support design, mounting hardware and equipment, support systems, restraint systems, anchorage systems, and installation shall conform to the CBC requirements. Submit calculations, plans, and documents stamped by a qualified California registered engineer.

C. Structural Review: Seismic engineering submittal documents, seismic loads, anchorage and support loads, and vertical loads applied to building structures and structural components shall be reviewed, analyzed, and approved by the project structural engineer of record.

D. Wind-Restraint Loading:
   1. Basic Wind Speed: minimum 110 mph.
   2. Building Classification Category: II.
   3. Minimum 10 lb per sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

E. Seismic-Restraint Loading: (to be confirmed for each building)
   1. Site Class as Defined in the CBC: D.
   2. Assigned Seismic Use Group or Building Category as Defined in the CBC: II.
      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 (0.2 Second): 1.057 g.
   4. Design Spectral Response Acceleration at 1.0-Second Period: 0.579 g.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
      2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 STEEL PIPE HANGERS AND SUPPORTS
   A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
   B. Manufacturers:
2. Grinnell Corp.
3. ERICO/Michigan Hanger Co.
5. Grinnell Corp.
6. Tolco Inc.
7. Superstrut
8. Or equal.

C. Galvanized, Metallic Coatings: Pregalvanized or hot-dip galvanized
D. ambient air temperature.

2.03 FASTENER SYSTEMS

A. Powder-Actuated Fasteners are prohibited

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated, except exterior or corrosive environments shall be stainless steel, 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:
   b. Hilti, Inc.
   c. ITW Ramset/Red Head.
   d. Powers Fasteners.
   e. Or equal.

C. Concrete Inserts: Carbon steel, hot-dip galvanized, except exterior or corrosive environments shall be stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. UL listed for use in metal deck formed concrete and formed slabs for pre-positioning and attaching hanger rods in poured concrete decks. Suitable for seismic loads and brace attachments.

1. Manufacturers:
   b. ISAT (Blue Banger Hanger).
   c. Simpson Strong-Tie Company (Blue Banger Hanger).
   d. NIBCO Inc.; Tolco.
   e. Or equal.

2.04 PIPE STAND FABRICATION

A. Pipe Stands, General: 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.
1. Manufacturers:
   a. ERICO/Michigan Hanger Co.
   b. MIRO Industries.
   c. Or equal.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
   1. Manufacturers:
      a. MIRO Industries.
      b. Or equal.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   1. Manufacturers:
      a. ERICO/Michigan Hanger Co.
      b. MIRO Industries.
      c. Portable Pipe Hangers.
      d. Or equal.

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: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   1. Manufacturers:
      a. Portable Pipe Hangers.
      b. Or equal.

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-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.05 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications if 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. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. 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.

2. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
3. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
4. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel 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 building structure.

B. Flexible connection located in horizontal piping shall be supported within 2 feet of each connector.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer’s written instructions.
E. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Penetration of roof membrane is prohibited.
   2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. 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.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. 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.

J. Load Distribution: Install hangers and supports to prohibit piping live and dead loads, and stresses from movement being transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes.

L. Exceeding maximum pipe deflections allowed by ASME B31.9 for building services piping are prohibited.

3.03 METAL FABRICATIONS

A. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

B. Field Welding: Comply with AWS D1.1 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 contours of welded surfaces match adjacent contours.

3.04 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.
3.05 PAINTING

A. Touch Up: 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.

3.06 ROOFTOP AND OUTDOOR APPLICATIONS

A. Outdoor assemblies shall be fully weather-proof design and installation. Mounting hardware such as bolts, nuts, washers, anchors straps, brackets, fastening hardware etc., shall be stainless steel.

END OF SECTION
SECTION 22 0553
IDENTIFICATION FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes the following mechanical identification materials and their installation:
   1. Pipe markers
   2. Valve tags
   3. Valve schedules/chart
   4. Danger and Warning signs

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples, when requested: For color, letter style, and graphic representation required for each identification material and device.
C. Valve Numbering Scheme. Provide hard-copy and electronic spreadsheet of valve schedule covering valve tags. Coordinate numbering scheme prior to submittal.
D. Valve Plans and Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) in maintenance manuals.
E. System Drawings: For each piping system for each air system (exhaust included). Furnish system one-line plan drawings indicating valves, dampers, instruments, control devices, smoke detectors, and equipment addressed in this section. Furnish electronic spread sheets for each system. Coordinate numbering scheme prior to submittal.

1.3 QUALITY ASSURANCE
B. NFPA Compliance: Comply with requirements of NFPA-99 for piping and equipment labeling and identification.

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 location of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS
2.1 MATERIALS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.
3. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise approved.
2. Lettering: Use piping system terms and abbreviations as approved by the University’s Representative.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.


E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by the University. Provide 5/32-inch hole for fastener.
1. Material: 0.040-inch-thick brass minimum 2” in diameter.
2. Valve-Tag Fasteners: Stainless steel chain, or S-hook.

2.4 VALVE PLANS

A. Valve Plans: For each piping system, on standard-size or 11”x17” bond paper. Provide a plan per floor showing the location, valve number, control device 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-Plan and Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve plan and schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.5 DANGER AND WARNING SIGNS

A. Danger and Warning signs: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: 4 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, WARNING, SAFETY FIRST or NOTICE.

2.6 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Seton Identification Products.
4. Or equal.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 22 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer’s option.

3.2 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.

2. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. At each branch of a tee.
3. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
4. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
5. At access doors, manholes, and similar access points that permit view of concealed piping.
6. Near major equipment items and other points of origination and termination.
7. Spaced at maximum intervals of 25 feet along each run. Located on each side of wall penetrations.

3.3 VALVE-TAG INSTALLATION

A. Install tags on any valve type and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; 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. Install tags on valves such that they will not interfere with the valve operation and maintenance. Installation on hand wheel or lever is prohibited.

B. Valve-Tag Application Schedule:

1. Information:
   a. Service.
   b. Floor.
   c. Valve number.
   d. Area served.
   e. Normal position.
   f. Duty.
   g. Type (if not obvious).

2. Valve-Tag Size and Shape:
   a. 2 inches, round.

3.4 VALVE-PLAN INSTALLATION

A. Mount valve plan on wall in accessible location in each major equipment room.
3.5 **WARNING-TAG INSTALLATION**

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.6 **ADJUSTING**

A. Relocate plumbing identification materials and devices that have become visually blocked by other work.

3.7 **CLEANING**

A. Clean faces of plumbing identification devices and glass frames of valve schedules.

**END OF SECTION**
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes fuel gas piping outside above ground to connection at Gas company meter or University’s gas recharge meter and within the building. Products include the following:

B. Adjust list below to suit Project.

1. Pipe, tube, fittings, and joining materials.
2. Protective pipe and fitting coating.
3. Piping specialties.
4. Specialty valves.
5. Service and Recharge meters.
6. Pressure regulators.
7. Earthquake valves.

1.02 DEFINITIONS

A. CPC: California Plumbing Code.

1.03 PROJECT CONDITIONS

A. Design values of fuel gas supplied for these systems are as follows:

1. Nominal Heating Value: 1000 Btu/cu. ft.
2. Nominal Specific Gravity: 0.6.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
2. Recharge-meter bars. Include Recharge-meter size of selected models.
3. Recharge meters. Include pressure rating and capacity of selected models.
4. Recharge-meter bypass fittings.
5. Pressure regulators. Include pressure rating, capacity, and settings of selected models.
6. Earthquake valves.
B. Shop Drawings: For fuel gas piping. Include plans and attachments to other work. Show different pressure zones and indicate pressure for each zone.


C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For natural gas specialties and accessories to include in emergency, operation, and maintenance manuals.

F. Structural Seismic Performance: Refer to Division 22 Section “Vibration and Seismic Controls for Plumbing.”

1.05 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

B. Electrical Components and Devices: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to University’s Representative, and marked for intended use.

C. Code: Comply with CPC.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: For modification of existing systems, remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

1.07 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the University or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

B. Notify University’s Representative not less than two weeks in advance of proposed utility interruptions.

1. Do not proceed with utility interruptions without University's Representative written permission.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified, or equal.
2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

A. Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; Schedule 40 black. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.

2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
5. Joint Compound and Tape: Suitable for natural gas.
7. Gasket Material: Thickness, material, and type suitable for natural gas.

2.04 PIPING SPECIALTIES

2.05 **SPECIALTY VALVES**

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves in category below are limited to 0.5 psig, are used for shutoff service to appliances, and are NPS 3/4 and smaller.

   1. Manufacturers:
      c. JMF Company
      d. Fisher Controls International, Inc.
      e. Jomar International Ltd.
      f. Key Gas Components, Inc.
      g. Legend Valve and Fitting, Inc.
      h. McDonald, A. Y. Mfg. Co.
      i. Mueller Co.; Mueller Gas Products Div.
      j. Robert Manufacturing Co.
      k. State Metals, Inc.
      l. Watts Industries, Inc.; Water Products Div.
      m. Or equal.

D. Gas Stops: Size, 2” and below, bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle; 2-psig minimum pressure rating.
      a. Manufacturers:
         2) Crane Valves.
         3) Honeywell International Inc.
         4) Milwaukee Valve Company.
         6) NIBCO INC.
         8) Or equal.

2. For 2-inch and larger: Prohibited (provide gate valves instead)

E. Earthquake Valves: Listed in CSA International’s "Certified Product Listing Directory: Components for Gas and Electrical Equipment" as complying with ASCE 25 and UL listed. The valves shall be certified by California Division of the State Architect.
2. Manufacturers:
   a. Safe T Quake Corp.
   b. Koso the California valve
   c. Or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for fuel oil piping system to verify actual locations of piping connections before equipment installation.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that equipment is turned off in affected piping section.

3.03 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to Campus or the Gas Company fuel gas distribution for service entrance to building.

B. Provide exterior fuel gas distribution system piping, earthquake valve, pressure regulator, and meter.

C. Install dielectric fitting downstream from and adjacent to each meter unless meter is supported from meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing." Dielectric union are prohibited.

D. Install strainer upstream from each earthquake valve. Strainers are specified in Division 22 Section "Domestic Water Piping Specialties."

3.04 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Fuel Gas Piping, 5 psig or Less:
1. NPS 1/2 to NPS 2: Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

C. Gas Piping above ground at Meters and Regulators, More Than 5 psig: Steel pipe, steel welding fittings, and welded joints.

D. PE-to-Steel Piping Connections: Transition fitting.

### 3.05 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 5 psig.

C. Piping Line Valves, NPS 2 and Smaller.

D. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve.

E. Valves at Meter, NPS 2 and Smaller.

F. Valves at Meter, NPS 2-1/2 and Larger: Plug valve.

G. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping gas mains.

### 3.06 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of meters. Locate where readily accessible for cleaning and emptying.

   1. Construct drips and sediment traps using tee fitting with bottom outlet and stop valve. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap and opening of the valve.

C. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

D. Install pressure test ports, upstream and downstream of gas meter.

E. Use eccentric reducer fittings to make reductions in pipe sizes on horizontal runs. Install fittings with level side down.

F. Connect branch piping from top or side of horizontal piping.
G. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

H. Install pipe bollards or other suitable barriers in front of outside gas meter assemblies for protection.

I. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

3.07 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 22 Section "Common Work Results for Plumbing."

B. Use materials suitable for fuel gas.

C. Prohibited fittings include: bushings, reducing couplings, street tees, and street elbows,

D. Preferred fittings for pipe size change is reducing nipple (swaged nipple).

E. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.08 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 22 Section "Hangers and Supports for Plumbing."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.09 CONNECTIONS

A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.
C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Gas pipe as grounding electrode is prohibited.

G. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

### 3.10 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each meter, pressure regulator, and specialty valve.

1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

2. Nameplates, pipe identification, and signs are specified in Division 22 Section "Identification for Plumbing."

### 3.11 PAINTING

A. Paint exterior meters, pressure regulators, exterior metal piping, and specialty valves.

1. Color: Gray or as directed by University's Representative.

### 3.12 FIELD QUALITY CONTROL

A. Test, inspect, and purge piping according to CPC and requirements of University's Representative.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Verify that specified piping tests are complete.

END OF SECTION
SECTION 23 0500
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Grout.
   2. Mechanical demolition.
   3. Equipment installation requirements common to equipment sections.
   4. Painting and finishing.
   5. Supports and anchorages.

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, 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 mechanical 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 duct shafts.

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 concrete pipe trench and unheated shelters.

F. The following are industry abbreviations for plastic materials:
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. PE: Polyethylene plastic.
   4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.
1.03 SUBMITTALS
   A. Product Data: For the following if proposed to be used on this project:
      1. Escutcheons.
   B. Welding certificates: Certificates shall be applicable for materials to be joined at the job-site.

1.04 QUALITY ASSURANCE
   A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel" and ASME Section VIII.
   B. Electrical Characteristics for Mechanical 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.
   C. Structural Seismic Performance: Refer to Division 23 Section "Vibration and Seismic Controls for HVAC."

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
      1. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 JOINING MATERIALS
   A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
   B. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.03 GROUT
   A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
      2. Design Mix: 5000-psi, 28-day compressive strength.
PART 3 - EXECUTION

3.01 MECHANICAL DEMOLITION

A. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
   1. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   2. Ducts to Be Abandoned in Place: Prohibited. Remove completely.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to University's Representative.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom.
B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Grease fittings shall be installed in accessible locations. Extended lube lines are prohibited.
D. Install equipment to allow right of way for piping installed at required slope.

3.03 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
B. Field Welding: Comply with AWS D1.1.
C. Outdoor Applications: Outdoor support assemblies and accessories shall be of “stainless steel material”, or “hot-dip galvanized carbon steel”, as noted below:
   1. Stainless steel: Mounting hardware such as bolts, nuts, washers, straps, brackets, fastening hardware etc., shall be stainless steel.
2. Hot-dip galvanized steel: Carbon steel support assemblies, including metal fabrications for use outdoors shall comply with each paragraph listed below:

   a. Assemblies must be shop-fabricated and pre-assembled for one-piece hot-dip galvanized coating process

D. Rooftop Applications: Rooftop support assemblies and accessories shall be fabricated for outdoor applications as noted above, and shall be designed per SMACNA design requirements.

   1. SMACNA Clearances: Pipes, pipe racks, and equipment shall be installed high enough above roofing surfaces to allow roofing access for maintenance and repair. Install piping and equipment at a minimum height as shown in Table 4-1 of SMACNA Architectural Sheet Metal Manual – 5th Edition.

   2. SMACNA Support Systems: Piping systems and equipment supports, unless otherwise shown, use round column supports to tie-in to structure with lead jacks for built-up roofs, and single-ply preformed jacks for single-ply roofs, lead flashing, and lead umbrellas with stainless steel draw band per Figure 4-16A, or Figure 4-16B, of SMACNA Architectural Sheet Metal Manual – 5th Edition.

3.05 GROUTING

   A. Mix and install grout for mechanical 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.

3.06 SHEET METAL

   A. Exposed edges shall be completely deburred and smooth or folded over (hemmed)

   B. Eliminate sharp corners through rounding, folding over, trimming, or other acceptable means.

   C. Sheet metal ducting shall not “oil can” or visibly deflect in service. Add additional reinforcement(s) as needed to eliminate these issues if observed.
END OF SECTION
SECTION 23 0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes the following hangers and supports for mechanical system piping and equipment:
   1. Metal framing systems.
   2. Fastener systems.
   3. Pipe stands.
   4. Equipment supports.

1.02 DEFINITIONS
A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

1.03 PERFORMANCE REQUIREMENTS
A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
B. Design seismic-restraint hangers and supports shop drawing for piping and equipment in accordance with CBC.
C. Wind-Restraint Loading:
   1. Basic Wind Speed: minimum 110 mph.
   2. Building Classification Category: II.
   3. Minimum 10 lb per sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.
D. Seismic-Restraint Loading: (to be confirmed for each building)
   1. Site Class as Defined in the CBC: D.
   2. Assigned Seismic Use Group or Building Category as Defined in the CBC: II.
      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 (0.2 Second): 1.057 g.
   4. Design Spectral Response Acceleration at 1.0-Second Period: 0.579 g.

1.04 SUBMITTALS
A. Product Data: For the following:
1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified California registered professional engineer. Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Metal framing systems. Include Product Data for components.
   3. Pipe stands. Include Product Data for components.
   4. Equipment supports.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
   5. ASME Boiler and Pressure Vessel Code: Section IX.

B. Seismic Engineering: Seismic bracing and support design, mounting hardware and equipment, support systems, restraint systems, anchorage systems, and installation shall conform to the CBC. Submit calculations, plans, and documents stamped by a qualified California registered engineer.

C. Structural Review: Seismic engineering submittal documents, seismic loads, anchorage and support loads, and vertical loads applied to building structures and structural components shall be reviewed, analyzed, and approved by the project structural engineer of record.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
B. Manufacturers:
   2. ERICO/Michigan Hanger Co.
   3. Grinnell Corp.
   4. Tolco Inc.
   5. Superstrut.
   6. Or equal.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dip galvanized.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.03 METAL FRAMING SYSTEMS
A. Description: MFMA-4, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:
   1. Allied Tube & Conduit.
   2. Cooper B-Line, Inc.
   3. Flex-Strut Inc.
   4. GS Metals Corp.
   5. Thomas & Betts Corporation.
   6. Unistrut Corporation; Atkore International, Ltd.
   7. Wesanco, Inc.
   8. Or equal.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.04 FASTENER SYSTEMS
A. Powder-Actuated Fasteners are prohibited.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated, except exterior or corrosive environments shall be stainless steel, 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:
      b. Hilti, Inc.
      c. ITW Ramset/Red Head.
      d. Simpson Strong-Tie Company.
      e. Or equal.
2.05 PIPE STAND FABRICATION

A. Pipe Stands, General: 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.
   1. Manufacturers:
      a. ERICO/Michigan Hanger Co.
      b. MIRO Industries.
      c. Or equal.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
   1. Manufacturers:
      a. MIRO Industries.
      b. Or equal.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   1. Manufacturers:
      a. ERICO/Michigan Hanger Co.
      b. MIRO Industries.
      c. Portable Pipe Hangers.
      d. Or equal.

   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: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   1. Manufacturers:
      a. Portable Pipe Hangers.
      b. Or equal.

   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-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.07 ROOFTOP AND OUTDOOR APPLICATIONS

A. Outdoor assemblies shall be fully weather-proof design and installation. Mounting hardware such as bolts, nuts, washers, anchors straps, brackets, fastening hardware etc., shall be stainless steel.

2.08 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Flexible connection located in horizontal piping shall be supported within 2 feet of each connector.

B. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Penetration of roof membrane is prohibited.
   2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

F. Hangers shall not be in direct contact with the pipe.
3.02 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 smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 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 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 contours of welded surfaces match adjacent contours.

3.04 PAINTING

A. Touch Up: 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
SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Steel and inertia, vibration isolation equipment bases.

1.02 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:
   1. Basic Wind Speed: minimum 110 mph.
   2. Building Classification Category: II.
   3. Minimum 10 lb per sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading: (to be confirmed for each building)
   1. Site Class as Defined in the CBC: D.
   2. Assigned Seismic Use Group or Building Category as Defined in the CBC: II.
      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 (0.2 Second): 1.057 g.
   4. Design Spectral Response Acceleration at 1.0-Second Period: 0.579 g.

C. Sound and Vibration Performance: The Design-Build Team shall retain a licensed professional acoustical engineer for acoustic and vibration analysis and design. Systems shall be reviewed by the acoustical engineer for compliance with acoustics and vibration control contract document requirements. Provide acoustic and vibration design solutions, including system modifications, equipment modifications, additional sound treatment devices, materials and devices, and labor per the acoustical engineer's design solution reports, and recommendations.

D. Rotating and reciprocating equipment shall be statically and dynamically balanced to meet the following vibration limits under design operating conditions and under specified vibration isolation:

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Vibration Limit (inches/sec, RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Drive Fans</td>
<td>0.05</td>
</tr>
<tr>
<td>Belt-Driven Fans</td>
<td>0.1</td>
</tr>
</tbody>
</table>
1. These vibration limits apply either on the bearings or the equipment support structure, whichever applicable.
2. The vibration limits shall include the effects of inertia mass or inertia bases, where applicable.
3. Equipment with variable frequency drives shall meet these limits throughout the entire frequency range that the equipment will operate.

E. Vibration Isolated Equipment with Variable Frequency Drives (VFD) shall not be operated below the following rotational speeds:

<table>
<thead>
<tr>
<th>Specified Isolation</th>
<th>Minimum Allowed Equipment Rotational Speed (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Static Deflection</td>
<td></td>
</tr>
<tr>
<td>Less than 1 inch</td>
<td>600</td>
</tr>
<tr>
<td>1 inch</td>
<td>500</td>
</tr>
<tr>
<td>2 inches</td>
<td>400</td>
</tr>
<tr>
<td>3 inches</td>
<td>350</td>
</tr>
<tr>
<td>4 inches</td>
<td>300</td>
</tr>
<tr>
<td>5 or more inches</td>
<td>250</td>
</tr>
</tbody>
</table>

1.03 SUBMITTALS

A. Product Data: Include load deflection curves for each vibration isolation device.
   1. Manufacturer’s model number for each vibration isolator, the equipment or ductwork or pipeline to which it is to be attached, and the number of isolators to be furnished for each installed system.
   2. An itemized list of isolated equipment with detailed schedules showing isolators proposed for each piece of equipment, referencing materials and drawings.

B. Shop Drawings: Signed and sealed by a qualified California registered professional engineer. Include the following:
   1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
      a. Show base construction for equipment; include dimensions, structural member sizes and support point locations.
      b. Dimensional and weight data for concrete inertia bases, steel and rail bases, and details of isolator attachment.
3. **Seismic-Restraint Details:** Detail fabrication and attachment of seismic restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
4. **Submittals for Interlocking Snubbers:** Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.
5. **Layout Drawings showing locations and sizes of braces for suspended piping and ductwork.**

C. **Manufacturer's Certification:** Upon completion of installation, submit written certification from equipment manufacturer that vibration isolation and seismic control devices are installed correctly and properly adjusted.

### 1.04 QUALITY ASSURANCE

A. **Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to CBC or shall bear anchorage preapproval "OPA" number, from OSHPD or another agency acceptable to University's Representative, 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 California registered professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

B. **Seismic Engineering:** Seismic bracing and support design, mounting hardware and equipment, support systems, restraint systems, anchorage systems, and installation shall conform to the CBC requirements. Submit calculations, plans, and documents stamped by a qualified California registered engineer.

C. **Structural Review:** Seismic engineering submittal documents, seismic loads, anchorage and support loads, and vertical loads applied to building structures and structural components shall be reviewed, analyzed, and approved by the project structural engineer of record.

### 1.05 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

1. Crystal Distribution Inc.
2. California Dynamics Corp.
4. Vibrex
5. Or equal.
2.02 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Roof-Curb Rails: Shall only be used with prior approval of University.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand 125-mph wind impinging laterally against side of equipment.

C. Lower Support Assembly: Sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind and seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall have access ports, for level adjustment, with removable waterproof covers at isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof. Isolator adjustment mechanism shall be a rigid lift platform to minimize side sway.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
   a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
   b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   d. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
   e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

E. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counter-flashed over roof materials.

F. Based on Mason RSC.

2.03 SEISMIC-RESTRAINT DEVICES

A. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.04 FACTORY FINISHES

A. Manufacturer's standard galvanized steel coating.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

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.

3.02 INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

B. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

C. Install resilient bolt isolation washers on equipment anchor bolts.

D. Seismic restraint systems shall be installed in strict accordance with the manufacturer’s seismic restraint guidelines manual and certified submittal data.

E. Branch lines may not be used to restrain main lines.

F. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide specified motion capability and limit motion of adjacent piping.

G. Do not brace a system to two independent structures such as ceiling and wall.

H. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.

I. Installation of seismic restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.

J. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

K. Additional Seismic devices, mounts, and equipment bases shall be installed, type of device shall be selected by licensed structural engineer, or licensed acoustical engineer as required to meet project requirements.

L. Ductwork shall be installed with vibration isolation devices required to meet sound criteria.
M. Provide seismic joints in piping and ductwork crossing building seismic joints.

3.03 EQUIPMENT ISOLATION

A. Install duct, piping and electrical flexible connections to externally vibration-isolated equipment.

B. Flexible duct connections shall result in a loose and resilient connection and maintain a minimum clearance of 4” between the two sides that they connect.

C. Flexible connectors shall be used to connect piping to isolated equipment, except equipment for which flexible connectors are not permitted by code.

D. Flexible pipe equipment connectors for externally isolated equipment shall be as follows:
   1. Spherical rubber expansion joints.
   2. Flexible hose joints.
   3. Locate isolation device downstream of shut-off valves.

E. Equipment Isolators: For equipment larger than 0.5 horsepower, use spring isolation device.

3.04 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:
   1. Isolator seismic-restraint clearance.
   2. Isolator deflection.
   3. Snubber minimum clearances.

3.05 ADJUSTING

A. 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.

B. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

C. Adjust active height of spring isolators.

D. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

E. Torque anchor bolts according to equipment manufacturer’s written recommendations to resist seismic forces.

3.06 CLEANING

A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION
SECTION 23 0553
IDENTIFICATION FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Duct markers.
5. Damper tags.
7. Warning tags.
8. Thermostats referencing terminal boxes.
9. Control devices and instruments

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples: For color, letter style, and graphic representation required for each identification material and device.
C. Air-Side Equipment Schedule: Provide hard copy and electronic spreadsheet of air-side equipment schedule covering damper, terminal boxes, instrumentation, etc. Coordinate numbering scheme prior to submittal.
D. System Drawings: For each piping system for each air system (exhaust included). Furnish system one-line plan drawings indicating valves, dampers, instruments, control devices, smoke detectors, and equipment addressed in this section. Furnish electronic spreadsheet for each system. Coordinate numbering scheme prior to submittal.
E. Equipment Location Plans: For each system. Furnish plans showing equipment, equipment identification numbers/tags, and description.

1.03 QUALITY ASSURANCE

B. NFPA Compliance: Comply with requirements of NFPA-99 for piping and equipment labeling and identification.
1.04 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 location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 MATERIALS

For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.
3. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
   a. Manufacturer, product name, model number, and serial number.
   b. Capacity, operating and power characteristics, and essential data.
   c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent epoxy adhesive or rivets.

1. Terminology: Match schedules as closely as possible.
2. Data:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. **Size:** 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

**C. Equipment Signs:** ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, white surface, black phenolic core, with black melamine subcore. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. **Data:** Instructions for operation of equipment and for safety procedures.
2. **Engraving:** Manufacturer’s standard letter style, of sizes and with terms to match equipment identification.
3. **Thickness:** 1/8 inch.
4. **Provide signs on equipment that is automatically started to comply with CAL-OSHA requirements.**
5. **Fasteners:** Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

**D. Access Panel and Door Markers:** 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. **Fasteners:** Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

### 2.03 DUCT IDENTIFICATION DEVICES

**A. Duct Markers:** Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent epoxy adhesive. As an option, stencil may be used.

**B. Automatic or Motorized Control Damper Tags:** Same as valve tags.

### 2.04 STENCILS

**A. Stencils:** Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. **Stencil Material:** Aluminum.
2. **Stencil Paint:** Use for pipe marking, exterior, gloss, acrylic enamel black. Paint may be in pressurized spray-can form.
3. **Identification Paint:** Use for contrasting background, exterior, acrylic enamel in colors according to ASME A13.1.

### 2.05 WARNING TAGS

**A. Warning Tags:** Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. **Size:** 3 by 5-1/4 inches minimum.
2. **Fasteners:** Brass grommet and wire.
3. **Nomenclature:** Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. **Color:** Yellow background with black lettering.
2.06 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Seton Identification Products.
4. Or equal.

PART 3 - EXECUTION

3.01 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer’s option.

3.02 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 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.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fans, blowers, primary balancing dampers, and mixing boxes.
   c. HVAC custom, central-station and zone-type air handling units.

C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Letter Size: Minimum 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.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

3. Include signs for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fans, blowers, primary balancing dampers, and mixing boxes.
   c. Packaged HVAC central-station and zone-type units.

D. Install access panel markers with screws on equipment access panels.

3.03 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive or stencil on air ducts in the following color codes:
   1. Green: For cold-air supply ducts.
   2. Yellow: For hot-air supply ducts.
   3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
   4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
   5. Letter Size: Minimum 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.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (maximum intervals of 25 feet for exhaust ductwork) in each space where ducts are exposed or concealed by removable ceiling system.

D. Duct markers shall include air system type, and air system number.

3.04 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.05 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.06 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION
SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes TAB to produce design objectives for the following new and existing systems affected by the Work of this project:

1. Balancing Air systems
2. Testing, Adjusting and Balancing HVAC equipment quantitative-performance settings
3. Vibration tests
4. Sound tests
5. Verifying that automatic control devices are functioning properly.
6. Reporting results of activities and procedures specified in this Section

1.02 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria

H. Report Forms: Test data sheets for recording test data in logical order

I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
L. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

M. TAB: Testing, adjusting, and balancing.

N. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

O. Test: A procedure to determine quantitative performance of systems or equipment

P. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures

1.03 SUBMITTALS

A. Qualification Data: Within 20 days of Contractor’s Notice to Proceed, 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: Within 30 days of Contractor’s Notice to Proceed or as directed by University's Representative, submit the Contract Documents review report as specified in Part 3.


D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, 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. Within 30 days of Contractor's Notice to Proceed, submit instrument calibration reports for instruments proposed to be used which shall include the following:

1. Instrument type and make
2. Serial number
3. Application
4. Dates of calibration

1.04 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB. Submit proof of a minimum of five years of experience in work similar to that required by the Project.

B. TAB Conference: Meet with University's Representative on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers’ authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.
1. Agenda Items: Include at least the following:

   a. Submittal distribution requirements
   b. The Construction Documents examination report.
   c. TAB plan
   d. Work schedule and Project-site access requirements
   e. Coordination and cooperation of trades and subcontractors
   f. Coordination of documentation and communication flow

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from AABC’s "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." If data required by the specification is not on standard forms, modify those forms or use a non-standard form or provide supplement form to provide the specified items.

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC’s "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems and NEBB’s "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.05 PROJECT CONDITIONS

A. Full University Occupancy: University will occupy the site and existing building during entire TAB period. Cooperate with University during TAB operations to minimize conflicts with University's operations.

1.06 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
1.07 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC’s "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Construction Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Construction Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify provision of balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. 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.

D. 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 those presented when the equipment was performance tested at the factory. 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.

E. Examine system and equipment installations verifying they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
F. Examine system and equipment test reports.
G. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
I. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
J. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
K. Examine equipment for installation and for properly operating safety interlocks and controls.
L. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices are operated by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in mixing boxes, and variable-air-volume terminals.
   4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
   5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, heat sources, and cold walls.
   6. Sensors are located to sense only the intended conditions.
   7. Sequence of operation for control modes.
   8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

M. 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.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Ensure that gauges and test equipment are recently calibrated. Use pressure gauges accurate to ±0.1% of full scale. Where measuring differential pressures, a direct-reading differential gauge may be used.

C. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete
2. Hydronic systems are filled, clean, and free of air
3. Automatic temperature-control systems are operational
4. Equipment and duct access doors are securely closed
5. Balance, smoke, and fire dampers are open
6. Fan isolation and control dampers are in correct position for the controls sequence and operate correctly and closed completely when commanded to close
7. Isolating and balancing valves are open and control valves are operational
8. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided
9. Windows and doors can be closed so indicated conditions for system operations can be met

3.03 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.

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.

3.04 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Use factory provided or field installed test ports. Cutting, drilling or otherwise penetrating of equipment with previously installed test ports is prohibited and if test port are not used may require complete new air handling unit doors or ductwork to be installed as directed by University's Representative. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project. Provide stainless steel test ports for stainless steel ductwork and plenums. Install test ports that comply with requirements in Section 23 3300 "Air Duct Accessories."

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.05 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.
C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and function.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

3.07 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.08 PROCEDURES FOR VIBRATION MEASUREMENTS

A. Use a vibration meter meeting the following criteria:
   1. Solid-state circuitry with a piezoelectric accelerometer
   2. Velocity range of 0.1 to 10 inches per second
   3. Displacement range of 1 to 100 mils
   4. Frequency range of at least 0 to 1000 Hz
   5. Capable of filtering unwanted frequencies

B. Calibrate the vibration meter before each day of testing.
   1. Use a calibrator provided with the vibration meter.
   2. Follow vibration meter and calibrator manufacturer's calibration procedures.

C. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.
   1. Turn off equipment in the building that might interfere with testing.
   2. Clear the space of people.

D. Perform vibration measurements after air and water balancing and equipment testing is complete.

E. Clean equipment surfaces in contact with the vibration transducer.

F. Position the vibration transducer according to manufacturer's written instructions and to avoid interference with the operation of the equipment being tested.

G. Measure and record vibration on rotating equipment over 1 hp.

H. Measure and record equipment vibration, bearing vibration, equipment base vibration, and building structure vibration. Record velocity and displacement readings in the horizontal, vertical, and axial planes.
   1. Pumps:
a. Pump Bearing: Drive end and opposite end  
b. Motor Bearing: Drive end and opposite end  
c. Pump Base: Top and side  
d. Building: Floor  
e. Piping: To and from the pump after flexible connections

2. Fans and HVAC Equipment with Fans:  
   a. Fan Bearing: Drive end and opposite end.  
   b. Motor Bearing: Drive end and opposite end.  
   c. Equipment Casing: Top and side  
   d. Equipment Base: Top and side  
   e. Building: Floor  
   f. Ductwork: To and from equipment after flexible connections  
   g. Piping: To and from equipment after flexible connections

3. HVAC Equipment with Compressors:  
   a. Compressor Bearing: Drive end and opposite end  
   b. Motor Bearing: Drive end and opposite end  
   c. Equipment Casing: Top and side  
   d. Equipment Base: Top and side  
   e. Building: Floor  
   f. Piping: To and from equipment after flexible connections

I. For equipment with vibration isolation, take floor measurements with the vibration isolation blocked solid to the floor and with the vibration isolation floating. Calculate and report the differences.

J. Inspect, measure, and record vibration isolation.  
   1. Verify that vibration isolation is installed in the required locations.  
   2. Verify that installation is level and plumb.  
   3. Verify that isolators are properly anchored.  
   4. For spring isolators, measure the compressed spring height, the spring OD, and the travel-to-solid distance.  
   5. Measure the operating clearance between each inertia base and the floor or concrete base below. Verify that there is unobstructed clearance between the bottom of the inertia base and the floor.

3.09 PROCEDURES FOR SOUND-LEVEL MEASUREMENTS

A. Perform sound-pressure-level measurements with an octave-band analyzer complying with ANSI S1.4 for Type 1 sound-level meters and ANSI S1.11 for octave-band filters. Comply with requirements in ANSI S1.13, unless otherwise indicated.

B. Calibrate sound meters before each day of testing. Use a calibrator provided with the sound meter complying with ANSI S1.40 and that has NIST certification.
C. Use a microphone that is suitable for the type of sound levels measured. For areas where air velocities exceed 100 fpm, use a windscreen on the microphone.

D. Perform sound-level testing after air and water balancing and equipment testing are complete.

E. Close windows and doors to the space.

F. Perform measurements when the space is not occupied and when the occupant noise level from other spaces in the building and outside are at a minimum.

G. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.

H. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, and other large surface capable of altering the measurements.

I. Take sound measurements using the dB(A) filter and in each of the 8 unweighted octave bands in the frequency range of 63 to 8000 Hz.

J. Take sound measurements with the HVAC systems off to establish the background sound levels and take sound measurements with the HVAC systems operating. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.

K. Perform sound testing at two locations on Project for each of the following space types. For each space type tested, select a measurement location that has the greatest sound level. If testing multiple locations for each space type, select at least one location that is near and at least one location that is remote from the predominant sound source.

1. Private office
2. Open office area
3. Conference room
4. Auditorium/large meeting room/lecture hall
5. Classroom/training room
6. Patient room/exam room
7. Sound or vibration sensitive laboratory
8. Each space with a noise criterion of RC or NC 25 or lower
9. Each space with an indicated noise criterion of RC or NC 35 and lower that is adjacent to a mechanical equipment room or roof mounted equipment
10. Inside each mechanical equipment room
11. Two additional areas as designated by the University

3.10 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or non-grounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following design rate tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: 0 to plus 10 percent
2. Individual room air outlets and inlets, and air flow rates: minus 5 percent to plus 10 percent. Total room shall be ±5 percent
3. Minimum Outside Air: 0 to plus 10 percent
4. Air Terminal Units (Max): Minus 5 percent to plus 5 percent
5. Air Terminal Units (Min): 0 to plus 10 percent

B. Maintaining pressure relationships and coil capacities as designed shall have priority over the tolerances specified above.

3.12 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: As Work progresses, prepare 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.
3.13 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

   1. Include a certification sheet in front of 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. Pump curves
   2. Fan curves
   3. Manufacturers’ test data
   4. Field test reports prepared by system and equipment installers
   5. Simplified system diagrams
   6. Other information relative to equipment performance, but do not include Shop Drawings and Product Data

C. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

   1. Title page
   2. Name and address of TAB firm
   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 firm 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, type size, and fittings.
   14. Notes to explain why certain final data in the body of reports varies from indicated values.
   15. Test conditions for fans and pump performance forms including the following:

      a. Settings for outside-, return-, and exhaust-air dampers
      b. Conditions of filters
c. Cooling coil, wet- and dry-bulb conditions

d. Face and bypass damper settings at coils

e. Fan drive settings including settings and percentage of maximum pitch diameter

f. Inlet vane settings for variable-air-volume systems

g. Settings for supply-air, static-pressure controller

h. 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 outside, supply, return, and exhaust airflows
2. Water and steam flow rates
3. Duct, outlet, and inlet sizes
4. Pipe and valve sizes and locations
5. Terminal units
6. Balancing stations
7. Position of balancing devices

E. 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 or exhaust fan number
   b. Location and zone
   c. Traverse air temperature in °F
   d. Duct static pressure in inches water gauge
   e. Duct size in inches
   f. Duct area in square feet
   g. Length of straight duct before traverse in feet and inches.
   h. Indicated airflow rate in cfm
   i. Indicated velocity in fpm
   j. Actual airflow rate in cfm
   k. Actual average velocity in fpm
   l. Barometric pressure in inches of mercury
   m. Duct mounted sound attenuator static-pressure differential in inches water gauge and velocity in fpm

F. Air-Terminal-Device Reports:

1. Unit Data:
   a. System and air-handling unit identification
   b. Location and zone
   c. Test apparatus used
   d. Area served
   e. Air-terminal-device make
   f. Air-terminal-device number from system diagram
g. Air-terminal-device type and model number
h. Air-terminal-device size
i. Air-terminal-device effective area in square feet

2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm
   b. Air velocity in fpm
   c. Preliminary airflow rate as needed in cfm
   d. Preliminary velocity as needed in fpm
   e. Final airflow rate in cfm
   f. Final velocity in fpm
   g. Space temperature in °F

G. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:
   a. Unit identification
   b. Location
   c. Unit make and model number
   d. Compressor make
   e. Compressor model and serial numbers
   f. Refrigerant weight in pounds
   g. Low ambient temperature cutoff in °F

2. Test Data (Indicated and Actual Values):
   a. Inlet-duct static pressure in inches water gauge
   b. Outlet-duct static pressure in inches water gauge
   c. Entering-air, dry-bulb temperature in °F
   d. Leaving-air, dry-bulb temperature in °F
   e. Condenser entering-water temperature in °F
   f. Condenser leaving-water temperature in °F
   g. Condenser-water temperature differential in °F
   h. Condenser entering-water pressure psig
   i. Condenser leaving-water pressure psig
   j. Condenser-water pressure differential psi
   k. Control settings
   l. Unloader set points
   m. Low-pressure-cutout set point in psig
   n. High-pressure-cutout set point in psig
   o. Suction pressure in psig
   p. Suction temperature in °F
   q. Condenser refrigerant pressure in psig
   r. Condenser refrigerant temperature in °F
   s. Oil pressure in psig
t. Oil temperature in °F
u. Voltage at each connection
v. Amperage for each phase
w. Kilowatt input
x. Crankcase heater kilowatt
y. Number of fans
z. Condenser fan rpm
aa. Condenser fan airflow rate in cfm
bb. Condenser fan motor make, frame size, rpm, and horsepower
cc. Condenser fan motor voltage at each connection
dd. Condenser fan motor amperage for each phase.

H. Vibration Measurement Reports:
1. Date and time of test
2. Vibration meter manufacturer, model number, and serial number
3. Equipment designation, location, equipment, speed, motor speed, and motor horsepower
4. Diagram of equipment showing the vibration measurement locations
5. Measurement readings for each measurement location
6. Calculate isolator efficiency using measurements taken
7. Description of predominant vibration source

I. Sound Measurement Reports:
Record sound measurements on octave band and dB(A) test forms and on an NC or RC chart indicating the decibel level measured in each frequency band for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms:
1. Date and time of test
2. Sound meter manufacturer, model number, and serial number
3. Space location within the building including floor level and room number
4. Diagram or color photograph of the space showing the measurement location
5. Time weighting of measurements, either fast or slow
6. Description of the measured sound: steady, transient, or tonal
7. Description of predominant sound source

J. Instrument Calibration Reports:
1. Report Data:
   a. Instrument type and make
   b. Serial number
   c. Application
   d. Dates of use
   e. Dates of calibration

3.14 INSPECTIONS
A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.

2. Randomly check the following for each system:
   a. Measure airflow of at least 10 percent of air outlets.
   b. Measure sound levels at two locations.
   c. Verify that balancing devices are marked with final balance position.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by University's Representative.

2. TAB firm test and balance engineer shall conduct the inspection in the presence of University's Representative.

3. University Representative shall randomly select measurements documented in the final report to be rechecked. The 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.

4. If the 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."

5. 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.

6. TAB firm shall recheck measurements and make adjustments. Revise the final report and balancing device settings to include changes and resubmit the final report.

7. Request a second final inspection. If the second final inspection also fails, University shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

END OF SECTION
SECTION 23 0700

HVAC INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes new piping and ductwork and equipment insulation that is not factory insulated and repair of existing insulation damaged by the Work of this contract:

1. Insulation Materials:
   a. Mineral fiber.

2. Thermal Blankets
3. Adhesives.
5. Securements.
6. Corner angles.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any). Clearly mark the materials being provided and its intended use of each product or the submittal will be rejected.

B. Submittal:

1. Product Data: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, nameplates, service plugs, HTW pipe anchors, guides, expansion joints, and HTW supports, and access panels.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.
7. Detail field application for each equipment type.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: From a qualified testing agency acceptable to Campus Fire Marshal 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.

F. Field quality-control reports if requested by the University's Representative.

1.03 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 per ASTM E 84, by a testing and inspecting agency acceptable to Campus Fire Marshal. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting 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.

C. Mockups shall be Type 1: An in-place review of items, materials and systems prior to execution, with approval by University's Representative. It is not the intent to modify materials or installation but to verify quality control expectations of the Contractor. The mockups shall include materials, finishes, and construction details to complete the finished appearance. The exact location shall be verified with the Contractor’s sequencing and the University’s Representative.

1. Ductwork Mockups:
   a. None unless installing special or alternate insulation, build in place mockups for each type of insulation and finish to demonstrate quality of insulation application and finishes. Build mockups using same materials as for the completed Work.

2. For each mockup, fabricate cutaway sections or shop drawing to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify University's Representative seven days in advance of dates and times when mockups will be constructed.
4. Obtain University's Representative's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless University's Representative specifically approves such deviations in writing.
1.04 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.

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.

1.05 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.06 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Prohibited: Products containing asbestos, lead, mercury, or mercury compounds.

C. Prohibited insulation materials: Calcium silicate, phenolic, or polyisocyanurate insulation.

D. 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.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Definition of "Or Equal": Where products are specified by manufacturers' name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

G. Mineral Wool: Inorganic mineral fiber made from Basalt, or high-recycled content mineral fiber insulation. Comply with ASTM C547 with or without factory applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Industrial Insulation Group, LLC
b. Roxul
   c. Thermafiber
   d. Or Equal

H. 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

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation without factory-applied jacket if needed for building up thicknesses of insulation otherwise provide with factory-applied ASJ or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; Commercial Board.
   b. Fibrex Insulations Inc.; FBX.
   c. Industrial Insulation Group, LLC
   d. Johns Manville; 800 Series Spin-Glas.
   e. Knauf Insulation; Insulation Board.
   f. Manson Insulation Inc.; AK Board.
   g. Owens Corning; Fiberglas 700 Series.
   h. Roxul
   i. Thermafiber
   j. Or equal.

2.02 THERMAL BLANKETS:

A. Thermal blankets: custom fit pre-engineered insulation system, flexible and removable after installation to allow reinstalling and access to hard to insulate items.

1. Insulation Material: ASTM C 1086, encapsulated 11 lb/cu. ft. fiberglass needled mat, Type E fiber
2. Inner and Outer Jacket: Minimum 16.5 oz./sq. yd. PTFE Teflon impregnated fiberglass.
3. Blanket Construction: Double sewn lock stitch with a minimum of 7 stitches per inch. Raw jacket edges shall have a PTFE Teflon fiberglass cloth binding with Teflon coated fiberglass thread stitching.
4. Quilting: Stainless steel tufts or pins placed at random locations no greater than 16” inches apart, with stainless steel speed washers for securing the insulation in place.
5. Fasteners: 12 or 14 gauge Type 304 Stainless Steel lacing pins shall be provided. The lacing pins will be held in place with 1-inch diameter, 14 gauge, type 304 stainless steel speed washers.
6. I.D. Tags: Stainless steel with embossed lettering.
7. Insulation thickness: to comply with insulation schedule in Part 3.
8. Thermal blankets installed outdoors shall be installed in a manner that rain and dew will not collect on blankets or seep inside of blanket. Provide removable aluminum jackets water shields or rain guards if necessary.
9. Custom Manufacturers:
   a. Orange County Thermal Industries, Inc.
   b. Sound Waves Insulations, Inc., Santa Ana
   c. Thermal Energy Products, Inc.
   d. Or equal.

2.03 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. 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.
      d. Or equal.

      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).

2.04 MASTICS

A. Materials shall be 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.
      d. ITW TACC, Division of Illinois Tool Works; CB-50.
      e. Marathon Industries, Inc.; 590.
      g. Vimasco Corporation; 749.
      h. Or equal.

      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.

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.
   e. Mon-Eco Industries, Inc.; 55-50.
   f. Vimasco Corporation; WC-1/WC-5.
   g. Or equal.

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.

D. High Temperature Water Mastic: asphalt cutback

1. Products:
   a. Pittsburgh Corning Corp.: Pittcote 300.
   b. Or equal.

2.05 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.
   d. Or equal.

2. Stainless Steel: ASTM A167 or ASTM A240/A 240M, Type 304 or Type 316; 0.015 inch thick, ¾ inch wide with wing seal.
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, ¾ inch wide with wing seal.
4. Springs: For larger than 84-inch diameter tank applications. Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:
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 1½-inch galvanized carbon-steel washer.
   
   a. **Products:** Subject to compliance with requirements, provide one of the following:
      
      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.
      5) Or equal.

2. **Self-Sticking-Base Insulation Hangers for Equipment:** Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Self-sticking-base is prohibited for use with ductwork insulation. Comply with the following requirements:
   
   a. **Products:** Subject to compliance with requirements, provide one of the following:
      
      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
      2) GEMCO; Press and Peel.
      3) Midwest Fasteners, Inc.; Self Stick.
      4) Or equal.
      
   b. **Baseplate:** Galvanized carbon-steel sheet, 0.015 inch thick by 2 inches square.
   
   c. **Spindle:** Low carbon steel, fully annealed, 0.105-inch-diameter (12 gage) shank, length to suit depth of insulation indicated.
   
   d. **Adhesive-backed base with a peel-off protective cover.**

3. **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 1-½ inches in diameter.
   
   a. **Products:** Subject to compliance with requirements, provide one of the following:
      
      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.
      5) Or equal.
      
   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
C. Staples: Outward-clinching insulation staples, nominal ¾-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed Monel®.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Childers Products.
   c. PABCO Metals Corporation.
   d. RPR Products, Inc.
   e. Or equal.

2.06 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A167 or ASTM A240/A240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment 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.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

1. Stainless Steel: Coat 300 series stainless steel with epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.
3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation in accordance with the manufacturer’s installation instructions. Any conflicts or differences shall be brought to the attention of the University’s Representative for review and approval before any work proceeds.

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and 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. Welding brackets, clips, or other attachment devices to piping, fittings, and specialties is prohibited.

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. Do not use two or more scrap pieces where a full-length section will fit.

K. 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.

L. Apply adhesives, mastics, and sealants at manufacturer’s recommended coverage rate and wet and dry film thicknesses. Their function is not to mask poor-fitting insulation.

M. Install insulation with factory-applied jackets as follows:

HVAC INSULATION
23 0700 - 9
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 on center.
3. Overlap jacket longitudinal seams at least 1-½ 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 on center.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
P. 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.
Q. 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 University’s Representative.

3.04 FINISHES
A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer’s recommended protective coating.

3.05 FIELD QUALITY CONTROL
A. Perform tests and inspections when requested and in the presence of University’s Representative. The University will test and inspect if there is a concern with the installer’s workmanship.
B. Tests and Inspections:
   1. Inspect ductwork, randomly selected by University’s Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each 5,000 cfm duct system.
   2. Inspect field-insulated equipment, randomly selected by University’s Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
3. Inspect pipe, fittings, strainers, and valves, randomly selected by University’s Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. Insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.06 DUCT INSULATION SCHEDULE, GENERAL

A. Ducts with duct liner within the duct shall still require exterior duct insulation.
B. Sound attenuators or duct silencers if installed in an insulated duct system shall also require exterior duct insulation.
C. Install duct insulation with a vapor barrier.
D. Provide professional appearance in exposed locations for blanket and board insulation. Board shall continue to suitable point to change to blanket insulation, e.g. elbow, tee, etc. Secure blanket insulation in exposed locations shall using tape. Exposed wire is prohibited.
E. Items Not Insulated:
   1. Factory-insulated flexible ducts.
   2. Factory-insulated plenums and casings.
   3. Flexible connectors.
   5. Factory-insulated access panels and doors.

3.07 DUCT AND PLENUM INSULATION SCHEDULE

<table>
<thead>
<tr>
<th>DUCT OR PLENUM LOCATION</th>
<th>TYPE</th>
<th>NOMINAL THICKNESS/ MINIMUM R-VALUE (HR-FT²°F/BTU) @ 75°F</th>
<th>DENSITY (LBS/FT³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SUPPLY</td>
<td>RETURN</td>
</tr>
<tr>
<td>Outdoors</td>
<td>Board</td>
<td>2” / 8</td>
<td>2” / 8</td>
</tr>
</tbody>
</table>

3.08 EQUIPMENT INSULATION SCHEDULE, GENERAL

A. Insulation materials and thicknesses are identified in following Article based on the equipment temperature service. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
B. Insulate indoor and outdoor equipment in paragraphs below that are not factory insulated or if the factory installed insulation that does not meet or exceed the specified thermal requirements.

END OF SECTION
SECTION 23 0800

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes commissioning process requirements for the following HVAC&R systems, assemblies, and equipment:

1. Energy supply systems, including [gas supply] [central-plant chilled water supply] [central-plant high temperature-water supply] <Insert supply sources>.
2. Heat generation systems, including [steam boilers] [hot-water boilers] [furnaces] [fuel-fired unit heaters] [auxiliary equipment] <Insert equipment>.
3. Cooling generation systems, including [chilled-water systems] [direct-expansion systems] <Insert systems>.
4. Distribution systems, including [air distribution (heating and cooling) systems] [high temperature-water distribution systems] [heating water distribution systems] [chilled-water distribution systems] [exhaust systems] [air-handling units] <Insert systems>.
5. Terminal and packaged units, including [unit ventilators] [unit heaters] [fan-coil units] [finned-tube radiation] [electric heating] [packaged units] <Insert units>.
6. Vibration and sound systems, including [sound attenuation] [vibration isolation devices] [seismic restraints].
7. Controls and instrumentation, including [BAS] [energy monitoring and control system] <Insert systems>.
8. Systems testing and balancing verification, including [heating-water piping systems] [chilled-water piping systems] [domestic hot-water circulating systems] [supply-air systems] [return-air systems] [exhaust-air systems] <Insert systems>.
9. <Insert HVAC systems>.

1.02 DEFINITIONS

A. BAS: Building automation system.
B. DDC: Direct digital controls.
D. "Systems," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.
E. TAB: Testing, adjusting, and balancing.
1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [BAS][and][HVAC&R] Testing Technician.

B. Construction Checklists: See related Sections for technical requirements for the following construction checklists:

1. Vibration and seismic controls for HVAC&R piping and equipment.
2. Instrumentation and control for HVAC&R.
3. Heating-water piping and accessories.
4. Cooling-water piping and accessories.
5. Steam and condensate piping and accessories.
6. Refrigerant piping.
7. Metal ducts and accessories.
8. Fans.
9. Particulate air filtration.
10. Air-handling units.
13. Chillers.
15. Cooling towers.

1.04 QUALITY ASSURANCE

A. BAS Testing Technician Qualifications: Technicians to perform BAS construction checklist verification tests, construction checklist verification test demonstrations, commissioning tests, and commissioning test demonstrations shall have the following minimum qualifications:

1. Journey-level or equivalent skill level with knowledge of BAS, HVAC&R, electrical concepts, and building operations.
2. Minimum [three years'] <Insert time> experience installing, servicing, and operating systems manufactured by approved manufacturer.

B. HVAC&R Testing Technician Qualifications: Technicians to perform HVAC&R construction checklist verification tests, construction checklist verification test demonstrations, commissioning tests, and commissioning test demonstrations shall have the following minimum qualifications:

1. Journey-level or equivalent skill level, Vocational School four-year program graduate or an Associate's degree in mechanical systems, air conditioning, or similar field. Degree may be offset by three years' experience in servicing mechanical systems in the HVAC industry. Generally, required knowledge includes HVAC&R systems, electrical concepts, building operations, and application and use of tools and
instrumentation to measure performance of HVAC&R equipment, assemblies, and systems.

2. Minimum [three years'] <Insert time> experience installing, servicing, and operating systems manufactured by approved manufacturer.

3. One of the following:
   b. Associated Air Balance Council (AABC) Certified Test and Balance Technician.
   c. Owner retains the right to waive NEBB or AABC Certification.

C. Testing Equipment and Instrumentation Quality and Calibration: For test equipment and instrumentation required to perform HVAC&R commissioning work, perform the following:

1. Submit test equipment and instrumentation list. For each equipment or instrument, identify the following:
   a. Equipment/instrument identification number.
   b. Planned commissioning application or use.
   c. Manufacturer, make, model, and serial number.
   d. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.

2. Test equipment and instrumentation shall meet the following criteria:
   a. Capable of testing and measuring performance within the specified acceptance criteria.
   b. Be calibrated at the manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
   c. Be maintained in good repair and operating condition throughout the duration of use on this Project.
   d. Be recalibrated/repai red if dropped or damaged in any way since last calibrated.

D. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the commissioning process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, perform the following:
   a. Submit proprietary instrumentation and tools list. For each instrument or tool, identify the following:
      1) Instrument or tool identification number.
      2) Equipment schedule designation of equipment for which the instrument or tool is required.
      3) Manufacturer, make, model, and serial number.
4) Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.
   
b. Include a separate list of proprietary test instrumentation and tools in the operation and maintenance manuals.
   
c. HVAC&R proprietary test instrumentation and tools become the property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL TESTING REQUIREMENTS

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents and approved Shop Drawings and submittals.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.

C. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria.

F. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and response according to acceptance criteria.

G. Construction Checklists: Prepare and submit detailed construction checklists for HVAC&R systems, subsystems, equipment, and components.
   
   1. Contributors to the development of construction checklists shall include, but are not limited to, the following:
      
      a. HVAC&R systems and equipment installers.
      b. TAB technicians.
      c. HVAC&R instrumentation and controls installers.

H. Perform tests using design conditions, whenever possible.
1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by Commissioning Coordinator and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.

2. Commissioning test procedures may direct that set points be altered when simulating conditions is impractical.

3. Commissioning test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.

J. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

K. Coordinate schedule with, and perform the following activities at the direction of, Commissioning Coordinator.

L. Comply with construction checklist requirements, including material verification, installation checks, start-up, and performance tests requirements specified in Sections specifying HVAC systems and equipment.

M. Provide technicians, instrumentation, tools, and equipment to complete and document the following:

   1. Performance tests.
   2. Demonstration of a sample of performance tests.
   3. Commissioning tests.

3.02 TAB COMMISSIONING TESTS

A. TAB Verification:

   1. Prerequisites: Completion of "Examination" Article requirements and correction of deficiencies, as specified in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."
   2. Completion of "Preparation" Article requirements for preparation of a TAB plan that includes strategies and step-by-step procedures, and system-readiness checks and reports, as specified in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."
   3. Scope: HVAC&R air systems and hydronic piping systems.
   4. Purpose: Differential flow relationships intended to maintain air pressurization differentials between the various areas of Project.
   5. Conditions of the Test:
a. Commissioning Test Demonstration Sampling Rate: As specified in "Inspections" Article in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."

b. Systems operating in full heating mode[with minimum outside-air volume].

c. Systems operating in full cooling mode[with minimum outside-air volume].

d. For measurements at air-handling units with economizer controls; systems operating in economizer mode with 100 percent outside air.

6. Acceptance Criteria:

a. Under all conditions, rechecked measurements comply with "Inspections" Article in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."

b. Additionally, no rechecked measurement shall differ from measurements documented in the final report by more than two times the tolerances allowed.

c. Under all conditions, where the Contract Documents indicate a differential in airflow between supply and exhaust and/or return in a space, the differential relationship shall be maintained.

3.03 HEATING CONTROL SYSTEM COMMISSIONING TESTS

A. Heating-Water Supply Temperature Control:

1. Prerequisites: Installation verification of the following:

a. Startup of [boiler] <Insert boiler designations> [steam to hot-water converter] <Insert converter designations> <Insert prime heating-water equipment>.

b. Startup of heating-water pump(s) <Insert pump designations>.

c. TAB of heating-water flow and pressure.

d. Input Device: Heating-water supply temperature; [thermostat] [thermistor temperature sensor] [resistance temperature sensor] <Insert device designations>.

e. Output Device: Control valve <Insert device designation>.

f. Display the following at the operator’s workstation:

1) Heating-water supply temperature.

2) Heating-water supply temperature set point.

3) Control-valve position.

2. Scope: Heating-water system.

3. Purpose: Control of heating-water supply temperature at input device <Insert device designation>.

4. Conditions of the Test:

a. Minimum heating-water flow.

b. Midrange Heating-Water Flow: [50 to 60] <Insert number(s)> percent of maximum.

c. Maximum heating-water flow.
5. Acceptance Criteria: Under all conditions, heating-water supply temperature is within plus or minus [2.0 deg F] <Insert temperature> of set point.

B. Heating-Water Supply Temperature Reset:

1. Prerequisites: Installation verification of the following:
   a. Startup of [boiler] <Insert boiler designations> [steam to hot-water converter] <Insert converter designations> <Insert prime heating-water equipment>.
   b. Startup of heating-water pump(s) <Insert pump designations>.
   c. TAB of heating-water flow and pressure.
   d. Input Device: Heating-water supply temperature; [thermostat] [thermistortemperature sensor] [resistance temperature sensor] <Insert device designations>.
   e. Input Device: Outdoor-air temperature; [electric, outdoor-air-reset controller] [outdoor-air sensor].
   f. Output Device: Control valve <Insert device designations>.
   g. Display the following at the operator's workstation:

      1) Outdoor-air temperature.
      2) Heating-water supply temperature.
      3) Heating-water supply temperature set point.
      4) Control-valve position.

2. Scope: Heating-water system.

3. Purpose: Control of heating-water supply temperature at heating-water supply temperature input device <Insert device designation> in response to variable outdoor-air temperature input; [electric, outdoor-air-reset controller] [outdoor-air sensor].

4. Conditions of the Test: Outdoor-air temperature input value may be overridden for this test.
   a. Low Temperature: Outdoor-air temperature between [minus 30 and 0 deg F] <Insert temperature range>.
   b. Midrange Temperature: Outdoor-air temperature between [30 and 45 deg F] <Insert temperature range>.

5. Acceptance Criteria: Heating-water supply temperature resets in straight-line relationship with outdoor-air temperature for the following reset schedule. Under all conditions, heating-water supply temperature is within [2.0 deg F] <Insert temperature> of set point.
   a. [195 deg F] <Insert temperature> heating water when outdoor-air temperature is [minus 30 deg F] <Insert temperature>. 
b. [130 deg F] <Insert temperature> heating water when outdoor-air temperature is [65 deg F] <Insert temperature>.

c. Under all conditions, heating-water supply temperature is within plus or minus [2.0 deg F] <Insert temperature> of set point.

C. Control Primary Circulating Pump(s):

1. Prerequisites: Installation verification of the following:

   a. Startup of heating-water pump(s) <Insert pump designations>.
   b. Input Device: Outdoor-air temperature; [electric, outdoor-air-reset controller] [outdoor-air sensor].
   c. Output Device: Heating-water pump; [starter] [DDC system command to starter] relay.
   d. Display the following at the operator’s workstation:

      1) Outdoor-air temperature.
      2) Operating status of primary circulating pump(s).

2. Scope: Heating-water pump(s) <Insert pump designations> and associated controls.

3. Purpose: On-off control of heating-water pump(s) in response to variable outdoor-air temperature input; [electric, outdoor-air-reset controller] [outdoor-air sensor].

4. Conditions of the Test:

   b. Low Temperature: Outdoor-air temperature below [65 deg F] <Insert temperature>.

5. Acceptance Criteria:

   a. High Temperature: Pump(s) are off when outside-air temperature is above [65 deg F] <Insert temperature>.
   b. Low Temperature: Pump(s) are on when outside-air temperature is below [65 deg F] <Insert temperature>.

3.04 CENTRAL REFRIGERATION SYSTEM COMMISSIONING TESTS

A. Start and Stop Condenser-Water Pump(s):

1. Prerequisites: Installation verification of the following:

   a. Startup of condenser-water pump(s) <Insert pump designations>.
   b. Startup of cooling tower <Insert cooling tower designations>.
   c. Input Device: Water pressure transducer <Insert device designation>.
   d. Input Device: [Space thermostat] [DDC system outdoor-air temperature] <Insert device designation>.
e. Input Device: [Time clock] [DDC system time schedule]  <Insert device designation>.
f. Output Device: Hard wired through motor starter; [DDC system binary output]  <Insert device designation>.
g. Output Device: [Time clock] [Binary output]  <Insert device designation>.
h. Display the following at the operator’s workstation:
   1) Low-level cooling-tower sump alarm.
   2) Outdoor-air temperature.
   3) Cooling (software) demand indication.
   4) Time and time schedule.
   5) Condenser-water pump(s) on-off status.
   6) Condenser-water pump(s) on-off indication.
   7) Condenser-water flow indication.

2. Scope:
   a. Condenser-water system, including condenser-water pump(s), cooling towers, and associated controls.

3. Purpose:
   a. Condenser-water pump(s) lockout.
   b. Condenser-water pump(s) start.
   c. Condenser-water pump(s) shutdown.
   d. Low-level cooling-tower sump alarm.
   e. Condenser-water pump(s) time-of-day schedule.

4. Conditions of the Test:
   a. Verify Lockout: Start with condenser-water pump enable-input devices in the "disable" state to prevent pump start. One-by-one, place the enable-input devices in the "enable" state, and then return each to the "disable" state before placing the next enable-input device to the "enable" state.
   b. Verify Start: Start with condenser-water pump enable-input devices in the "disable" state to prevent pump start. One-by-one, place the enable-input devices in the "enable" state.
   c. Verify Shutdown: Place all enable-input devices in the "enable" state to allow the pump(s) to start. One-by-one, place the enable-input devices to their "disable" state, and then return each to the "enable" state before placing the next enable-input device to the "disable" state.
   d. Verify Schedule: Compare condenser-water pump start and stop schedule times with Owner-approved time-of-day schedule.

5. Acceptance Criteria:
   a. Lockout: No single enable-input device starts the pump(s) when released to the enable state.
b. Start: Condenser-water pump(s) start when and only when all enable-input devices are in the "enable" state.

c. Shutdown: Each enable-input device stops the condenser-water pump(s) when placed in the "disable" state, regardless of the state of other enable-input devices.

d. Schedule: Condenser-water pump start and stop schedule times agree with Owner-approved time-of-day schedule.

B. Start and Stop Chilled-Water Pump(s):

1. Prerequisites: Installation verification of the following:

   a. Startup of chilled-water pump(s) <Insert pump designations>.

   b. Startup of condenser-water pump(s) <Insert pump designations>.

   c. Startup of cooling tower <Insert cooling tower designations>.


   e. Output Device: [Starter] [DDC system command to starter] relay.

   f. Display of the following at the operator's workstation:

      1) Chilled-water flow indication.
      2) Condenser-water flow indication.
      3) Chilled-water pump(s) on-off status.
      4) Chilled-water pump(s) on-off indication.

2. Scope: Chilled-water system, including chilled-water pump(s), associated controls, and condenser-water system controls.

3. Purpose:

   a. Chilled-water pump(s) start.
   b. Chilled-water pump(s) shutdown.

4. Conditions of the Test:

   a. Verify Start: Start with chilled-water pump enable-input device in the "disable" state to prevent pump start. Place the enable-input device in the "enable" state.

   b. Verify Shutdown: Start with the enable-input device in the "enable" state to allow the pump(s) to run. Then place the enable-input device to the "disable" state.

5. Acceptance Criteria:

   a. Start: Chilled-water pump(s) start when and only when the enable-input device is in the "enable" state.
   b. Shutdown: The enable-input device stops the chilled-water pump(s) when placed in the "disable" state.
1. Prerequisites: Installation verification of the following:
   b. Output Device: [Starter] [DDC system command to starter] relay.
   c. Display:
      1) Condenser-water flow indication.
      2) Cooling-tower fan(s) on-off indication.

2. Scope: Condenser-water system, including cooling tower, condenser-water pump(s), and associated controls.
3. Purpose:
   a. Cooling-tower fan(s) start.
   b. Cooling-tower fan(s) shutdown.

4. Conditions of the Test:
   a. Verify Start: Start with cooling-tower fan enable-input device in the "disable" state to prevent fan(s) start. Place the enable-input device in the "enable" state.
   b. Verify Shutdown: Start with the enable-input device in the "enable" state to allow the fan(s) to run. Then place the enable-input device to the "disable" state.

5. Acceptance Criteria:
   a. Start: Chilled-water pump(s) start when and only when the enable-input device is in the "enable" state.
   b. Shutdown: The enable-input device stops the chilled-water pump(s) when placed in the "disable" state.

D. Alternative Chiller(s):

1. Prerequisites: Installation verification of the following:
   a. Input Device: [Electric alternator] [DDC system software] <Insert device designation>.
   b. Output Device: [Chiller] [DDC system command to chiller] <Insert device designation> terminal strip.
   c. Display:
      1) Chiller(s) on-off indication.
      2) Chiller failure alarm.

2. Scope:
   a. Chilled-water system and associated controls.
   b. Condenser-water system and associated controls.
3. **Purpose:**
   
   a. Lead-lag rotation of chillers.
   b. Replacement of failed chiller in rotation.
   c. Adding and dropping chillers as follows: <Insert sequence and parameters>.
   d. Replacement of failed chiller in add/drop sequence.
   e. Chiller failure alarm initiation.

4. **Conditions of the Test:**
   
   a. Lead-Lag Rotation - Chiller Start: Create a number of chilled-water system start-stop cycles equal to the number of chillers plus one.
   b. Lead-Lag Rotation - Lead Chiller Fail: Disable the lead chiller while it is running.
   c. Lead-Lag Rotation - Lag Chiller Fail: Disable a lag chiller while it is running.
   d. Lead-Lag Rotation - Chiller Start Fail: Disable a chiller while it is in standby mode. Initiate a lead-lag rotation call for the disabled chiller to start.
   e. Add/Drop Sequence - Increasing Demand: Increase chilled-water demand incrementally to observe the corresponding addition of chillers. Increase demand gradually as the load approached the set point for adding the next chiller to permit observation of the actual load at the time the next chiller is enabled.
   f. Add/Drop Sequence - Decreasing Demand: Decrease chilled-water demand incrementally to observe the corresponding dropping of chillers. Decrease demand gradually as the load approached the set point for dropping the next chiller to permit observation of the actual load at the time the next chiller is disabled.
   g. Add/Drop Sequence - Operating Chiller Fail:
   h. Add/Drop Sequence - Chiller Start Fail:

5. **Acceptance Criteria:**
   
   a. Lead-Lag Rotation - Chiller Start: On each chilled-water system start event, the [other] [next] chiller in rotation starts as the lead chiller, and the previous lead chiller is designated as the [last] lag chiller.
   b. Lead-Lag Rotation - Lead Chiller Fail: When the lead chiller fails, the [other] [next] chiller in rotation starts as the lead chiller, and a chiller failure alarm is initiated for the failed chiller.
   c. Lead-Lag Rotation - Lag Chiller Fail: When the lag chiller fails, [the next chiller in rotation starts as the lead chiller, and] a chiller failure alarm is initiated for the failed chiller.
   d. Lead-Lag Rotation - Chiller Start Fail: When a chiller fails to start, [the next chiller in rotation starts in its place, and] a chiller failure alarm is initiated for the failed chiller.
   e. Add/Drop Sequence - Increasing Demand: Chillers are added at the specified load set point, plus or minus [5] <Insert number> percent. Chilled-water supply temperature remains stable within plus or minus [2.0 deg F] <Insert temperature> of set point.
f. Add/Drop Sequence - Decreasing Demand: Chillers are dropped at the specified load set point, plus or minus \[5\] \(<\text{Insert number}\>\) percent. Chilled-water supply temperature remains stable within plus or minus \[2.0\ \text{deg F}\] \(<\text{Insert temperature}\>\) of set point.

g. Add/Drop Sequence - Operating Chiller Fail: When an operating chiller fails, the next chiller in sequence starts and a chiller failure alarm is initiated for the failed chiller.

h. Add/Drop Sequence - Chiller Start Fail: When a chiller fails to start, the next chiller in sequence starts in its place, and a chiller failure alarm is initiated for the failed chiller.

3.05 TERMINAL UNIT EQUIPMENT COMMISSIONING TESTS

A. Variable-Air-Volume Terminal Air Units with Coils:

1. Prerequisites: Installation verification of the following:

a. Occupancy Input Device: Occupancy sensor.
b. Occupancy Output Device: DDC system binary output.
c. Room Temperature Input Device: \([\text{Room thermostat}] \ [\text{Electronic temperature sensor}]\).
d. Room Temperature Output Device: \([\text{Pneumatic}] \ [\text{Electronic}]\) damper actuators and control-valve operators.
e. Display the following at the operator’s workstation:
   1) Room/area served.
   2) Room occupied/unoccupied.
   3) Room temperature indication.
   4) Room temperature set point.
   5) Room temperature set point, occupied.
   6) Room temperature set point, unoccupied.
   7) Air-damper position as percentage open.
   8) Control-valve position as percentage open.

2. Scope: Variable-air-volume terminal air units with \([\text{hydronic}] \ [\text{steam}]\) coils in supply-air systems, and associated controls.

3. Purpose:

a. Occupancy-dependent room temperature set-point reset.
b. Room temperature control.

4. Conditions of the Test:

a. Commissioning Test Demonstration Sampling Rate: \([10]\) \(<\text{Insert number}\>\) percent of each model/size unit.
b. Temperature Control - Occupied: Start with the room unoccupied. Occupy the room and observe the change to occupied status. Observe temperature control until room temperature is stable at occupied set point plus or minus \([1.0\ \text{deg F}] \ <\text{Insert temperature}\>\).
c. Temperature Control - Unoccupied: Start with the room occupied. Vacate the room and observe the change to unoccupied status. Observe temperature control until room temperature is stable at unoccupied set point plus or minus [1.0 deg F] <Insert temperature>.

5. Acceptance Criteria:
   a. Temperature Control - Occupied:
      1) Control system status changes from "occupied" to "unoccupied" after the specified time.
      2) Room temperature is stable at occupied set point plus or minus [1.0 deg F] <Insert temperature> within [10] <Insert number> minutes of occupancy. Room temperature does not overshoot or undershoot set point by more than [2.0 deg F] <Insert temperature> during transition.
   b. Temperature Control - Unoccupied:
      1) Control system status changes from "unoccupied" to "occupied" immediately after five minutes of continuous occupancy.
      2) Room temperature is stable at unoccupied set point plus or minus [1.0 deg F] <Insert temperature> within [30] <Insert number> minutes of occupancy.

3.06 AIR-HANDLING SYSTEM COMMISSIONING TESTS

A. Supply Fan(s) Variable-Volume Control:
   1. Prerequisites: Installation verification of the following:
      a. Volume Control Input Device: [Static-pressure transmitter] [Differential-pressure switch] sensing supply-duct static pressure referenced to conditioned-space static pressure.
      b. Volume Control Output Device: [Receiver controller] [DDC system analog output] [DDC system analog output to digital-to-pneumatic transducer] to modulating damper actuator. Set inlet guide vanes to [minimum] [closed] position when fan is stopped.
      c. Volume Control Input Device: [Static-pressure transmitter] [Differential-pressure switch] sensing supply-duct static pressure referenced to conditioned-space static pressure.
      d. Volume Control Output Device: [Receiver controller] [DDC system analog output] to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
      e. High-Pressure Input Device: Static-pressure transmitter sensing supply-duct static pressure referenced to static pressure outside the duct.
      f. High-Pressure Output Device: [Receiver controller] [DDC system binary output] to [alarm panel] [motor starter].
      g. Display the following at the operator's workstation:
1) Supply-fan-discharge static-pressure indication.
2) Supply-fan-discharge static-pressure set point.
3) Supply-fan airflow rate.
4) Supply-fan [inlet vane position] [speed].

2. Scope: Variable-air-volume supply fan units and associated controls.
3. Purpose:
   a. Supply-air discharge static pressure control.
   b. Response to excess supply-air discharge static pressure condition.

4. Conditions of the Test:
   a. Minimum supply-air flow.
   b. Midrange Supply-Air Flow: [50 to 60] <Insert number(s)> percent of maximum.
   c. Maximum supply-air flow.
   d. Excess supply-air discharge static pressure.

5. Acceptance Criteria:
   a. At all supply-air flow rates, and during changes in supply-air flow, discharge air static pressure is at set point plus or minus [2] <Insert number> percent.
   b. Fan stops and an alarm is initiated at the operator’s workstation when supply-air discharge static pressure is at the excess static pressure plus or minus [2] <Insert number> percent.

B. Air-Handler Mixed-Air Control:

1. Prerequisites: Installation verification of the following:
   a. Minimum Position Input Device: [Time clock] [DDC system time schedule].
   b. Output Device: [Receiver controller] [DDC system analog output] [DDC system analog output to digital-to-pneumatic transducer] to modulating damper actuator(s).
   c. Heating Reset Input Device: [Room thermostat] [DDC system software].
   d. [Supply] [Mixed]-Air Temperature Input Device: [Duct-mounted thermostat] [Electronic temperature sensor].
   e. Cooling Reset Input Device: Outdoor- and return-air, duct-mounted [thermostats] [electronic temperature sensors].
   f. Display the following at the operator’s workstation:
      1) Mixed-air-temperature indication.
      2) Mixed-air-temperature set point.
      3) Mixed-air damper position.

2. Scope: Air handler with mixed-air control and associated controls.
3. Purpose:
a. Occupied time control.
b. Minimum damper position control.
c. Heating reset control.
d. [Supply] [Mixed]-air temperature control.
e. Cooling reset control.
f. Unoccupied time control.

4. Conditions of the Test:

   a. Occupied Time Control: Start in unoccupied schedule. Advance to occupied
      schedule time.
   b. Minimum Damper Position Control: Command system to mode in which
      minimum damper position is required.
   c. Heating Reset Control: Create a call for heating.
   d. [Supply] [Mixed]-Air Temperature Control: Override [supply] [mixed]-air
      temperature set point to a value [2.0 deg F] <Insert temperature> above
      current [supply] [mixed]-air temperature.
   e. Cooling Reset Control: Override outdoor-air [temperature to a value that
      exceeds return-air temperature] [enthalpy to a value that exceeds return-
      air enthalpy].
   f. Unoccupied Time Control: Advance to unoccupied schedule time.
   g. Control Data Trend Log: Set up a data trend log of the following input device
      values and output device commands. Record data at [hourly] <Insert
      alternative recording frequency> intervals. Submit trend data for [24-hour]
      <Insert time> periods in which natural conditions require heating reset
      control, [supply] [mixed]-air temperature control, and cooling reset control.

      1) Minimum position input device.
      2) Heating reset input device.
      3) [Supply] [Mixed]-air temperature input device.
      4) Cooling reset input device.

5. Acceptance Criteria:

   a. Occupied Time Control: Mixed-air control is active in occupied mode.
   b. Minimum Damper Position Control: Controller [opens minimum outdoor-air
      dampers] [positions outdoor-air dampers to minimum position].
   c. Heating Reset Control: Controller [closes minimum outdoor-air dampers]
      [sets outdoor-air dampers to minimum position].
   d. [Supply] [Mixed]-Air Temperature Control: Controller modulates outdoor-, return-, and relief-air dampers to maintain temporary [supply] [mixed]-air
      temperature set point plus or minus [1.0 deg F] <Insert temperature>.
   e. Cooling Reset Control: Controller sets outdoor-air dampers to minimum
      position when outdoor-air [temperature exceeds return-air temperature]
      [enthalpy exceeds return-air enthalpy].
   f. Unoccupied Time Control: Controller positions outdoor- and relief-air dampers
      closed and return-air dampers open.
   g. Control Data Trend Log: Data verifies control according to sequence of control.
END OF SECTION
# SECTION 23 0900

## INSTRUMENTATION AND CONTROLS

### Contents

<table>
<thead>
<tr>
<th>PART 1: GENERAL</th>
<th></th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section Includes</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Products Furnished but Not Installed under This Section</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Products Installed but Not Furnished under This Section</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Products Not Furnished or Installed under but Integrated with the Work of This Section</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Related Sections</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Description</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Approved Control system Manufacturers</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Quality Assurance</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Codes and Standards</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>System Performance</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Submittals</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Warranty</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Ownership of Proprietary Material</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Definitions</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>PART 2: PRODUCTS</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Section Includes</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Materials</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Operator Interface</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Controller Software</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Controllers</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Input and Output Interface</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Power Supplies and Line Filtering</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Auxiliary Control Devices</td>
<td></td>
<td>26</td>
</tr>
</tbody>
</table>
Wiring and Raceways .................................................................................................................. 30
Fiber Optic Cable System ........................................................................................................ 30

**PART 3: EXECUTION** ................................................................................................................. 31
Section Includes ....................................................................................................................... 31
Examination .............................................................................................................................. 32
Protection .................................................................................................................................... 32
Coordination ............................................................................................................................. 32
General Workmanship ............................................................................................................. 33
Field Quality Control ............................................................................................................. 33
Existing Equipment .................................................................................................................. 34
Wiring .......................................................................................................................................... 35
Communication Wiring ............................................................................................................. 36
Fiber Optic Cable System .......................................................................................................... 36
Installation of Sensors .............................................................................................................. 37
Flow Switch Installation ........................................................................................................... 37
Actuators ...................................................................................................................................... 38
Warning Labels ........................................................................................................................ 39
Identification of Hardware and Wiring ........................................................................................ 39
Controllers ................................................................................................................................... 40
Programming ............................................................................................................................ 40
Control System Checkout and Testing .................................................................................... 41
Control System Demonstration and Acceptance ...................................................................... 42
Cleaning ....................................................................................................................................... 43
Training ........................................................................................................................................ 43
Sequences of Operation ............................................................................................................ 45
Control Valve Installation .......................................................................................................... 45
Control Damper Installation ...................................................................................................... 45
Smoke Damper Installation ........................................................................................................ 45
Duct Smoke Detection .............................................................................................................. 45
Packaged Equipment Controls ................................................................................................. 45

**INSTRUMENTATION AND CONTROLS**
23 0900 - 2
Start-Up and Checkout Procedures ................................................................. 46

PART 1: GENERAL .......................................................................................... 48

Section Includes .............................................................................................. 48

Variable Air Volume - AHU (typical of 17) ....................................................... 49
Outside Air Conditions - Temperature and Humidity Station (typical of 1) ...... 58
VAV - Terminal Unit (typical of 5) ................................................................. 59
Point Summary .............................................................................................. 63

APPENDIX A: Glossary of Terms .................................................................... 65
23 09 23 Direct-Digital Control System for HVAC

PART 1: GENERAL

1.0 Section Includes
1.1 Products Furnished but Not Installed under This Section
1.2 Products Installed but Not Furnished under This Section
1.3 Products Not Furnished or Installed under but Integrated with the Work of This Section
1.4 Related Sections
1.5 Description
1.6 Approved Control system Manufacturers
1.7 Quality Assurance
1.8 Codes and Standards
1.9 System Performance
1.10 Submittals
1.11 Warranty
1.12 Ownership of Proprietary Material
1.13 Definitions
1.1 Products Furnished but Not Installed under This Section
   A. Section 23 09 13.33 - Control Valves
      1. Control valves

1.2 Products Installed but Not Furnished under This Section
   A. Section 23 09 13.23 - Sensors and Transmitters
      1. Duct static pressure sensors

1.3 Products Not Furnished or Installed under but Integrated with the Work of This Section
   A. Section - General
      1. Coordination Meeting: The Installer furnishing the DDC network shall meet with the Installer(s) furnishing each of the following products to coordinate details of the interface between these products and the DDC network. The Owner or his designated representative shall be present at this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface including PICS for BACnet equipment, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the DDC network. Submittals for these products shall not be approved prior to the completion of this meeting.

   B. Section 26 29 00 - Low-Voltage Controllers
      1. Variable frequency drives: The variable frequency drive (VFD) vendor shall furnish VFDs with an interface to the control and monitoring points specified in Section 23 09 93. These specified points shall be the minimum acceptable interface to the VFD. The connection to these points shall be by one of the following methods: (a) Hardwired connection such as relay, 0-10VDC, or 4-20mA. (b) BACnet/IP network connection. (c) BACnet over ARCNET network connection. (d) BACnet MS/TP network connection.

1.4 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. Section 23 05 00 - Common Work Results for HVAC
      2. Section 26 05 00 - Common Work Results for Electrical
      3. Section 26 09 00 - Instrumentation and Control for Electrical Systems
      4. Section 26 20 00 - Low Voltage Electrical Transmission
      5. Section 26 29 00 - Low-Voltage Controllers
      6. Section 28 00 00 - Electronic Safety and Security
1.5 Description

A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.

B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner’s local area network, and (at the owner’s discretion) over the Internet. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.

C. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms specified in 23 09 93 – “Sequence of Operations for HVAC Controls” shall be BACnet objects.

1.6 Approved Control system Manufacturers

A. The following are approved control system suppliers, manufacturers, and product lines:
   1. Automated Logic Controls
   2. Siemens Building Technologies
   3. Johnson Controls, Inc.

The above list does not indicate order of preference. Inclusion on this list does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.

4. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.

5. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.7 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.
1.8 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 current editions in effect 30 days prior to the receipt of bids of the following codes:

1. National Electric Code (NEC)
2. International Building Code (IBC)
   a. Section 719 Ducts and Air Transfer Openings
   b. Section 907 Fire Alarm and Detection Systems
   c. Section 909 Smoke Control Systems
   d. Chapter 28 Mechanical
3. International Mechanical Code (CMC)

1.9 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. A graphic with 20 dynamic points shall display with current data within 10 sec.
2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 sec.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
9. **Reporting Accuracy.** System shall report values with minimum end-to-end accuracy listed in Table 1.

10. **Control Stability and Accuracy.** Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.
Table 1
Reporting Accuracy

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Reported Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Temperature</td>
<td>±0.5°C (±1°F)</td>
</tr>
<tr>
<td>Ducted Air</td>
<td>±0.5°C (±1°F)</td>
</tr>
<tr>
<td>Outside Air</td>
<td>±1.0°C (±2°F)</td>
</tr>
<tr>
<td>Dew Point</td>
<td>±1.5°C (±3°F)</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>±5% RH</td>
</tr>
<tr>
<td>Airflow (terminal)</td>
<td>±10% of full scale (see Note 1)</td>
</tr>
<tr>
<td>Airflow (measuring stations)</td>
<td>±5% of full scale</td>
</tr>
<tr>
<td>Airflow (pressurized spaces)</td>
<td>±3% of full scale</td>
</tr>
<tr>
<td>Air Pressure (ducts)</td>
<td>±25 Pa (±0.1 in. w.g.)</td>
</tr>
<tr>
<td>Air Pressure (space)</td>
<td>±3 Pa (±0.01 in. w.g.)</td>
</tr>
<tr>
<td>Electrical</td>
<td>±1% of reading (see Note 3)</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>±5% of reading</td>
</tr>
<tr>
<td>Carbon Dioxide (CO2)</td>
<td>±50 ppm</td>
</tr>
</tbody>
</table>

Note 1: Accuracy applies to 10%–100% of scale
Note 2: For both absolute and differential pressure
Note 3: Not including utility-supplied meters

Table 2
Control Stability and Accuracy

<table>
<thead>
<tr>
<th>Controlled Variable</th>
<th>Control Accuracy</th>
<th>Range of Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Pressure</td>
<td>±50 Pa (±0.2 in. w.g.)</td>
<td>0–1.5 kPa (0–6 in. w.g.)</td>
</tr>
<tr>
<td></td>
<td>±3 Pa (±0.01 in. w.g.)</td>
<td>-25 to 25 Pa (-0.1 to 0.1 in. w.g.)</td>
</tr>
<tr>
<td>Airflow</td>
<td>±10% of full scale</td>
<td></td>
</tr>
<tr>
<td>Space Temperature</td>
<td>±1.0°C (±2.0°F)</td>
<td></td>
</tr>
<tr>
<td>Duct Temperature</td>
<td>±1.5°C (±3°F)</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>±5% RH</td>
<td></td>
</tr>
</tbody>
</table>
1.10 Submittals

A. Product Data and Shop Drawings: Meet requirements of Section 01 30 00 on Shop Drawings, Product Data, and Samples. In addition, the contractor shall provide shop drawings or other submittals on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and three 11” x 17” prints of each drawing. When manufacturer’s cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:

1. DDC System Hardware
   a. A complete bill of materials to be used indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
   b. Manufacturer’s description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
      i. Direct digital controllers (controller panels)
      ii. Transducers and transmitters
      iii. Sensors (including accuracy data)
      iv. Actuators
      v. Valves
      vi. Relays and switches
      vii. Control panels
      viii. Power supplies
      ix. Batteries
      x. Operator interface equipment
      xi. Wiring
   c. Wiring diagrams and layouts for each control panel. Show termination numbers.
   d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Central System Hardware and Software
   a. A complete bill of material of equipment used indicating quantity, manufacturer, model number, and relevant technical.
b. Manufacturer’s description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:
   i. Central Processing Unit (CPU) or web server
   ii. Monitors
   iii. Keyboards
   iv. Power supplies
   v. Battery backups
   vi. Interface equipment between CPU or server and control panels
   vii. Operating System software
   viii. Operator interface software
   ix. Color graphic software
   x. Third-party software

   c. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers’ model numbers and functions. Show interface wiring to control system.

   d. Network riser diagrams of wiring between central control unit and control panels.

3. Controlled Systems
   a. Riser diagrams showing control network layout, communication protocol, and wire types.
   b. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
   c. A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
   d. An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
   e. A mounting, wiring, and routing plan-view drawing. The design shall take into account HVAC, electrical, and other systems’ design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.
   f. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
   g. A point list for each control system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.

4. Quantities of items submitted shall be reviewed but are the responsibility of the Contractor.
5. A description of the proposed process along with all report formats and checklists to be used in Section 23 09 23 Article 3.17 (Control System Demonstration and Acceptance).

6. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.

B. Schedules
   1. Within one month of contract award, provide a schedule of the work indicating the following:
      a. Intended sequence of work items
      b. Start date of each work item
      c. Duration of each work item
      d. Planned delivery dates for ordered material and equipment and expected lead times
      e. Milestones indicating possible restraints on work by other trades or situations
   2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

C. Project Record Documents. Upon completion of installation, submit three copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and shall include:
   1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD compatible files on magnetic or optical media (file format: .DWG, .DXF, .VSD, or comparable) and as 11” x 17” prints.
   2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Section 23 09 23 Article 3.17 (Control System Demonstration and Acceptance).
   4. As-built versions of submittal product data.
   5. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
   6. Operator’s manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
   7. Programming manual or set of 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.
   8. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
   9. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
10. Graphic files, programs, and database on magnetic or optical media.
11. List of recommended spare parts with part numbers and suppliers.
12. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
13. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
14. Licenses, guarantees, and warranty documents for equipment and systems.
15. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner’s needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.11 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. If the engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve the contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner’s written authorization.
5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and
materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

### 1.12 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

### 1.13 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACnet Interoperability Building Blocks (BIBB)</td>
<td>A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBS are combined to build the BACnet functional requirements for a device in a specification.</td>
</tr>
<tr>
<td>BACnet/BACnet Standard</td>
<td>BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.</td>
</tr>
<tr>
<td>Control Systems Server</td>
<td>A computer(s) that maintain(s) the systems configuration and programming database.</td>
</tr>
<tr>
<td>Controller</td>
<td>Intelligent stand-alone control device. Controller is a generic reference to building controllers, custom application controllers, and application specific controllers.</td>
</tr>
<tr>
<td>Direct Digital Control</td>
<td>Microprocessor-based control including Analog/Digital conversion and program logic.</td>
</tr>
<tr>
<td>Gateway</td>
<td>Bi-directional protocol translator connecting control systems that use different communication protocols.</td>
</tr>
<tr>
<td>Local Area Network</td>
<td>Computer or control system communications network limited to local building or campus.</td>
</tr>
<tr>
<td>Master-Slave/Token Passing</td>
<td>Data link protocol as defined by the BACnet standard.</td>
</tr>
<tr>
<td>Point-to-Point</td>
<td>Serial communication as defined in the BACnet standard.</td>
</tr>
<tr>
<td>Primary Controlling LAN</td>
<td>High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.</td>
</tr>
<tr>
<td>Protocol Implementation Conformance Statement</td>
<td>A written document that identifies the particular options specified by BACnet that are implemented in a device.</td>
</tr>
<tr>
<td>Router</td>
<td>A device that connects two or more networks at the network layer.</td>
</tr>
<tr>
<td>Wiring</td>
<td>Raceway, fittings, wire, boxes and related items.</td>
</tr>
</tbody>
</table>
PART 2: PRODUCTS

2.0 Section Includes
2.1 Materials
2.2 Communication
2.3 Operator Interface
2.4 Controller Software
2.5 Controllers
2.6 Input and Output Interfaces
2.7 Power Supplies and Line Filtering
2.8 Auxiliary Control Devices
2.9 Wiring and Raceways
2.10 Fiber Optic Cable System
2.11 Compressed Air Supply - Pneumatic
2.1 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.

2.2 Communication
   A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
   B. Install new wiring and network devices as required to provide a complete and workable control network.
   C. Use existing Ethernet backbone for network segments marked "existing" on project drawings.
   D. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
   E. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
      1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
      2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 23 09 93. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
   F. Workstations, Building Control Panels, and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.
   G. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

2.3 Operator Interface
   A. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to
access all system information. The Operator Workstation or server shall conform to the BACnet Operator Workstation (B-OWS) or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L.

B. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

C. Hardware.
   1. Workstation or web server. Industry-standard hardware shall meet or exceed DDC system manufacturer’s recommended specifications and shall meet response times specified elsewhere in this document. The following hardware requirements also apply:
      a. The hard disk shall have sufficient memory to store:
         i. All required operator workstation software.
         ii. A DDC database at least twice the size of the delivered system database.
         iii. One year of trend data based on the points specified to be trended at their specified trend intervals.
      b. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.
      c. Minimum hardware configuration shall include the following:
         i. Quad Core Processor
         ii. 8 GB RAM
         iii. 1 TB hard disk providing data at 3.0 Gb/sec
         iv. 16x DVD+-/-RW drive
         v. Serial, parallel, and network communication ports and cables as required for proper DDC system operation

D. System Software.
   1. Operating System. Web server or workstation shall have an industry-standard professional-grade operating system. Operating system shall meet or exceed the DDC System manufacturers minimum requirements for their software. Acceptable systems include Microsoft Windows 7 or 8, Microsoft Vista, Windows Server 2008 or 2012, Red Hat Enterprise Linux, or Ubuntu Desktop 12.04.
   2. System Graphics. The operator interface software shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building.
included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.

a. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

b. Animation. Graphics shall be able to animate by displaying different image files for changed object status.

c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

d. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in or shall only require widely available no-cost plug-ins (such as Adobe Flash).

3. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in the same formats as are used for system graphics.

4. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.

E. System Applications. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.
2. Manual Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection. Operators shall be able to configure the system.

4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.

5. Security. Each operator shall be required to log on to the system with user name and password in order to view, edit, add, or delete data.
   a. Operator Access. The user name and password combination shall define accessible viewing, editing, adding, and deleting privileges for that operator. Users with system administrator rights shall be able to create new users and edit the privileges of all existing users. System Administrators shall also be able to vary and deny each operator’s privileges based on the geographic location of the equipment, such as the ability to edit operating parameters in Building A, to view but not edit parameters in Building B, and to not even see equipment in Building C.
   b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. This auto logoff time shall be user adjustable.

6. System Diagnostics. The system shall automatically monitor the operation of all building management panels and controllers. The failure of any device shall be annunciated to the operator.

7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 09 93 (Sequences of Operation). Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be
able to recognize the source, location, and nature of the alarm without relying on acronyms or mnemonics.

9. Alarm Reactions. Operator shall be able to configure (by object) what, if any actions are to be taken during an alarm. As a minimum, the workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

10. Alarm and Event log. Operators shall be able to view all system alarms and changes of state from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and delete alarms, and archive closed alarms to the workstation or web server hard disk.

11. Trend Logs. The operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified in Section 23 09 93 (Sequences of Operation). Trends shall be BACnet trend objects.

12. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object or property in the system. The status shall be available by menu, on graphics, or through custom programs.

13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

14. Standard Reports. Furnish the following standard system reports:
   a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
   c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:
      i. Alarm History.
      ii. Trend Data. Operator shall be able to select trends to be logged.
      iii. Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.
15. Environmental Index. System shall monitor all occupied zones and compile an index that provides a numerical indication of the environmental comfort within the zone. As a minimum, this indication shall be based upon the deviation of the zone temperature from the heating or cooling setpoint. If humidity is being measured within the zone then the environmental index shall be adjusted to reflect a lower comfort level for high or low humidity levels. Similarly, if carbon dioxide levels are being measured as an indication of ventilation effectiveness then the environmental index shall be adjusted to indicate degraded comfort at high carbon dioxide levels. Other adjustments may be made to the environmental index based upon additional measurements. The system shall maintain a trend of the environmental index for each zone in the trend log. The system shall also compute an average comfort index for every building included in this contract and maintain trendlogs of these building environmental indices. Similarly, the system shall compute the percentage of occupied time that comfortable conditions were maintained within the zones. Through the UI the user shall be able to add a weighting factor to adjust the contribution of each zone to the average index based upon the floor area of the zone, importance of the zone, or other static criteria.

16. Time Span Graphic Replay. Operator shall be able to “replay” any graphic in the system to see how key values changed over an operator-selected period of time. Operator shall be able to select the starting date/time for this display and the end date/time or the display period. On completion of the project specified herein, the BAS contractor shall demonstrate that up to 24 hours of data within the last 30 days of operation can be instantly replayed. System shall then display the graphic as it would have looked at the beginning of that period, displaying key data, dynamic colors, etc. based upon values recorded at the start time. When the operator starts the replay the graphics and key values shall dynamically change to produce the effect of “fast forwarding” through the designated period of time. Once the system has been operational for at least 30 days, the contractor shall demonstrate that up to 24 hours of data from within the last 30 days can be replayed on any graphic page. Owner’s representative shall choose the graphic pages for this demonstration at the time of the demonstration.

F. Workstation Application Editors. Each PC or browser workstation shall support editing of all system applications. The applications shall be downloaded and executed at one or more of the controller panels.
1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.

2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and schedule type. Exception schedules and holidays shall be shown clearly on the calendar. The start and stop times for each object shall be adjustable from this interface.

3. Custom Application Programming. Provide the tools to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:
   a. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.
   b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.
   c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.
   d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step’s time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.
   e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
   f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.
g. Variables. Operator shall be able to use variable values in program conditional statements and mathematical functions.
   i. Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.
   ii. System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

G. Portable Operator's Terminal. Provide all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator's Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.

2.4 Controller Software

A. Furnish the following applications for building and energy management. All software application shall reside and operate in the system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. System Security. See Paragraph 2.3.E.5 (Security) and Paragraph 2.3.E.14.c.iii (Operator Activity).

C. Scheduling. Provide the capability to execute control functions according to a user created or edited schedule. Each schedule shall provide the following schedule options as a minimum:
   1. Weekly Schedule. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).
   2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule has executed, the system shall discard and replace the exception schedule with the standard schedule for that day of the week.
   3. Holiday Schedules. Provide the capability for the operator to define up to 24 special or holiday schedules. These schedules will be repeated each year. The operator shall be able to define the length of each holiday period.
D. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

E. Binary Alarms. Each binary object shall have the capability to be configured to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.

F. Analog Alarms. Each analog object shall have both high and low alarm limits. The operator shall be able to enable or disable these alarms.

G. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display on graphics.

H. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

I. Demand Limiting.
   1. The demand-limiting program shall monitor building power consumption from a building power meter (provided by others) which generates pulse signals or a BACnet communications interface. An acceptable alternative is for the system to monitor a watt transducer or current transformer attached to the building feeder lines.
   2. When power consumption exceeds adjustable levels, system shall automatically adjust setpoints, de-energize low-priority equipment, and take other programmatic actions to reduce demand as specified in Section 23 09 93 (Sequences of Operation). When demand drops below adjustable levels, system shall restore loads as specified.

J. Maintenance Management. The system shall be capable of generating maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified in 23 09 93 (Sequences of Operation).

K. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or stage a series of outputs. The calculation interval, PID gains, and other tuning parameters shall be adjustable by a user with the correct security level.

L. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

M. Anti-Short Cycling. All binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.
N. On and Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and a setpoint. The algorithm shall be direct-acting or reverse-acting.

O. Runtime Totalization. Provide software to totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified in Section 23 09 93 (Sequence of Operations).

2.5 Controllers

A. General. Provide an adequate number of Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified in Section 23 09 23 Article 1.9 (System Performance). Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L. Unless otherwise specified, hardwired actuators and sensors may be used in lieu of BACnet Smart Actuators and Smart Sensors.

B. BACnet


2. Advanced Application Controllers (AACs). Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.

3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.

4. Smart Sensors (SSs). Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.

5. BACnet Communication.

   a. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.

   b. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
c. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

d. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

e. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

f. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.

C. 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 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 specified in Section 23 09 93 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 such as outdoor air conditions, supply air or water temperature coming from source equipment, etc.

D. Environment. Controller hardware shall be suitable for anticipated ambient conditions.

1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).

2. 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).

E. Keypad. Provide a local keypad and display for each BC and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and AAC, provide the software and any
interface cabling needed to use a laptop computer as a Portable Operator’s Terminal for the system.

F. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

G. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to a field-removable modular terminal strip or to a termination card connected by a ribbon cable. 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.

H. 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 72 hours in the event of power loss.
   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.

I. 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).

J. 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 Input and Output Interface

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground shall cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no controller damage.

C. Binary Inputs. Binary inputs shall allow the monitoring of ON/OFF signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices 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 also accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall allow the monitoring of 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 provide for ON/OFF operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on Building Controllers 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 provide a modulating signal for the control of end devices. Outputs shall provide either a 0–10 Vdc or a 4–20 mA signal as required to properly control output devices. Each Building Controller 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. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. 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.

J. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.7 Power Supplies and Line Filtering

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.
   1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
      a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
      b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering.
   1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
      a. Dielectric strength of 1000 V minimum
      b. Response time of 10 nanoseconds or less
      c. Transverse mode noise attenuation of 65 dB or greater
      d. Common mode noise attenuation of 150 dB or greater at 40–100 Hz
2.8 Auxiliary Control Devices

A. Motorized Control Dampers, unless otherwise specified elsewhere, shall be as follow.

1. Type. Control dampers shall be the parallel or opposed-blade type as specified below or as scheduled on drawings.
   a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
   b. Other modulating dampers shall be opposed-blade.
   c. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.

2. Frame. Damper frames shall be 2.38 mm (13 gauge) galvanized steel channel or 3.175 mm (⅛ in.) extruded aluminum with reinforced corner bracing.

3. Blades. Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades shall be suitable for medium velocity (10 m/s [2000 fpm]) performance. Blades shall be not less than 1.5875 mm (16 gauge).

4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.

5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 L/s·m² (10 cfm per ft²) at 1000 Pa (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 7.5 m/s (1500 fpm).

6. Sections. Individual damper sections shall not exceed 125 cm × 150 cm (48 in. × 60 in.). Each section shall have at least one damper actuator.

7. Modulating dampers shall provide a linear flow characteristic where possible.

8. Linkages. Dampers shall have exposed linkages.

B. Electric Damper and Valve Actuators.

1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator’s rotation.

2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).

3. Signal and Range. Proportional actuators shall accept a 0–10 Vdc or a 0–20 mA control signal and shall have a 2–10 Vdc or 4–20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)

4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.

5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N-m (60 in.-lb) torque capacity shall have a manual crank.

C. Binary Temperature Devices.

1. Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation.
heater, concealed setpoint adjustment, 13°C–30°C (55°F–85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

2. Line-Voltage Space Thermostats. Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 13°C–30°C (55°F–85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

3. Low-Limit Thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

D. Temperature Sensors.

1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.

2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m² (10 ft²) of duct cross-section.

3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.

4. Space Sensors. Space sensors shall have setpoint adjustment, override switch, display, and communication port as shown.


E. Humidity Sensors.

1. Duct and room sensors shall have a sensing range of 20%–80%.

2. Duct sensors shall have a sampling chamber.

3. Outdoor air humidity sensors shall have a sensing range of 20%–95% RH and shall be suitable for ambient conditions of -40°C–75°C (-40°F–170°F).

4. Humidity sensors shall not drift more than 1% of full scale annually.

F. Flow Switches. Flow-proving switches shall be paddle (water service only) or differential pressure type (air or water service) as shown. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).

1. Paddle switches shall have adjustable sensitivity and NEMA 1 enclosure unless otherwise specified.

2. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

G. Relays.

1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable
for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

H. Override Timers.
   1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0–6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.

I. Current Transmitters.
   1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4–20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale 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.

J. Current Transformers.
   1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
   2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.
   3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

K. Voltage Transmitters.
   1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4–20 mA output with zero and span adjustment.
   2. Adjustable full-scale unit ranges shall be 100–130 Vac, 200–250 Vac, 250–330 Vac, and 400–600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
   3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

L. Voltage Transformers.
   1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
   2. Transformers shall be suitable for ambient temperatures of 4°C–55°C (40°F–130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
   3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

M. Power Monitors.
   1. Selectable rate pulse output for kWh reading, 4–20 mA output for kW reading, N.O. alarm contact, and ability to operate with 5.0 amp current inputs or 0–0.33 volt inputs.
   2. 1.0% full-scale true RMS power accuracy, ±0.5 Hz, voltage input range 120–600 V, and auto range select.

INSTRUMENTATION AND CONTROLS 23 09 23-28
4. NEMA 1 enclosure.
5. Current transformers having a 0.5% FS accuracy, 600 VAC isolation voltage with 0–0.33 V output. If 0–5 A current transformers are provided, a three-phase disconnect/shorting switch assembly is required.

N. Thermal Energy Meters
   1. Matched RTD, solid state, or thermistor temperature sensors with a differential temperature accuracy of ±0.15°F.
   2. Flow meter: See "Hydronic Flowmeters" section.
   3. Unit accuracy of ±1% factory calibrated, traceable to NIST with certification.
   4. NEMA 1 enclosure.
   5. Panel mounted display.
   6. UL listed.
   7. Isolated 4–20 ma signals for energy rate and supply and return temperatures and flow.

O. Current Switches.
   1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

P. Pressure Transducers.
   1. Transducers shall have linear output signal and field-adjustable zero and span.
   2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.
   3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Transducer shall have 4–20 mA output, suitable mounting provisions, and block and bleed valves.
   4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Over-range limit (differential pressure) and maximum static pressure shall be 2000 kPa (300 psi). Transducer shall have 4–20 mA output, suitable mounting provisions, and 5-valve manifold.

Q. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

R. Pressure-Electric (PE) Switches.
   1. Shall be metal or neoprene diaphragm actuated, operating pressure rated for 0–175 kPa (0–25 psig), with calibrated scale minimum setpoint range of 14–125 kPa (2–18 psig) minimum, UL listed.
   2. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application. Electrically rated for pilot duty service (125 VA minimum) and/or for motor control.
   3. Switches shall be open type (panel-mounted) or enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.
4. Each pneumatic signal line to PE switches shall have permanent indicating gauge.

S. Occupancy Sensors. Occupancy sensors shall utilize Passive Infrared (PIR) and/or Microphonic Passive technology to detect the presence of people within a room. Sensors shall be mounted as indicated on the approved drawings. The sensor output shall be accessible by any lighting and/or HVAC controller in the system. Occupancy sensors shall be capable of being powered from the lighting or HVAC control panel, as shown on the drawings. Occupancy sensor delay shall be software adjustable through the user interface and shall not require manual adjustment at the sensor.

T. Local Control Panels.
   1. 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.
   2. Interconnections between internal and face-mounted 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.
   3. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.9 Wiring and Raceways

   A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.
   B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.
PART 3: EXECUTION

3.0 Section Includes
3.1 Examination
3.2 Protection
3.3 Coordination
3.4 General Workmanship
3.5 Field Quality Control
3.6 Existing Equipment
3.7 Wiring
3.8 Communication Wiring
3.9 Control Air Tubing
3.10 Installation of Sensors
3.11 Flow Switch Installation
3.12 Actuators
3.13 Warning Labels
3.14 Identification of Hardware and Wiring
3.15 Controllers
3.16 Programming
3.17 Control system Checkout and Testing
3.18 Control System Demonstration and Acceptance
3.19 Cleaning
3.20 Training
3.21 Sequences of Operation
3.22 Control Damper Installation
3.23 Duct Smoke Detection
3.24 Packaged Equipment Controls
3.25 Start-Up and Checkout Procedures
3.1 Examination

A. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

B. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor’s work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor’s work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and at the expense of—this contractor.

3.2 Protection

A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 Coordination

A. Site
   1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
   2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Submittals. See Section 23 09 23 Article 1.10 (Submittals).

C. Test and Balance.
   1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
   2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
   3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
   4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

D. Life Safety.
1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in Section 23 09 93 (Sequences of Operation).

2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as specified in Section 23 09 93 (Sequences of Operation).

3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.

E. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
   1. All communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.2 (Communication).
   2. Each supplier of a controls product is responsible for the configuration, programming, start up, and testing of that product to meet the sequences of operation described in Section 23 09 93.
   3. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
   4. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
   5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.4 General Workmanship

   A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
   B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
   C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).
   D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
   E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 Field Quality Control
A. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.8 (Codes and Standards).

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

C. Contractor shall have work inspection by local and/or state authorities having jurisdiction over the work.

3.6 Existing Equipment

A. Wiring. The contractor may reuse any abandoned wires. The integrity of the wire and its proper application to the installation are the responsibility of the contractor. The wire shall be properly identified and tested in accordance with this specification. Unused or redundant wiring must be properly identified as such.

B. Local Control Panels. The contractor may reuse any existing local control panel to locate new equipment. All redundant equipment within these panels must be removed. Panel face cover must be patched to fill all holes caused by removal of unused equipment or replaced with new.

C. Repair. Unless otherwise directed, the contractor is not responsible for repair or replacement of existing energy equipment and systems, valves, dampers, or actuators. Should the contractor find existing equipment that requires maintenance, the engineer is to be notified immediately.

D. Temperature Sensor Wells. The contractor may reuse any existing wells in piping for temperature sensors. These wells shall be modified as required for proper fit of new sensors.

E. Indicator Gauges. Where these devices remain and are not removed, they must be made operational and recalibrated to ensure reasonable accuracy.

F. Room Thermostats. Room thermostats may be reused. Remove and deliver unnecessary thermostats to Owner unless otherwise noted. Patch and finish holes and marks left by removal to match existing walls.

G. Electronic Sensors and Transmitters. Unless specifically noted otherwise, existing sensors and transmitters may be reused. Remove and deliver unnecessary sensors and transmitters to Owner.

H. Controllers and Auxiliary Electronic Devices. Existing controllers and auxiliary electronic devices may be reused unless specifically noted otherwise. Recondition as necessary. Remove unnecessary sensors and transmitters.

I. Damper Actuators, Linkages, and Appurtenances. Existing damper actuators, linkages, and appurtenances may be reused unless specifically noted otherwise. Recondition as necessary. Remove and deliver unnecessary equipment to Owner.

J. Existing System Operating Schedule. Existing mechanical system may be disabled during this work.

K. The scheduling of fans through existing or temporary time clocks or control system shall be maintained throughout the DDC system installation.

L. Install control panels where shown.
M. Modify existing starter control circuits, if necessary, to provide hand-off-auto control of each controlled starter. If new starters or starter control packages are required, these shall be included as part of this contract.
N. Patch holes and finish to match existing walls.

3.7 Wiring

A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification, Where the requirements of this section differ from Division 26, the requirements of this section shall take precedence.
B. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.
C. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.
D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.
E. All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway at levels below 3 m (10ft).
F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
G. Do not install wiring in raceway containing tubing.
H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.
I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
O. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer’s recommendations and NEC requirements, except as noted elsewhere.
P. Include one pull string in each raceway 2.5 cm (1 in.) or larger.
Q. Use color-coded conductors throughout with conductors of different colors.
R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

S. Conceal all raceways except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g. steam pipes or flues).

T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

U. Adhere to this specification’s Division 26 requirements where raceway crosses building expansion joints.

V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.

W. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

X. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.8 Communication Wiring

A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.

B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer’s installation recommendations for all communication cabling.

C. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

E. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.

F. When a cable enters or exits a building, a lightning arrester must be installed between the lines and ground. The lighting arrester shall be installed according to manufacturer’s instructions.

G. All runs of communication wiring shall be unspliced length when that length is commercially available.

H. All communication wiring shall be labeled to indicate origination and destination data.

I. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
J. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:

1. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot.)
2. The maximum length of an MS/TP segment is 1200 meters (4000 ft) with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485.
3. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.
4. An MS/TP EIA-485 network shall have no T connections.

### 3.9 Installation of Sensors

A. Install sensors in accordance with the manufacturer's recommendations.
B. Mount sensors rigidly and adequately for environment within which the sensor operates.
C. Room temperature sensors shall be installed on concealed junction boxes properly supported by wall framing.
D. All wires attached to sensors shall be sealed in their raceways or in the wall to stop air transmitted from other areas from affecting sensor readings.
E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.
F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m² (1 ft²) of coil area.
G. Do not install temperature sensors within the vapor plume of a humidifier. If installing a sensor downstream of a humidifier, install it at least 3 m (10 ft) downstream.
H. All pipe-mounted temperature sensors shall be installed in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.
I. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.
J. Differential Air Static Pressure.
   1. Supply Duct Static Pressure. Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
   2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.
   3. Building Static Pressure. Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.
4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.

5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.

6. All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shut-off valves installed before the tee.

K. Smoke detectors, freeze stats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

L. Install humidity sensors for duct mounted humidifiers at least 3 m (10 ft) downstream of the humidifier. Do not install filters between the humidifier and the sensor.

3.10 Actuators

A. General. Mount and link control damper actuators according to manufacturer's instructions.

1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.

2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

3. Provide all mounting hardware and linkages for actuator installation.

B. Electric/Electronic

1. Dampers: Actuators shall be direct mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° travel available for tightening the damper seal. Actuators shall be mounted following manufacturer’s recommendations.

2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer’s recommendations.

C. Pneumatic Actuators.

1. Size pneumatic damper actuator to operate the related control damper(s) with sufficient reserve power to provide smooth modulating action or two-position action. Actuator also shall be sized for proper speed of response at the velocity and pressure conditions to which the control damper is subject.

2. Pneumatic damper actuators shall produce sufficient torque to close off against the maximum system pressures encountered. Size the pneumatic damper actuator to close off against the fan shutoff pressure, as a minimum.
3. Where two or more pneumatic damper actuators are installed for interrelated operation in unison, such as dampers used for mixing, provide the dampers with a positive pilot positioner. The positive pilot positioner shall be directly mounted to the pneumatic damper actuator and have pressure gauges for supply input and output pressures.

4. The total damper area operated by an actuator shall not exceed 80% of the manufacturer’s maximum area rating. Provide at least one actuator for each damper section. Each damper actuator shall not power more than 2 m² (20 ft²) of damper.

5. Use line shafting or shaft couplings (jackshafting) in lieu of blade-to-blade linkages or shaft coupling when driving axially aligned damper sections.

3.11 Warning Labels

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the control system.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.

   CAUTION
   This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.

   CAUTION
   This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.12 Identification of Hardware and Wiring

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with control system address or termination number.

B. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show the instrument or item served.

D. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

E. Identify all other control components with permanent labels. All plug-in components shall be labeled such that label removal of the component does not remove the label.
F. Identify room sensors related to terminal boxes or valves with nameplates.
G. Manufacturers’ nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
H. Identifiers shall match record documents.

3.13 Controllers

A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in Section 23 09 93 (Sequences of Operation).

3.14 Programming

A. Provide sufficient internal memory for the specified sequences of operation and trend logging.
B. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation. See Section 23 09 93 (Sequences of Operation). If character limitations or space restrictions make it advisable to shorten the name, the abbreviations given in Appendix B to Section 23 09 93 may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.
C. Software Programming.
   1. Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Embed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
      a. Text-based:
         i. Must provide actions for all possible situations
         ii. Must be modular and structured
         iii. Must be commented
      b. Graphic-based:
         i. Must provide actions for all possible situations
         ii. Must be documented
      c. Parameter-based:
         i. Must provide actions for all possible situations
         ii. Must be documented
   D. Operator Interface.
1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all relevant input and output points for that equipment. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points List in Section 23 09 93.

2. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

3.15 Control System Checkout and Testing

A. Startup Testing. All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner’s representative is notified of the system demonstration.

1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.

2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers’ recommendations.

4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.

6. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.

7. Alarms and Interlocks:
   a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
   b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action

3.16 Control System Demonstration and Acceptance

A. Demonstration.

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.

2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.

3. The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.

4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.

5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.


7. Demonstrate compliance with sequences of operation through all modes of operation.

8. Demonstrate complete operation of operator interface.

9. Additionally, the following items shall be demonstrated:

   a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.

   b. Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-
minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.

c. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.

d. Interface to the building fire alarm system.

e. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance.

1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.

2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, "Submittals."

3.17 Cleaning

A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, 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 cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.18 Training

A. Provide training for a designated staff of Owner’s representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

B. Training shall enable students to accomplish the following objectives.
1. Day-to-day Operators:
   a. Proficiently operate the system
   b. Understand control system architecture and configuration
   c. Understand DDC system components
   d. Understand system operation, including DDC system control and optimizing routines (algorithms)
   e. Operate the workstation and peripherals
   f. Log on and off the system
   g. Access graphics, point reports, and logs
   h. Adjust and change system set points, time schedules, and holiday schedules
   i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
   j. Understand system drawings and Operation and Maintenance manual
   k. Understand the job layout and location of control components
   l. Access data from DDC controllers and ASCs
   m. Operate portable operator’s terminals

2. Advanced Operators:
   a. Make and change graphics on the workstation
   b. Create, delete, and modify alarms, including annunciation and routing of these
   c. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals
   d. Create, delete, and modify reports
   e. Add, remove, and modify system’s physical points
   f. Create, modify, and delete programming
   g. Add panels when required
   h. Add operator interface stations
   i. Create, delete, and modify system displays, both graphical and others
   j. Perform DDC system field checkout procedures
   k. Perform DDC controller unit operation and maintenance procedures
   l. Perform workstation and peripheral operation and maintenance procedures
   m. Perform DDC system diagnostic procedures
   n. Configure hardware including PC boards, switches, communication, and I/O points
   o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
   p. Adjust, calibrate, and replace system components

3. System Managers/Administrators:
   a. Maintain software and prepare backups
   b. Interface with job-specific, third-party operator software
   c. Add new users and understand password security procedures

C. Organize the training into sessions or modules for the three levels of operators listed above. (Day-to-Day Operators, Advanced Operators, System Managers and Administrators)
Administrators). Students will receive one or more of the training packages, depending on knowledge level required.

D. Provide course outline and materials according to the "Submittals" article in Part 1 of this specification. Provide one copy of training material per student.

E. The instructor(s) shall be factory-trained and experienced in presenting this material.

F. Classroom training shall be done using a network of working controllers representative of installed hardware.

3.19 Sequences of Operation

See Section 23, Appendix A (Sequences of Operation, With Points Lists).

3.20 Control Damper Installation

A. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.

B. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure ¼ in. larger than damper dimensions and shall be square, straight, and level.

C. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8 in.) of each other.

D. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

E. Install extended shaft or jackshaft according to manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)

F. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.

G. Provide a visible and accessible indication of damper position on the drive shaft end.

H. Support ductwork in area of damper when required to prevent sagging due to damper weight.

I. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

3.21 Duct Smoke Detection

A. Submit data for coordination of duct smoke detector interface to HVAC systems as required in Part 1, "Submittals."

B. This Contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

3.22 Packaged Equipment Controls
A. General. The electronic controls packaged with any equipment furnished under this contract shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ANSI/ASHRAE Standard 135 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.

B. Distributed Processing. The controller shall be capable of stand-alone operation and shall continue to provide control functions if the network connection is lost.

C. I/O Capacity. The controller shall contain sufficient I/O capacity to control the target system.

D. The Controller shall have a physical connection for a laptop computer or a portable operator’s tool.

E. Environment. The hardware shall be suitable for the anticipated ambient conditions.
   1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 40°C to 60°C (40°F to 140°F).
   2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

F. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.

G. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 30 days.

H. Power. Controller shall be able to operate at 90% to 110% of nominal voltage rating.

I. Transformer. Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

3.23 Start-Up and Checkout Procedures

A. Start up, check out, and test all hardware and software and verify communication between all components.
   1. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
   2. Verify that all analog and binary input/output points read properly.
   3. Verify alarms and interlocks.
   4. Verify operation of the integrated system.
23 09 93 Sequence of Operations for HVAC Controls

PART 1: GENERAL

1.0 Section Includes
1.1 Variable Air Volume - AHU
1.2 Outside Air Conditions - Temperature and Humidity Station
1.3 VAV - Terminal Unit
1.4 Point Summary
1.1 Variable Air Volume - RTU (typical of 17)

Run Conditions - Requested:
The unit shall run whenever:

- Any zone is occupied.
- OR a definable number of unoccupied zones need heating or cooling.

Emergency Shutdown:
The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.

High Static Shutdown:
The unit shall shut down and generate an alarm upon receiving an high static shutdown signal.

Supply Air Smoke Detection:
The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

RTU Optimal Start:
The unit shall start prior to scheduled occupancy based on the time necessary for the zones to reach their occupied setpoints. The start time shall automatically adjust based on changes in outside air temperature and zone temperatures.

Demand Limiting - Setpoint Adjust:
To lower power consumption, the supply air temperature setpoint shall automatically relax (raised for cooling; lowered for heating) when the facility power consumption exceeds definable thresholds. The amount of relaxation shall be accomplished by one of the following methods:

- The supply air temperature setpoint shall relax by 2°F (adj.) for each demand threshold exceeded.
- The setpoints in the zones supplied by this unit shall be relaxed as specified in the Sequence of Operations for the zones. This shall in turn relax the unit’s supply air temperature setpoint by a user definable amount.
All setpoints shall automatically return to their previous settings when the facility power consumption drops below the thresholds.

**Supply Fan:**
The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.

Alarms shall be provided as follows:
- Supply Fan Failure: Commanded on, but the status is off.
- Supply Fan in Hand: Commanded off, but the status is on.
- Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

**Supply Air Duct Static Pressure Control:**
The controller shall measure duct static pressure and modulate the supply fan VFD speed to maintain a duct static pressure setpoint. The speed shall not drop below 30% (adj.). The static pressure setpoint shall be reset based upon the position of the zone dampers, with a goal of reducing the static pressure until at least one zone damper is nearly wide open.

- The initial duct static pressure setpoint shall be 1.5 in H2O (adj.).
- If no zone damper is nearly wide open, the setpoint shall incrementally reset down to a minimum of 1.0 in H2O (adj.).
- As one or more dampers nears the wide open position, the setpoint shall incrementally reset up to a maximum of 1.8 in H2O (adj.).

Alarms shall be provided as follows:
- High Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) greater than setpoint.
- Low Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) less than setpoint.
- Supply Fan VFD Fault.
Supply Air Temperature Setpoint - Optimized:
The controller shall monitor the supply air temperature and shall maintain a supply air temperature setpoint reset based on zone cooling and heating requirements

The supply air temperature setpoint shall be reset for cooling based on zone cooling requirements as follows:

- The initial supply air temperature setpoint shall be 55°F (adj.).
- As cooling demand increases, the setpoint shall incrementally reset down to a minimum of 53°F (adj.).
- As cooling demand decreases, the setpoint shall incrementally reset up to a maximum of 72°F (adj.).

If more zones need heating than cooling, then the supply air temperature setpoint shall be reset for heating as follows:

- The initial supply air temperature setpoint shall be 82°F (adj.).
- As heating demand increases, the setpoint shall incrementally reset up to a maximum of 85°F (adj.).
- As heating demand decreases, the setpoint shall incrementally reset down to a minimum of 72°F (adj.).

Cooling Stages:
The controller shall measure the supply air temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime.

The cooling shall be enabled whenever:

- Outside air temperature is greater than 60°F (adj.).
- AND the economizer (if present) is disabled or fully open.
- AND the supply fan status is on.
• AND the heating (if present) is not active.

Alarms shall be provided as follows:
• High Supply Air Temp: If the supply air temperature is 5°F (adj.) greater than setpoint.

Gas Heating Stages:
The controller shall measure the supply air temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime.

The heating shall be enabled whenever:
• Outside air temperature is less than 65°F (adj.).
• AND the supply fan status is on.
• AND the cooling (if present) is not active.

The heating stages shall run for freeze protection whenever:
• Supply air temperature drops from 40°F to 35°F (adj.).
• AND the supply fan status is on.

Alarms shall be provided as follows:
• Low Supply Air Temp: If the supply air temperature is 5°F (adj.) less than setpoint.

Building Static Pressure Control:
The controller shall measure the building static pressure and modulate the exhaust air damper to maintain building static pressure setpoint of 0.05in H2O (adj).

exhaust air damper shall be enabled when the supply fan status is proven and close when the unit is off.
Alarms shall be provided as follows:

- High Building Static Pressure: If the building static pressure is 25% (adj.) greater than setpoint.
- Low Building Static Pressure: If the building static pressure is 25% (adj.) less than setpoint.

Economizer:
The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°F (adj.) less than the supply air temperature setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open whenever occupied.

The economizer shall be enabled whenever:

- Outside air temperature is less than 65°F (adj.).
- AND the outside air enthalpy is less than 22Btu/lb (adj.)
- AND the outside air temperature is less than the return air temperature.
- AND the outside air enthalpy is less than the return air enthalpy.
- AND the supply fan status is on.

The economizer shall close whenever:

- Mixed air temperature drops from 40°F to 35°F (adj.)
- OR the freezestat (if present) is on.
- OR on loss of supply fan status.

The outside and exhaust air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.
Minimum Outside Air Ventilation - Fixed Percentage:
The outside air dampers shall maintain a minimum adjustable position during building occupied hours and be closed during unoccupied hours.

Final Filter Differential Pressure Monitor:
The controller shall monitor the differential pressure across the final filter.

Alarms shall be provided as follows:
- Final Filter Change Required: Final filter differential pressure exceeds a user definable limit (adj.).

Mixed Air Temperature:
The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).

Alarms shall be provided as follows:
- High Mixed Air Temp: If the mixed air temperature is greater than 90°F (adj.).
- Low Mixed Air Temp: If the mixed air temperature is less than 45°F (adj.).

Return Air Carbon Dioxide (CO2) Concentration Monitoring:
The controller shall measure the return air CO2 concentration.

Alarms shall be provided as follows:
- High Return Air Carbon Dioxide Concentration: If the return air CO2 concentration is greater than 1000ppm (adj.) when in the unit is running.

Return Air Humidity:
The controller shall monitor the return air humidity and use as required for economizer control (if present) or humidity control (if present).
Alarms shall be provided as follows:

- High Return Air Humidity: If the return air humidity is greater than 70% (adj.).
- Low Return Air Humidity: If the return air humidity is less than 35% (adj.).

Return Air Temperature:
The controller shall monitor the return air temperature and use as required for setpoint control or economizer control (if present).

Alarms shall be provided as follows:

- High Return Air Temp: If the return air temperature is greater than 90°F (adj.).
- Low Return Air Temp: If the return air temperature is less than 45°F (adj.).

Supply Air Temperature:
The controller shall monitor the supply air temperature.

Alarms shall be provided as follows:

- High Supply Air Temp: If the supply air temperature is greater than 120°F (adj.).
- Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

<table>
<thead>
<tr>
<th>Point Name</th>
<th>Hardware Points</th>
<th>Software Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AI</td>
<td>AO</td>
</tr>
<tr>
<td>Building Static Pressure</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Final Filter Differential Pressure</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Mixed Air Temp</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Return Air Carbon Dioxide PPM</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Return Air Humidity</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Return Air Temp</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Supply Air Static Pressure</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Supply Air Temp</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Exhaust Air Damper</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Mixed Air Dampers</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Point Name</td>
<td>Hardware Points</td>
<td>Software Points</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Supply Fan VFD Speed</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Exhaust Air Damper Status</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>High Static Shutdown</td>
<td>x</td>
<td>x x x</td>
</tr>
<tr>
<td>Supply Air Smoke Detector</td>
<td>x</td>
<td>x x x</td>
</tr>
<tr>
<td>Supply Fan Status</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Supply Fan VFD Fault</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cooling Stage 1</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cooling Stage 2</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cooling Stage 3</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cooling Stage 4</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Heating Stage 1</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Heating Stage 2</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Supply Fan Start/Stop</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Building Static Pressure Setpoint</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Demand Limit Level</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Economizer Mixed Air Temp Setpoint</td>
<td>x</td>
<td>x x</td>
</tr>
<tr>
<td>Supply Air Static Pressure Setpoint</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Supply Air Temp Setpoint</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Emergency Shutdown</td>
<td>x</td>
<td>x x x</td>
</tr>
<tr>
<td>Compressor Runtime Exceeded</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Exhaust Air Damper Failure</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Exhaust Air Damper in Hand</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Final Filter Change Required</td>
<td></td>
<td>x x</td>
</tr>
<tr>
<td>High Mixed Air Temp</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>High Return Air Carbon Dioxide Con-</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>High Return Air Humidity</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>High Return Air Temp</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>High Supply Air Static Pressure</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>High Supply Air Temp</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Low Mixed Air Temp</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Low Return Air Humidity</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Low Return Air Temp</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Low Supply Air Static Pressure</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

INSTRUMENTATION AND CONTROLS 23 09 23-56
<table>
<thead>
<tr>
<th>Point Name</th>
<th>AI</th>
<th>AO</th>
<th>BI</th>
<th>BO</th>
<th>AV</th>
<th>BV</th>
<th>Loop</th>
<th>Sched</th>
<th>Trend</th>
<th>Alarm</th>
<th>Show On Graphic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Supply Air Temp</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>25</td>
<td>25</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Low Supply Air Temp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Supply Fan Failure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Supply Fan in Hand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Supply Fan Runtime Exceeded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>25</td>
<td>25</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>

**Total Hardware (23)**  
**Total Software (56)**
Outside Air Conditions - Temperature and Humidity Station (typical of 1)

Outside Air Conditions:
The controller shall monitor the outside air temperature and humidity and calculate the outside air enthalpy on a continual basis. These values shall be made available to the system at all times.

Alarm shall be generated as follows:

- Sensor Failure: Sensor reading indicates shorted or disconnected sensor. In the event of a sensor failure, an alternate outside air conditions sensor shall be made available to the system without interruption in sensor readings.

If an OA Temp Sensor cannot be read, a default value of 65°F will be used.

If an OA Humidity Sensor cannot be read, a default value of 50 % will be used.

Outside Air Temperature History:
The controller shall monitor and record the high and low temperature readings for the outside air. These readings shall be recorded on a daily, month-to-date, and year-to-date basis.

<table>
<thead>
<tr>
<th>Point Name</th>
<th>AI</th>
<th>AO</th>
<th>BI</th>
<th>BO</th>
<th>AV</th>
<th>BV</th>
<th>Loop</th>
<th>Sched</th>
<th>Trend</th>
<th>Alarm</th>
<th>Show On Graphic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Air Humidity</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Outside Air Temp</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Outside Air Enthalpy</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>High Temp Month-to-Date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>High Temp Today</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Temp Year-to-Date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Temp Month-to-Date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Temp Today</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Temp Year-to-Date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor Failure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>1</td>
<td>9</td>
</tr>
</tbody>
</table>

Total Hardware: 2
Total Software: 11
VAV - Terminal Unit (typical of 5)

Run Conditions - Scheduled:
The unit shall run according to a user definable time schedule in the following modes:

- **Occupied Mode**: The unit shall maintain
  - A 75°F (adj.) cooling setpoint
  - A 70°F (adj.) heating setpoint.

- **Unoccupied Mode (night setback)**: The unit shall maintain
  - A 85°F (adj.) cooling setpoint.
  - A 55°F (adj.) heating setpoint.

Alarms shall be provided as follows:

- **High Zone Temp**: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
- **Low Zone Temp**: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Minimum Ventilation on Carbon Dioxide (CO2) Concentration:
When in the occupied mode, the controller shall measure the zone CO2 concentration and modulate the zone damper open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of not more than 750 ppm (adj.).

Alarms shall be provided as follows:

- **High Zone Carbon Dioxide Concentration**: If the zone CO2 concentration is greater than 1000 ppm (adj.).

Demand Limiting - Zone Setpoint Optimization:
To lower power consumption, the zone setpoints shall automatically relax when the facility power consumption exceeds definable thresholds. The amount of relaxation shall be individually
configurable for each zone. The zone setpoints shall automatically return to their previous settings when the facility power consumption drops below the thresholds.

Zone Setpoint Adjust:
The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Optimal Start:
The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

Zone Unoccupied Override:
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Reversing Variable Volume Terminal Unit - Flow Control:
The unit shall maintain zone setpoints by controlling the airflow through one of the following:

Occupied:

- When zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
- When the zone temperature is between the cooling setpoint and the heating setpoint, the zone damper shall maintain the minimum required zone ventilation (adj.).
- When zone temperature is less than its heating setpoint, the controller shall enable heating to maintain the zone temperature at its heating setpoint. Additionally, if warm air is available from the AHU, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum heating airflow (adj.) until the zone is satisfied.

Unoccupied:
When the zone is unoccupied the zone damper shall control to its minimum unoccupied airflow (adj.).

When the zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.

When zone temperature is less than its unoccupied heating setpoint, the controller shall enable heating to maintain the zone temperature at the setpoint. Additionally, if warm air is available from the AHU, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the auxiliary heating airflow (adj.) until the zone is satisfied.

Discharge Air Temperature:
The controller shall monitor the discharge air temperature.

Alarms shall be provided as follows:

- High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
- Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

Environmental Index:
When the zone is occupied, the controller will monitor the deviation of the zone temperature from the heating or cooling setpoint and calculate a 0 - 100% Environmental Index which gives an indication of how well the zone is maintaining comfort. The controller will also calculate the percentage of time since occupancy began that the Environmental Index is 70% or higher. Optionally, a weighting factor can be configured to adjust the contribution of the zone to the rollup average index based upon the floor area of the zone, importance of the zone, or other static criteria.

<table>
<thead>
<tr>
<th>Point Name</th>
<th>Hardware Points</th>
<th>Software Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airflow</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Discharge Air Temp</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Zone Carbon Dioxide PPM</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Zone Setpoint Adjust</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Zone Temp</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
## SKYE HALL HVAC

**Project Number:** 950583 – CAAN #P5380  
**Contract Number:** 950583-EDPALT-2020-35

### Instrumentation and Controls 23 09 23-62

<table>
<thead>
<tr>
<th>Hardware Points</th>
<th>Software Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Point Name</strong></td>
<td><strong>AI</strong></td>
</tr>
<tr>
<td>Zone Damper</td>
<td>x</td>
</tr>
<tr>
<td>Zone Override</td>
<td>x</td>
</tr>
<tr>
<td>Airflow Setpoint</td>
<td>x</td>
</tr>
<tr>
<td>Cooling Setpoint</td>
<td>x</td>
</tr>
<tr>
<td>Environmental Index</td>
<td>x</td>
</tr>
<tr>
<td>Heating Setpoint</td>
<td>x</td>
</tr>
<tr>
<td>Percent of Time Satisfied</td>
<td>x</td>
</tr>
<tr>
<td>Zone Carbon Dioxide PPM Setpoint</td>
<td>x</td>
</tr>
<tr>
<td>Heating Mode</td>
<td>x</td>
</tr>
<tr>
<td>Schedule</td>
<td></td>
</tr>
<tr>
<td>High Discharge Air Temp</td>
<td></td>
</tr>
<tr>
<td>High Zone Carbon Dioxide Concentration</td>
<td></td>
</tr>
<tr>
<td>High Zone Temp</td>
<td></td>
</tr>
<tr>
<td>Low Discharge Air Temp</td>
<td></td>
</tr>
<tr>
<td>Low Zone Temp</td>
<td></td>
</tr>
</tbody>
</table>

| Totals | **5** | **1** | **1** | **0** | **6** | **1** | **0** | **13** | **5** | **11** |

**Total Hardware (7)**  
**Total Software (26)**
### Point Summary

#### Hardware Points

<table>
<thead>
<tr>
<th>Point Name</th>
<th>Qty</th>
<th>AI</th>
<th>AO</th>
<th>BI</th>
<th>BO</th>
<th>AV</th>
<th>BV</th>
<th>Loop</th>
<th>Sched</th>
<th>Trend</th>
<th>Alarm</th>
<th>Show On Graphic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable Air Volume - AHU (Typical of 17)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td></td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>25</td>
<td>25</td>
<td>29</td>
</tr>
<tr>
<td>Total (x17)</td>
<td>13</td>
<td>51</td>
<td>85</td>
<td>11</td>
<td>9</td>
<td>85</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>425</td>
<td>425</td>
<td>493</td>
</tr>
<tr>
<td>Outside Air Conditions - Temperature and Humidity Station (Typical of 1)</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Each</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (x1)</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>VAV - Terminal Unit (Typical of 5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Total (x5)</td>
<td>25</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>30</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>65</td>
<td>25</td>
<td></td>
<td>55</td>
</tr>
</tbody>
</table>

#### Project Totals

<table>
<thead>
<tr>
<th></th>
<th>16</th>
<th>56</th>
<th>90</th>
<th>11</th>
<th>9</th>
<th>11</th>
<th>6</th>
<th>22</th>
<th>0</th>
<th>5</th>
<th>499</th>
<th>451</th>
<th>557</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hardware (428)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Software (1093)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX A: Glossary of Terms

Terms used within the Specification Text:

- **Advanced Application Controller (AAC):**
  A fully programmable control module. This control module may be capable of some of the advanced features found in Building Controllers (storing trends, initiating read and write requests, etc.) but it does not serve as a master controller. Advanced Application Controllers may reside on either the Ethernet/IP backbone or on a subnet.

- **Application Specific Controller (ASC):**
  A pre-programmed control module which is intended for use in a specific application. ASCs may be configurable, in that the user can choose between various pre-programmed options, but it does not support full custom programming. ASCs are often used on terminal equipment such as VAV boxes or fan coil units. In many vendors’ architectures ASCs do not store trends or schedules but instead rely upon a Building Controller to provide those functions.

- **BACnet/IP:**
  An approved BACnet network type which uses an Ethernet carrier and IP addressing.

- **BACnet MS/TP:**
  An approved BACnet network type which uses a Master-Slave Token Passing configuration. MS/TP networks are unique to BACnet and utilize EIA485 twisted pair topology running at 9600 to 76,800 bps.

- **BACnet over ARCNET:**
  An approved BACnet network type which uses an ARCNET (attached resource computer network) carrier. ARCNET is an industry standard that can utilize several speeds and wiring standards. The most common configuration used by BACnet controllers is an EIA485 twisted pair topology running at 156,000 bps.

- **Building Controller (BC):**
  A fully programmable control module which is capable of storing trends and schedules, serving as a router to devices on a subnet, and initiating read and write requests to other controllers. Typically this controller is located on the Ethernet/IP backbone of the BAS. In many vendors’ architectures a Building Controller will serve as a master controller, storing
schedules and trends for controllers on a subnet underneath the Building Controller.

- **Direct Digital Control (DDC):**
  A control system in which a digital computer or microprocessor is directly connected to the valves, dampers, and other actuators which control the system, as opposed to indirectly controlling a system by resetting setpoints on an analog pneumatic or electronic controller.

- **PICS - Protocol Implementation Conformance Statement:**
  A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device.

- **Smart Actuator (SA):**
  An actuator which is controlled by a network connection rather than a binary or analog signal. (0-10v, 4-20mA, relay, etc.)

- **Smart Sensor (SS):**
  A sensor which provides information to the BAS via network connection rather than a binary or analog signal. (0-10000 ohm, 4-20mA, dry contact, etc.)

- **Web services:**
  Web services are a standard method of exchanging data between computer systems using the XML (extensible markup language) and SOAP (simple object access protocol) standards. Web services can be used at any level within a Building Automation System (BAS), but most commonly they are used to transfer data between BAS using different protocols or between a BAS and a non-BAS system such as a tenant billing system or a utility management system.

**Terms used within the Sequences of Operation:**

- **adj.**
  Adjustable by the end user, through the supplied user interface.

- **AI, AO, etc. (Column Headings on Points List)**
  
  AI = Analog Input. A physical input to the control module.
  AO = Analog Output. A physical output from the control module.
  AV = Analog Value. An intermediate (software) point that may be editable or read-only. Editable AVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only AVs are typically used to display the status of a control operation.
BI = Binary Input. A physical input to the control module.
BO = Binary Output. A physical output from the control module.
BV = Binary Value. An intermediate (software) point that may be editable or read-only. Editable BVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only BVs are typically used to display the status of a control operation.

Loop = A control loop. Most commonly a PID control loop. Typically a control loop will include a setpoint, an input which is compared to the setpoint, and an output which controls some action based upon the difference between the input and the setpoint. A PID control loop will also include gains for the proportional, integral, and derivative response as well as an interval which controls how frequently the control loop updates its output. These gains may be adjustable by the end user for control loop "tuning," but in self-tuning control loops or loops which have been optimized for a specific application the gains may not be adjustable.

Sched = Schedule. The control algorithm for this equipment shall include a user editable schedule.

Trend. The control system shall be configured to collect and display a trend log of this object. The trending interval shall be no less than one sample every 5 minutes. (Change of Value trending, where a sample is taken every time the value changes by more than a user-defined minimum, is an acceptable alternative.)

Alarm. The control system shall be configured to generate an alarm when this object exceeds user definable limits, as described in the Sequence of Controls.

Note: If the specifications require use of the BACnet protocol, all of the above shall be provided as BACnet objects.

• KW Demand Limiting: *

An energy management strategy that reduces energy consumption when a system's electric power meter exceeds an operator-defined threshold.

When power consumption exceeds defined levels, the system automatically adjust setpoints, de-energizes low priority equipment, and takes other pre-programmed actions to avoid peak demand charges. As the demand drops, the system restores loads in a predetermined manner.

• Occupant Override Switch, or Timed Local Override:

A control option that allows building occupants to override the programmed HVAC schedule for a limited period of time.

When the override time expires, the zone returns to its unoccupied state.

• Occupant Setpoint Adjustment:
A control option that allows building occupants to adjust - within limits set by the HVAC control system - the heating and cooling setpoints of selected zones. Typically the user interface for this function is built into the zone sensor.

- **Optimal Start-Up:** *

A control strategy that automatically starts an HVAC system at the latest possible time yet ensures comfort conditions by the time the building becomes occupied.

In a typical implementation, a controller measures the temperature of the zone and the outside air. Then, using design heating or cooling capacity at the design outside air temperature, the system computes how long a unit must run at maximum capacity to bring the zone temperature to its occupied setpoint.

The optimal start algorithm often includes a self-learning feature to adjust for variations from design capacity.

A distributed system must use Run on Request with Optimal Start. (See below.)

- **Requested, or Run on Request:** *

A control strategy that optimizes the runtime of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service. Source equipment runs only when needed, not on a fixed schedule.

The source equipment runs when one or more receiving units request its services. An operator determines how many requests are required to start the source equipment.

For example, if all the zones in a building are unoccupied and the zone terminal units do not need heating or cooling, the AHU will shut down. However, if a zone becomes occupied or needs cooling, the terminal unit will send a run request to the AHU to initiate the start-up sequence. If this AHU depends on a central chiller, it can send a run request to the chiller.

The run on request algorithm also allows an operator to schedule occupancy for individual zones based on the needs of the occupants without having to adjust the schedules of related AHUs and chillers.

- **Trim and Respond, or Setpoint Optimization:** *

A control strategy that optimizes the setpoint of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service.
The source unit communicates with receiving units to determine heating, cooling, and other requirements, and then adjusts its setpoint.

For example, if all zones are comfortable and do not request cooling, the AHU will gradually increase (trim) its supply air setpoint. When a zone requests cooling, the AHU responds by dropping its setpoint. The more zones that request cooling, the more it drops the setpoint. The AHU repeats this process throughout the day to keep zones cool, but with a supply air setpoint that is no cooler than necessary.

Contracting Terms:

- **Furnished or Provided:**
  The act of supplying a device or piece of equipment as required meeting the scope of work specified and making that device or equipment operational. All costs required to furnish the specified device or equipment and make it operational are borne by the division specified to be responsible for providing the device or equipment.

- **Install or Installed:**
  The physical act of mounting, piping or wiring a device or piece of equipment in accordance with the manufacturer’s instructions and the scope of work as specified. All costs required to complete the installation are borne by the division specified to include labor and any ancillary materials.

- **Interface:**
  The physical device required to provide integration capabilities from an equipment vendor’s product to the control system. The equipment vendor most normally furnishes the interface device. An example of an interface is the chilled water temperature reset interface card provided by the chiller manufacturer in order to allow the control system to integrate the chilled water temperature reset function into the control system.

- **Integrate:**
  The physical connections from a control system to all specified equipment through an interface as required to allow the specified control and monitoring functions of the equipment to be performed via the control system.
PART 1 - GENERAL

1.01 SUMMARY
A. This document contains the specification and input/output summaries for a Facility Monitoring System (FMS). The system architecture shall use local space pickup devices and duct probes networked to an Air Sampling Network and Multi-Sensor Monitor(s). The Air Sampling Network shall consist of Air Sampling Controllers and an air packet transportation network that shall transport air samples from environment being monitored to Multi-Sensor Monitor(s) located throughout the facility. The FMS shall provide continuous air sampling of environmental conditions as prescribed in the Multi-Sensor Monitor section, report on those conditions via a web based user interface, and interface with other microprocessor based building subsystems as shown on the drawings and as specified.

1.02 DEFINITIONS
A. BAS refers to the Building Automation System. (Similar terms are: EMS, Energy Management System; BMS, Building Management System; or ATC, Automatic Temperature Control)
B. LCS – refers to the Laboratory Control system
C. FMC refers to the Facility Monitoring System Contractor. The FMC is the Contractor responsible for the implementation of this specification section.
D. FMS refers to the hardware, software and other components comprising the Facility Monitoring System as herein described.

1.03 ACCEPTABLE FACILITY MONITORING SYSTEM CONTRACTOR (FMC)
A. The FMC shall have support services within a 50 mile radius of Project Site and comply with the service requirements of a 48 hour response time. Support services is defined as having complete parts inventory, having required test and diagnostic equipment, and have trained technicians on the systems specified herein.

1.04 CONTRACTOR RESPONSIBILITIES:
A. The FMC shall furnish necessary hardware, software, and computing equipment required for a complete and functional system meeting the design intent and as defined in this specification.
B. Installation of FMS components; and electrical work required as an integral part of this section as noted in Part 3 Execution including but not limited to Multi-Sensor Monitors, Air Sampling Controllers, Air Sampling Network, Space pickup devices, Duct Probes, Transformers, Vacuum Pumps, Network Servers, Air Sampling Tubing, etc.
C. The FMC shall coordinate with the Electrical Contractor to provide a dedicated power source for the FMS. Provide an emergency power source for buildings with an
1.05 SYSTEM REQUIREMENTS

A. Material and equipment used shall be standard components, regularly manufactured and available by the manufacturer and not custom designed especially for this project. Systems and components, except site specific software, shall have previously been thoroughly tested and proven in actual use prior to installation on this project.

B. The system architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.

C. The system, upon completion of the installation and prior to acceptance of the project, shall perform operating functions as detailed in this specification.

1.06 EQUIPMENT

A. System Hardware

1. The FMC shall provide the following: Air Sampling Controllers, Multi-Sensor Monitors, Space pickup devices, Duct Probes, Network Servers, Vacuum Pumps, Air Sampling Tubing, Air Sampling Network, transformers, solenoids, relays, switches, sensing devices, indicating devices, uninterrupted power source (UPS) and transducers required to perform the functions listed.

B. System Software

1. The FMC shall provide software identified in this specification. The database required for implementation of these specifications shall be provided by the FMC, including point descriptor, alarm limits, calibration variables, reports and point summaries. The FMC shall provide and create the system database using the latest software release, at the time of Shop Drawing approval.

2. The FMC shall provide a BACnet compatible integration server and software to interface with the facility's BAS as required.

C. Building Ethernet Connection Cabling:

1. The University shall provide CAT-5e or CAT-6 cabling and installation between the Network Server and the University's Building Ethernet Connection. Final Building Ethernet Connection shall be coordinated with the University's IT Group.

D. Air Sampling Controllers and Multi-Sensor Monitors supplied shall be listed per Underwriters Laboratories UL916 - Energy Management Equipment.

E. The FMC shall have quality control procedures for design and manufacture of facility monitoring systems for precision monitoring, indoor air quality, energy savings and preventative maintenance.

F. The FMC shall provide test area attribute data and programming and shall coordinate object naming conventions and network map requirements with the University's internal BAS department.

1.07 SUBMITTALS

A. As soon as Submittals are prepared, an electronic version shall be provided. This
B. Shop Drawings shall include:

1. Index: The first sheet of the Shop Drawings shall be an Index of sheets in the set.

2. Legend: A description of symbols and acronyms used shall be provided at the beginning of the set of Shop Drawings.

3. Communications Riser: A single-page diagram depicting the system architecture complete with a communications riser. Riser shall include space pickup devices and duct probe location locations and addressing for each Air Sampling Controller and Multi-Sensor Monitor. Include a Bill of Material for equipment in this diagram but not included with the unique controlled systems.

4. Device Addressing Scheme: Install equipment implementing an addressing scheme consistent with a reference-document. The addressing scheme shall be submitted, reviewed and approved by the University prior to implementation.

5. Point-to-point Wiring Details: Drawings shall include point-to-point wiring details and must show field devices, Air Sampling Controllers, Multi-Sensor Monitors, panel devices, wiring terminal numbers and any special information (i.e. shielding requirements) for properly monitoring areas and controlling equipment.

6. As-Built Drawings shall conform to requirements in Division 01.

C. Operating and Maintenance Manuals

1. Operating and Maintenance (O&M) manuals for the system shall include project specific, detailed information describing the specific installation. Manual shall contain as a minimum:

   a. System overview
   b. Networking architecture
   c. Established test sequences and schedules
   d. Hardware cut-sheets and product descriptions
   e. Wiring diagrams for controllers and field hardware
   f. Installation, mounting and connection details for field hardware and accessories

1.08 CONTRACTOR (FMC) EXPERIENCE AND PERFORMANCE

A. The FMC shall have a local office or representative, staffed with factory trained engineers, fully capable of providing instruction, routine maintenance, and emergency maintenance service on system components. The FMC shall be responsible for replacement of products supplied for a period of not less than 5 years following project substantial completion.
1.09 COORDINATION

A. Coordinate layout and installation of wall and ceiling-mounted devices with existing wall and ceiling construction and other ceiling supported equipment, including light fixtures, HVAC equipment, fire-suppression system, and fire-rated partition or ceiling assemblies.

1.10 WARRANTY

A. Repair or replace any defective product and correct any defect in material or workmanship for a period of five years following the date of substantial completion of the system.

PART 2 - PRODUCTS

2.01 AIR SAMPLING NETWORK

A. The Air Sampling Network of the FMS shall consist of networked based distributed Air Sampling Controllers for routing of discreet air and data packets from the designated test areas/locations back to the Multi-Sensor Monitor; or individual home runs of Air Sampling Tubing from the designated test areas/locations back to the Multi-Sensor Monitor.

B. Air Sampling Network shall include electronics, air solenoid valves, sampling manifolds, firmware, and software as furnished as an integral assembly within the Air Sampling Controller or the Multi-Sensor Monitor. Air Sampling Network shall utilize an internal, factory pre-assembled air sampling manifold to interface to the on-board solenoid valves, and push to connect speed fittings for ease of interface to the Air Sampling Tubing. Romex connectors and knockouts shall be factory furnished and installed on the Air Sampling Controller and Multi-Sensor Monitor.

C. Air Sampling Network shall receive commands from the Multi-Sensor Monitor to open the solenoid valve of each test area to be monitored while simultaneously closing other solenoid valves in the system. A direct path between the test area and the sensors located with the Multi-Sensor Monitor shall be established to draw a continuous vacuum of air through the Air Sampling Tubing. A continuous duty vacuum pump shall be provided for each Multi-Sensor Monitor.

D. Air Sampling Controller or Multi-Sensor Monitor shall be capable of sampling multiple test areas. Air Sampling Controller or Multi-Sensor Monitor shall be sized and configured with the appropriate number of air sampling solenoid valves including hardware and software to accommodate the number of test areas noted on the plans and/or specifications; and the required sampling rate as noted in the Multi-Sensor Monitor section.

E. Temperature Sensing – Additional Inputs/Outputs:

1. Air Sampling Controller or Multi-Sensor Monitor shall be capable of sensing per test area/sampling point the temperature at the space or duct via a local room temperature sensor or duct probe. Local temperature readings shall be in addition to the sampled air data gathered through the Air Sampling Network. Temperature reading[s] shall be capable of being shared with and interfaced to the BAS through
local hardwired analog outputs as noted below.

2. Air Sampling Controller or Multi-Sensor Monitor shall be capable of accepting universal 0-10 v and 4-20 mA inputs, in addition to temperature sensors as noted above, and generating 0-10 v and 4-20 mA outputs through expansion boards for interfacing to the facility's BAS and other third party devices and controllers.

F. Air Sampling Controllers shall operate on 24 vac power fed from a common 120/24 vac transformer provided by the FMC connected to the Multi-Sensor Monitor that serves the Air Sampling Controller. Low voltage power shall be distributed to the Air Sampling Controller through the associated Air Sampling Tubing.

2.02 SENSOR SUITE

A. The Sensor Suite shall be a distributed, network based, multipoint sensing device. The Sensor Suite shall be furnished as a complete, self contained unit housing electronics, sensing card cage, sampling manifolds, flow regulators, pressure regulators, firmware, and software.

B. The Sensor Suite shall provide communications between the Air Data Router sub network and the Information Management Server over an isolated RS-485 network. The Sensor Suite shall support communications with a sub network of 30 Air Data Routers; 30 other Sensor Suites, and an Information Management Server.

C. The Sensor Suite base unit shall consist of an enclosure; hinged door with keyed lock; terminations area for both field wiring and Structured Cable connections; a communications/processor board; electronic flow measurement and controller assembly; and sensor bay.

D. The Sensor Suite shall utilize a card cage to allow for the ease of selection and installation of a diverse array of environmental and specialty sensors. At a minimum, the Sensor Suite shall incorporate the sensors to meet the required applications as shown on Attachment 2.02.D at the end of this specification section.

E. The Sensor Suite shall be modular in nature, and allow for the addition and removal of the sensors for application specific sensing requirements, and ease of calibration and service. Additional, modular sensor bay expansion capabilities shall be provided for additional sensors.

F. The Sensor Suite shall house an on-board flow regulator, orifice plate, and differential pressure sensor to maintain a continuous, regulated flow rate through the Structured Cable.

G. On-board diagnostics shall continuously perform system checks.

H. Each Sensor Suite shall contain a serial port for the interface with a portable computer. Sensor Suite and network interrogation shall be possible through this port.

I. Sensor Suites shall be capable of proper operation in an ambient temperature environment of 40 degrees F to 120 degrees F, 0 – 90% RH.

J. Sensor Suites shall have LED indication for visual status of communication and power.

K. Sensor Suites shall operate on 24Vac power fed from a common 120/24Vac transformer connected to the Sensor Suite provided by the FMC. Transformer shall also
distribute low voltage power to the Air Date Routers connected to the Sensor Suite through the associated structured cable.

2.03 AIR DATA ROUTERS

A. The Air Data Router shall be furnished as a complete, self contained, unit housing electronics, air solenoid valves, sampling manifolds, firmware, and software. Unit shall be furnished with internal devices and wiring assembled and tested at the factory.

B. Air Data Routers shall receive commands from the Sensor Suite to open the solenoid valve of each test area to be monitored while simultaneously closing the other solenoid valves in the system. A direct path between the test area and the virtual sensors located with the Sensor Suite shall be established to draw a continuous stream of air through the Structured Cable.

C. Air Data Routers shall consist of an enclosure; terminations areas for both field wiring and Structured Cable connections; a communications/processor board; high capacity solenoid valves; and sampling manifold.

D. Air Data Router shall have provisions to interface to the FMS Structured Cable. Air Data Router shall utilize an internal, factory pre-assembled air sampling manifold to interface to the on-board solenoid valves, and push to connect speed fittings for ease of interface to the Structured Cable. Romex connectors and knockouts shall be factory furnished and installed on the Router.

E. Air Data Routers shall be capable of sampling of up to four test areas. Air Data Routers shall be sized and configured with the appropriate number of air sampling solenoid valves including hardware and software to accommodate the number of test areas noted on the plans and/or specifications.

F. Air Data Router shall have the capacity to sense per test area the temperature at the room, duct or outside air via a room temperature sensor, duct probe, or outside air probe. A total of four sensor inputs shall be provided that corresponds to the air sampling of the respective four test areas.

G. Air Data router shall be capable of accepting universal 0-10Vdc and 4-20mA inputs and outputs through expansion boards for interfacing to other third party devices and controllers.

H. Up to 30 Air Data Routers shall communicate on an isolated RS-485 network with the Sensor Suite.

I. Point data, algorithms and application software within the Air Data Routers shall be programmable from the Information Management Server. Each Air Data Router shall contain both software and firmware to receive and perform full test sequencing schemes downloaded from the Server.

J. Each Air Data Router shall contain a serial port for the interface with a portable computer. Air Data Router and network interrogation shall be possible through this port.

K. Air Data Routers shall be capable of proper operation in an ambient temperature environment of 40 degrees F to 120 degrees F, 0 – 90% RH.
L. Air Data Routers shall have LED indication for visual status of communication and power.

M. Air Data Routers shall operate on 24Vac power fed from a common 120/24Vac transformer connected to the Sensor Suite that serves the Air Data Router. Low voltage power shall be distributed to the Air Data Routers through the associated structured cable.

2.04 INFORMATION MANAGEMENT SERVER

A. The Information Management Server (Server) shall provide network management of Sensor Suites, integration to the BAS, and interface to the web based Aircuity Knowledge Center for viewing and outputting graphs, charts and data derived from the Facility Monitoring System.

B. The hardware platform for the Server shall, at a minimum, consist of:
   1. PC processor with minimum 64-bit word structure.
   2. Minimum 1 GHz processor speed.
   3. Minimum 256MB on board RAM
   4. Hard drive or equal high-speed data storage, minimum 20 gigabytes.
   5. Network Interface Card: (10/100)
   6. RS-232 Serial Port
   7. Operating System shall be Windows XP.

C. The University shall provide CAT-5e or CAT-6 cabling and installation between the Information Management Server's Network Interface Card and the University's Building Ethernet Connection. Final Building Ethernet Connection shall be coordinated with the University's IT Group.

D. The Server shall be located within 25 feet of the nearest Sensor Suite and be connected to the Server through the RS-232 serial port.

E. The Server shall be mounted within a ventilated and lockable wall mounted enclosure

2.05 STRUCTURED CABLE

A. The FMS shall utilize a pre-engineered system of Structured Cable to facilitate network wide communications; distribution of low voltage power to Air Data Routers and Sensor Suites; and provide a sampling conduit for air samples within a single cable.

B. The cable shall consist of a plurality of wires to distribute communications, data and low voltage power throughout the FMS. As a minimum, Structured cable shall consist of:
   1. Communications – 22 AWG twisted shield pair with drain wire
   2. Low Voltage Power – 18 AWG, 3 wire

C. An inner pathway, MicroDuct, shall be furnished as an integral part of the Structured Cable to facilitate collection of test area air samples. MicroDuct shall be lined with a smooth, electrically conductive, chemically inert surface to insure air samples remain pure and uncorrupted and do not adhere to the wall lining during transport. Aircuity OSC or stainless steel tubing only. No exceptions. Polyethylene tubing, copper tubing,
galvanized pipe are prohibited. See below for stainless steel specifications.

D. Structured cable shall not require any specialized tools for installation. Installation of the cable shall follow traditional local area network practices.

E. Structured cable shall be suitable for riser and plenum applications, be Underwriter’s Laboratories Listed to UL CMP and C-UL CMP standards, and carry the appropriate markings throughout the cable length.

F. Alternate provision for furnishing Air Sampling Tubing shall be to furnish:

1. A dedicated air sampling network interconnecting the Air Sampling Controllers, Multi-Sensor Monitors, and room/duct sensors consisting of Type 304 Stainless Steel Welded Tubing 5/16” OD, .273” ID, .020” Wall, McMaster-Carr part number 8989K92. Compression fittings and couplings shall be used and be a minimum of Type 304, or 316L Stainless Steel, McMaster-Carr part number 50715K262. Traditional copper, plastic tubing, or variants thereof used in pneumatic controls or other processes shall not be acceptable.

2. Dedicated wiring specifically used for the FMS consisting of a minimum of:
   a. Communications – 22 AWG twisted shield pair with drain wire
   b. Low Voltage Power – 18 AWG, 3 wire

2.06 ROOM SENSORS/DUCT PROBES

A. Room Sensors:

1. A semi-flush mounted, room temperature sensor with an integral air sampling port are to be housed within one enclosure; the port within the enclosure will accept the MicroDuct from the Structured Cable.

2. Temperature Sensing Element:
   a. Platinum RTD: range -30 – 130°F
   b. Accuracy: + .30 °F

3. Internal coarse filter to screen out large particulate matter from entering the MicroDuct.

4. Terminations:
   a. Sensor – one wire
   b. Power – three wire
   c. MicroDuct – integral hose clamp

B. Duct Probe – Duct and Outdoor Air Mount

1. A duct temperature sensor and air sample probe is to be mounted within one enclosure. Duct sample probe to accept integral MicroDuct from Structured Cable.

2. Temperature Sensing Element:
   a. Platinum RTD: range -30 – 130°F
   b. Accuracy: + .30 °F
3. Internal coarse filter to screen out large particulate matter from entering the MicroDuct.

4. Terminations:
   a. Sensor – one wire
   b. Power – three wire
   c. MicroDuct – speed fitting

5. Outdoor Air Locations – A NEMA 4X weatherproof enclosure shall be provided.

2.07 HIGH FLOW VACUUM PUMP

A. Each Sensor Suite will be equipped with a High Flow Vacuum Pump (HFP) that will draw samples from the sampling ports in the system, through the Sensor Suite, and then discharge them. Samples will be discharged into the nearest exhaust duct so the samples are safely discharged from the building.

B. The HFP will meet the following specifications:
   1. Maximum Vacuum pressure: 24 inches Hg
   2. Minimum Flow Rate: 1.2 SCFM

C. Pump mounting: Pumps shall be mounted securely to prevent it from moving due to vibration, and in a location where the sound of the pump will not be heard outside the immediate area. The pumps shall be mounted wall mounted on a bracket in a location that has adequate ventilation for cooling the pump.

D. Standby pump with automatic switchover: Provides a second pump, identical to the first, with automatic switchover controller that will automatically take over should the on-line pump stop for any reason other than a complete failure of local AC power. When the primary pumps stops for any reason, or there is some other condition resulting in a loss of vacuum at the SST, the standby pump will be placed in operation and a notification will be sent to the Aircuity remote data center, notifying customer support that the backup pump is in operation, prompting a field visit. At any point, if there is a sustained loss of vacuum at the SST, a notification will be sent to the Aircuity remote data center, and BACnet points whose integrity is affected by the loss of vacuum condition will be marked as "unreliable", which can be observed by the BMS, so that they can respond accordingly. The notification will be reset once the loss of vacuum condition is remedied.

E. Vacuum pump shall be oil-less type operation with permanently lubricated bearings, long-life diaphragm and balanced for smooth, low vibration operation.

F. Provide pump with factory set pressure relief valve, muffler and mounting feet with rubber isolators.

G. Pump shall be hardwired for a permanent installation.

2.08 OCCUPANCY SENSORS

A. Manufacturers:
   1. Watt Stopper (The).
   2. Or equal.
B. General Description: Ceiling or wall-mounted, solid-state units, used only for HVAC.
   1. Operation: Switch HVAC airflow to occupied mode when covered area is occupied and to unoccupied mode when unoccupied; with a time delay for switching to unoccupied mode, adjustable over a minimum range of 1 to 30 minutes.
   2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by CEC.
   3. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   4. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   5. Bypass Switch: Override the on function in case of sensor failure.

C. Dual-Technology Type: Ceiling or wall-mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit. Sensor shall be capable of corner mounting to a wall or ceiling to eliminate detection through open doorways and outside of control area. Both technologies must be complete and overlapping throughout the controlled area to provide immediate activation upon entry.
   1. Sensitivity Adjustment: Separate for each sensing technology.
   2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.09 TRANSFORMER
A. Provide transformers to provide low voltage power to the Sensor Suite and Air Data Router.
B. Provide one transformer for the Sensor Suite and a separate transformer for the Air Data Routers.
C. Transformer specifications: 120 Vac primary, 24 Vac secondary, 96 Volt-amp rating, UL listed Class 2.
D. Provide with manual reset, 4 amp trip circuit breaker and dual junction boxes.

2.10 SYSTEM SOFTWARE OVERVIEW
A. The FMC shall provide software required for operation of the FMS system specified herein. Functionality described herein shall be regarded as a minimum. The FMC shall provide the following as a minimum:
1. Completed database.
2. Configuration of Air Data Router, Sensor Suite, Server and user interface application programs.
3. Configuration Tools, and software licenses, required to configure and operate products installed on this project.

2.11 SYSTEM CONFIGURATION
A. Database Creation and Modification. Changes shall be done utilizing standard procedures. The system shall allow changes to be made at the local site through the Information Management Server.
B. The system shall permit the operator to perform, as a minimum, the following:
   1. Add and delete points/objects
   2. Modify point parameters
   3. Create and modify control sequences and programs
   4. Reconfigure application programs

2.12 WEB BASED USER INTERFACE AND DATA MANAGEMENT SYSTEM
A. Included with the system shall be a fully integrated web based user interface and data management system. The data management system shall be password protected and shall be able to store sampled data from test areas for online viewing and reporting.
B. Unlimited data access, viewing, report generation and remote data storage shall be provided with the FMS for the duration of the project commissioning and for the entire warranty period.

2.13 TEST SEQUENCING
A. The system shall allow the operator to designate any test area to be scheduled with an operator command through the Information Management Server.
B. The operator shall be able to make schedule additions, modifications and deletions to the test schedules. The operator shall have the capability to edit schedules and then download schedule changes to the FMS.

PART 3 - EXECUTION

3.01 GENERAL
A. Verify that systems are complete and ensure that the systems are capable of being started and operated in a safe and normal condition before attempting to operate the FMS.
B. Install software in Air Sampling Controllers, Multi-Sensor Monitors and Network Server. Implement features of programs to specified requirements and as appropriate for sequence of operation.
C. Connect and configure equipment and software to achieve sequence of operation
specified.

3.02 WIRING AND AIR SAMPLING TUBING INSTALLATION

A. FMC contractor shall install systems and materials in accordance with manufacturer’s instructions, rough-in drawings and equipment details. Install electrical components Air Sampling Tubing and use electrical products complying with requirements of applicable sections of these specifications.

B. FMC contractor shall install wiring and Air Sampling Tubing neatly and professionally, in accordance with requirements of applicable installation section and California Electric Code.

C. FMC contractor shall provide wiring and Air Sampling Tubing as required by the functions specified.

D. FMC contractor shall install wiring, cables and Air Sampling Tubing according to the electrical installation section and as follows:
   1. Bundle and harness multi-conductor cable in place of single cables where several cables follow a common path.
   2. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
   3. Exposed control wiring and Air Sampling Tubing in the mechanical, electrical, telephone, and similar rooms shall be installed in raceways.
   4. Control wiring and Air Sampling Tubing shall be installed in a neat and workmanlike manner parallel to building lines with adequate support. Both conduit and plenum wiring and Air Sampling Tubing shall be supported from or anchored to structural members. Conduit, plenum wiring or Air Sampling Tubing supported from or anchored to piping, duct supports, the ceiling suspension system, is prohibited. Wiring and Air Sampling Tubing buried in slab-on-grade concrete or explosion-proof areas shall be in rigid metal conduit. Provide adequate strain relief for field terminations.

3.03 CONTROL DEVICE INSTALLATION

A. Room sensors and emergency pushbuttons shall be mounted in accordance with ADA Guidelines, unless otherwise noted on the drawings.

B. Duct probes shall be installed per SMACNA guidelines and/or manufacturer’s installation instructions. Existing duct insulation damaged during the installation of the probe shall be repaired to match existing conditions. Provide duct sealant around penetrations of existing ductwork.

C. Freestanding enclosures and panels, server, pump and transformers shall be supported on steel Unistrut frames and shelving, or equal, and be securely anchored to the wall or floor and be well braced.

D. Enclosures and panels mounted directly to the wall shall be provided with a minimum
airspace of one-inch between the enclosure and the wall.

E. A minimum of three foot working clearance shall be provided in front of enclosures and panels; clearance shall be ensured to permit the enclosure door to open at least 90° from its closed position.

F. A field-installed, 14-gage galvanized steel drip shield shall be provided where enclosures and panels may be subjected to dripping water.

G. Install emergency pushbuttons/horns at exits of every laboratory.

H. Install Occupancy Sensors or use existing to integrate with the FMS to achieve greater energy savings.

3.04 SENSOR INSTALLATION

A. Manufacturer’s recommendations shall be followed for proper placement and adjustment of sensors.

B. Install and aim sensors in locations to achieve 100 percent coverage of each lab space. Do not exceed coverage limits specified in manufacturer’s written instructions.

3.05 IDENTIFICATION

A. The FMC shall label each system device with a point address or other clearly identifiable notation inside the device cover -labels shall be permanent and use a laser printer. FMS equipment shall be clearly identified as noted on the approved submittals.

3.06 ACCEPTANCE OF COMPLETED FMS INSTALLATION

A. Upon completion of the installation, the FMC shall start up the system and perform necessary calibration, testing, and debugging operations. An acceptance test shall be performed by the FMC in the presence of the University’s Representative. Acceptance test shall be scheduled with at least 10 working days advance notice.

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

C. After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Demonstrate compliance with specifications, including calibration and testing, and air sampling test sequences. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

E. The acceptance test shall include, but not be limited to:

1. The FMC shall verify the proper operation of input and outputs.

2. The FMC shall verify inputs meet or exceed manufacturer’s stated tolerances for accuracy. The FMC shall verify that on-line graphical displays of air sampling test data accurately represent the real time state of the field conditions.
3. The FMC shall verify the reliability of communications of Air Sampling Controllers and Multi-Sensor Monitors. The test shall include functional verification of interfaces and system integration required to meet the scope of this project.

4. Acceptance: When the field test procedures have been successfully demonstrated to the University's Representative and the system performance is deemed satisfactory, the system parts will be accepted for beneficial use and placed under warranty. At this time, a "notice of completion" shall be issued by the University's Representative and the warranty period shall start.

3.07 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:
   1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
   2. Operational Test: Verify actuation of each sensor and adjust time delays.
   3. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train University's maintenance personnel to adjust, operate, and maintain control systems and components.

B. Train University's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

C. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of 8 hours' dedicated instructor time on-site.

D. Review data in maintenance manuals. Refer to Division 01.

E. Schedule training with University, through University's Representative. Refer to Division 01.

3.09 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by University's Representative, to adjust and calibrate components and to assist University's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.
## ATTACHMENT 2.02.D - SENSOR SPECIFICATIONS:

<table>
<thead>
<tr>
<th>Model Number</th>
<th>SEN-CO2-2A</th>
<th>SEN-DPT-2</th>
<th>SEN-PAR-1</th>
<th>SEN-COM-1</th>
<th>SEN-TVC-1&amp;2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 Based Demand Controlled Ventilation (DCV) or Monitoring</td>
<td>Dewpoint Temp, Relative Humidity*, Enthalpy*, Monitoring or Control</td>
<td>Particulate Monitoring or Control</td>
<td>Carbon Monoxide Monitoring or Control</td>
<td>Combines the MOS sensor (SEN-TVC-1) and the PID sensor (SEN-TVC-2) into one assembly, while supporting the individual sensing capabilities of each. This configuration is recommended for Research Lab or Vivarium applications.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical Application</th>
<th>Sensor: Carbon Dioxide (CO2)</th>
<th>Sensor: Dewpoint Temp (DPT)</th>
<th>Sensor: Airborne Particulates - Small Particles PM2.5</th>
<th>Sensor: TVOCs</th>
<th>Sensor:: TVOCs (SEN-TVC-1)</th>
<th>Sensor: TVOCs (SEN-TVC-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element</td>
<td>Dual Wavelength, Non-Dispersive Infrared Sensor</td>
<td>Capacitive Polymer Sensor</td>
<td>Optical Particle Counter</td>
<td>Electrochemical Sensor</td>
<td>Metal Oxide Semiconductor (MOS)</td>
<td>Photoionization Detector (PID)-VOCs &amp; other gases with ionization potentials &lt;10.6eV</td>
</tr>
<tr>
<td>Range</td>
<td>0-3000 ppm</td>
<td>0 to ambient DPT Deg F or 70 Deg F, whichever is less</td>
<td>PM2.5 - 0.3 - 2.5µm</td>
<td>0-150 ppm</td>
<td>Calibrated Range: 0-50 ppm (as Isobutylene)</td>
<td>Calibrated Range: 0-5 ppm (as Isobutylene)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 60 ppm</td>
<td>Dewpoint: ± 2 Deg F RH: @ 65°F and ± 0.5°F ± 6% RH @10-60%RH ±</td>
<td>± 3 ppm or 5% of reading, whichever is greater</td>
<td>± 2 ppm (as Isobutylene) or 25% of reading (whichever is greater)</td>
<td>± 0.2 ppm (as Isobutylene) or 2.5% of reading (whichever is greater)</td>
<td></td>
</tr>
</tbody>
</table>

### Specifications:
- **Model SEN-CO2-2A**
  - **Sensor:** Carbon Dioxide (CO2)
  - **Range:** 0-3000 ppm
  - **Accuracy:** ± 60 ppm

- **Model SEN-DPT-2**
  - **Sensor:** Dewpoint Temp
  - **Range:** 0 to ambient DPT Deg F or 70 Deg F, whichever is less
  - **Accuracy:** ± 60 ppm

- **Model SEN-PAR-1**
  - **Sensor:** Particulate Monitoring
  - **Range:** PM2.5 - 0.3 - 2.5µm
  - **Accuracy:** ± 25% of reading

- **Model SEN-COM-1**
  - **Sensor:** Carbon Monoxide Monitoring
  - **Range:** 0-150 ppm
  - **Accuracy:** ± 3 ppm or 5% of reading, whichever is greater

- **Model SEN-TVC-1&2**
  - **Sensor:** TVOCs
  - **Calibrated Range:**
    - 0-50 ppm (as Isobutylene)
    - 0-5 ppm (as Isobutylene)
  - **Maximum Range:**
    - 0-100 ppm (as Isobutylene)
  - **Accuracy:**
    - ± 0.2 ppm (as Isobutylene) or 2.5% of reading (whichever is greater)
<table>
<thead>
<tr>
<th>Resolution</th>
<th>8% RH @ 61-90%RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>3 ppm</td>
</tr>
<tr>
<td>Response</td>
<td>0.25 Deg F DPT</td>
</tr>
<tr>
<td>Response</td>
<td>± 10% of reading</td>
</tr>
<tr>
<td>Response</td>
<td>1 ppm</td>
</tr>
<tr>
<td>Response</td>
<td>1 ppm</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.01 ppm</td>
</tr>
<tr>
<td>Repeatability</td>
<td>± 5 ppm</td>
</tr>
<tr>
<td>Response</td>
<td>25 seconds</td>
</tr>
<tr>
<td>Response</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Response</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Response</td>
<td>60 seconds</td>
</tr>
<tr>
<td>Response</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Response</td>
<td>30 seconds</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 23 3113
METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10 inches w.g. Metal ducts include the following:
   1. Rectangular ducts and fittings.
   2. Single-wall, round, and flat-oval spiral-seam ducts and formed fittings.
   3. Duct liner. Exposed fibrous glass duct liners are prohibited.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, 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.
   1. Duct system design shall be used to select size and type of air-moving and distribution equipment and other air system components. Design of the layout and configuration of duct system shall be approved in writing by the University’s Representative.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Structural Seismic Performance: Refer to Division 23 Section “Vibration and Seismic Controls for HVAC.”

1.03 SUBMITTALS

A. Shop Drawings: CAD-generated. Show fabrication and installation details for metal ducts.
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Equipment service clearance and access panels and door swings.
   3. Duct layout indicating sizes and pressure classes.
   4. Elevations of top and bottom 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. Duct accessories, including access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.
13. Fabrication details and materials may be a separate submittal from ductwork shop drawings.
14. Seismic bracing calculations, details, products, and plans.

B. Welding certificates.
C. Field quality-control test reports.
D. Submittals:
   1. Product Data: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
   2. Product Data: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
   3. Leakage Test Report: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
   4. Duct-Cleaning Test Report: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-Up."
   5. Product Data: For adhesives and sealants, including printed statement of VOC content.

E. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.
   4. Ducts, fittings, hangers, dampers, supports, fasteners and any other sheet metal products used.

1.04 QUALITY ASSURANCE


B. Seismic Engineering: Seismic bracing and support design, product installation, equipment, and systems shall conform to the CBC. Submit calculations, plans, and documents stamped by a qualified California registered engineer.

C. Structural Review: Seismic engineering submittal documents, seismic loads, anchorage loads, and vertical loads applied to the building structure shall be approved by the project structural engineer of record.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 SHEET METAL MATERIALS

A. 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: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation. Ducts shall have mill-phosphatized finish for surfaces exposed to public view and that are specified to be painted.

C. Stainless Steel: ASTM A 480/A 480M, Type 316L unless otherwise indicated, and having a No. 2D finish for concealed ducts and No. 4 finish for ducts exposed to public view. Minimum 18 gage. Provide welded construction.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

E. Tie Rods: Tie rods inside ductwork are prohibited.

2.03 DUCT LINER

A. Fibrous-Glass Liner: Shall not be used without University's Representatives written approval. When approved liner shall comply with the following:

1. Manufacturers:
   a. Certain Teed Corp.; Insulation Group.
   c. Knauf Fiber Glass GmbH.
   d. Owens Corning.
   e. Or equal.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
   a. Thickness: 1 inch.
   b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

d. Liner Adhesive: Comply with ASTM C 916.

e. Interior surface shall be perforated galvanized sheets.

f. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1) Tensile Strength: Indefinitely sustain a 50-lb tensile, dead-load test perpendicular to duct wall.

2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.

3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

g. 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).

3. 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.

B. Flexible Elastomeric Duct Liner: Comply with NFPA 90A. Shall not be used without University’s Representatives written approval.

1. Manufacturers:
   a. Armacell
   b. Aeroflex USA
   c. K-flex USA
   d. Or equal.

2. Materials: Flexible Polymeric Foam Sheet Insulation complying with ASTM C 1534, Type I,
   a. Thickness: 1 inch.
   b. Thermal Conductivity (k-Value): less than 0.25 at 75 deg F mean temperature.
   c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411.
   d. UL 181 for mold growth/humidity, air erosion and passes ASTM G 21 Fungal Resistance.
   e. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A.
   f. 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).
2.04 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**: 4 inches.
   3. **Sealant**: Modified styrene acrylic.
   4. **Water resistant**.
   5. **Mold and mildew resistant**.
   6. **Maximum Static-Pressure Class**: 10 inches w.g., 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.
   10. For indoor applications use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:
   1. **Application Method**: Brush on.
   2. **Solids Content**: Minimum 65 percent.
   4. **Water resistant**.
   5. **Mold and mildew resistant**.
   6. **VOC**: Maximum 75 g/L (less water).
   7. **Maximum Static-Pressure Class**: 10 inches w.g, positive and negative.
   8. **Service**: Indoor or outdoor.
   9. **Substrate**: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel.

D. 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 use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1 inch w.g. and shall be rated for 10 inches w.g. 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.

2.05 HANGERS AND SUPPORTS

A. Building Attachments: Drilled in fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use drilled in concrete fasteners for standard-weight aggregate concretes or for slabs more than 5 inches thick.

B. Powder-Actuated Fasteners are prohibited.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

2. Supports for Stainless-Steel Ducts: Galvanized-steel or stainless steel shapes and plates.

2.06 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" third edition and complying with requirements for metal thickness, reinforcing types and intervals, and joint types and intervals except as modified by this specification.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Elbows shall be short radius with splitter or guide vanes are the standard method to be used on campus or if space permits, long radius elbows may be used, figure 4-2, type RE 1 and RE 3 in the SMACNA manual. Use short radius elbows with 1, 2, or 3 splitter or guide vanes. Construct splitter or guide vanes per SMACNA HVAC Systems Duct Design Manual.

1. Mitered elbows with or without turning vanes and other elbow types are prohibited.

C. Divided flow branches shall be per SMACNA manual figure 4-5, type 1 or type 4A or 4B only.

D. Branch connections per SMACNA manual figure 4-6; 45-degree entry shall only be used where airflow in branch is less than 25% of total airflow in main duct.

E. Offsets shall be SMACNA manual figure 4-7, type 3 only.

F. Provide bellmouth transitions for connections to air handling units and plenums.
G. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:
   a. Ductmate Industries, Inc.
   b. Nexus Inc.
   c. Ward Industries, Inc.
   d. Or equal.

H. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

1. Button punch snap lock seams are prohibited.

I. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations.

J. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 20 gauge (0.0359 inch thick) or less, with more than 10 sq. ft. of nonbraced panel area.

2.07 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 100 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams.

G. 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.

H. 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:
   1. Fan discharges.
   2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.

I. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent. Use solid metal (nonperforated) inner ducts for material handling exhaust systems.

J. Terminate inner ducts with build outs attached to fire-damper sleeves, dampers, splitter vane assemblies, or other devices. Fabricated build outs (metal hat sections) or other build out means are optional; when used, secure build outs to duct walls with bolts, screws, rivets, or welds.

2.08 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

C. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Fabricate ducts larger than 72 inches in diameter with butt-welded longitudinal seams.

1. Manufacturers:
   b. SEMCO Incorporated.
   c. Or equal.

D. Duct Joints:

1. Ducts up to 20 inches in Diameter: Interior, center-beaded slip coupling per SMACNA figure 3-1, RT-1, sealed before and after fastening, attached with sheet metal screws.

2. Three-piece, gasketed flanged joint consisting of two external flanges with sealant, SMACNA manual figure 3-1, RT-2 and 2A.

3. Round Ducts: Prefabricated connection system consisting of neoprene gasket dual flanges. Manufacture ducts according to connection system manufacturer's tolerances.
   a. Manufacturers:
      1) Ductmate Industries, model Spiralmate
      2) Or equal.

4. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
   a. Manufacturers:
1) Ductmate Industries, Inc.
3) SEMCO Incorporated.
4) Or equal.

E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA’s "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting into branch tap entrance.

G. Fabricate elbows using die-formed, gored, segmented, or mitered construction. Ratio of centerline radius to duct diameter of elbows shall be 1½. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Number of Pieces: Welded construction complying with SMACNA’s "HVAC Duct Construction Standards--Metal and Flexible," comply with table 3-1.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2 to plus 2 inches w.g.:
   a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
   b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
   c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
   d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10 inches w.g.:
   a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
   b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
   c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
   d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
5. Round Elbows 8 inches and less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 inches in Diameter: Fabricate gored elbows for 30, 45, 60, and 90 degrees. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction. Fabricate 90 degrees elbows with minimum of 5 pieces.
7. Round Elbows Larger than 14 inches in Diameter and Flat-Oval Elbows: Fabricate gored elbows.
8. Die-Formed Elbows for Sizes through 8 inches in Diameter and Pressures 0.040 inch thick with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
10. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.

PART 3 - EXECUTION

3.01 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless approved by the University's Representative, construct ducts according to the following:

1. Supply Ducts (exterior installation): plus 6 inches water gauge (w.g.).
2. Supply Ducts before (upstream) Air Terminal Units (VAV boxes or air valves): plus 4 inches w.g.
3. Supply Ducts after (downstream) Air Terminal Units (VAV boxes or air valves): plus 2 inches w.g.
4. Supply Ducts (in Mechanical Equipment Rooms): plus 6 inches w.g.
5. Return ducts (negative pressure) after (downstream) Air Terminal Units (VAV boxes, air valves, or filters): minus 4 inches w.g.
6. Return Ducts (negative pressure) before (upstream) Air Terminal Units (VAV boxes, air valves, or filters): minus 2 inches w.g.
7. Vertical risers shall be constructed to a minimum of plus or minus 4 inches w.g., regardless of service.

B. Ducts shall be galvanized steel except as follows:

1. Ductwork exposed on roof and not furnished with insulation and metal jacket: Type 316L stainless steel.
2. Outside Air / Air Make-up Ducts: Type 316L stainless steel.

C. Use round ducts to the maximum extent possible. As duct size increases, flat oval shall be considered. Rectangular ducts shall be limited to areas of space restriction with a maximum aspect ratio of 3:1. If due to a structural clearance constraint, duct aspect ratio can be increased and/or duct cross section reduced if upstream transition has included angles of 60 degrees or less and downstream transition has included angles of 30 degrees or less.

D. Ducts exposed outside to elements shall be of round construction to shed rainwater. If conditions do not allow round ducts, slope the flat top of ductwork so rainwater will not stand on top of duct. Ensure that rectangular or square exhaust ducting is stiff enough that it will not pull inward on the top and create ponding areas for water under maximum design conditions of pressure and air flow.

E. Except for connection of terminal discharge duct to air outlets, 90 degree taps shall not be used. Takeoff feeding terminals shall be conical branch; 45 wye conical branch; low loss tee; bell mouth, or branch with a loss coefficient equivalent to that for the conical branch. The slopes of transitions shall be approximately one to five, and no abrupt changes or offsets of any kind in the duct system shall be permitted.
3.02 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA’s "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs in ducts that would be over 12 feet in length.

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 2 inch on each side, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Stainless steel ducts shall be welded joints and fittings except for connections to air valves and fume hoods, which shall be flanged or draw-band connections.

M. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

N. Prohibited: Painting interiors of metal ducts.

O. Protect duct openings from damage and prevent entrance of foreign materials.

P. Sealants shall not take the place of welding of metal ducts, where required.

3.03 SEAM AND JOINT SEALING

A. Seal duct seams and transverse and longitudinal joints regardless of pressure classification.

B. Seal ducts before external insulation is applied.

C. Provide airtight seal on seams around fan and coil housings with clear caulking compound.
D. Do not use permanent sealants on duct mounted equipment. Sealant at equipment, or other in-duct maintenance component, shall be sealed with a code approved sealant that may be easily removed and replaced upon repair and replacement of the device connected to the ductwork.

3.04 HANGING AND SUPPORTING

A. Attachment method, hanger device selection, loads, and spacing shall be coordinated and approved with the structural engineer.

B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Support vertical ducts at maximum intervals of 16 feet and at each floor.

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load. Wire and friction clamps are prohibited.

E. Install concrete inserts before placing concrete.

F. Install drilled in concrete anchors after concrete is placed and completely cured.

G. Powder-Actuated Fasteners: are prohibited except when executed in accordance with Division 01.

H. Wet, or High Moisture Areas: Provide stainless steel supports, brackets, and mounting hardware for spaces that have wet process, wash-down, or high humidity.

I. Outdoor Applications: Support assemblies shall be of stainless steel material, or hot-dip galvanized carbon steel:

1. Fasteners: Mounting hardware such as bolts, nuts, washers, straps, brackets, fastening hardware etc., shall be stainless steel.

2. Supports: Carbon steel support assemblies, including metal fabrications for use outdoors shall comply with each paragraph listed below:

a. Assemblies must be shop-fabricated and pre-assembled for one-piece hot-dip galvanized coating process.

b. Touch-up and repair per manufacturer’s recommendations after field installation.

J. Ducts and equipment shall be supported high enough above roofing surfaces to allow roofing access for maintenance and repair. Install ducts and equipment at a minimum height as shown in Table 4-1 of SMACNA Architectural Sheet Metal Manual – 5th Edition.

K. Roof-mounted duct and equipment supports: Unless otherwise shown, use round column supports to tie-in to structure with lead jacks, lead flashing, and lead umbrellas with stainless steel draw band per Figure 4-17A, or Figure 4-17B, of SMACNA architectural Sheet Metal Manual – 6th Edition. Coordinate flashing, waterproofing, and structural connection methods with other disciplines.

METAL DUCTS
23 3113 - 12
3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories" unless equipment is internally isolated.

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

C. Make connections to grilles, registers or diffusers the same size as the flange outer perimeter or neck size of the grille, register, or diffuser.

3.06 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2 inches w.g. (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10 inches w.g.
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

B. Supply, return and exhaust ducts shall be sealed to minimize leakage. Ducts in concealed spaces such as chases or shafts and above wallboard ceilings shall be pressure-tested prior to concealment. Seams and joints of ducts shall be sealed with mastic or mastic plus tape or gasketing as appropriate to limit the air leakage.

C. Laboratory and kitchen grease exhaust shall not have any leakage for welded segments. Pressure test at 95% of duct pressure rating, checking every joint by spraying soap test to verify seal.

D. Materials such as duct, stiffeners, gaskets, bolting, etc., intended as part of the final installation, which are damaged during testing shall be replaced.

E. Ductwork may be tested in sections. The section of the ductwork to be tested shall be prepared by blanking off duct outlets, etc.

F. Dampers in the tested ductwork shall be left in the open position. Testing shall be satisfactorily completed before insulation or enclosure of the ductwork and before terminal units are installed.

G. Ductwork downstream of terminal units and air valves need not be leak tested.
3.07 CLEANING NEW SYSTEMS

A. If the ductwork system is maintained in a clean state during the installation the following is not required. If in the opinion of the University’s Representative the ductwork system becomes dirty during installation the following shall be complied with:

B. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

C. Use service openings, as required, for physical and mechanical entry and for inspection.
   1. Create other openings to comply with duct standards.
   2. Disconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling sections to gain access during the cleaning process.

D. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

E. Clean the following metal duct systems 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.
   5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.

F. 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.
   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.

G. Cleanliness Verification:
1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

3.08 CLEANING EXISTING SYSTEMS

A. Use service openings, as required, for physical and mechanical entry and for inspection.
   1. Use existing service openings where possible.
   2. 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 Division 23 Section "Air Duct Accessories" for access panels and doors.
   3. Disconnect flexible ducts as needed for cleaning and inspection.
   4. Remove and reinstall ceiling sections to gain access during the cleaning process.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.

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 the outside, use filtration to contain debris removed from HVAC system, and locate exhaust downwind 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.
   5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
   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 operative drainage system 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.

F. Duct System Cleanliness Tests:

1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.

2. Visually inspect duct system to ensure that no visible contaminants are present.

3. Where contaminants are discovered, re-clean and reinspect ducts.

4. Test sections of metal duct system, chosen randomly by University’s Representative, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems." Comply with ASHRAE 62.1-2004, in which Section 7.2.4 - "Ventilation System Start-Up" requires that distribution systems be clean of dirt and debris.

   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

5. Duct system will be considered defective if it does not pass tests and inspections.

6. Prepare test and inspection reports.

G. Gravimetric Analysis: At discretion and expense of the University, sections of metal duct system, chosen randomly by the University, may be tested for cleanliness according to NADCA vacuum test gravimetric analysis.

1. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.

2. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal duct system shall be re-cleaned and re-verified.

END OF SECTION
SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:

2. Automatic balancing damper
3. Backdraft dampers
4. Motorized control dampers.
5. Fan isolation and bypass dampers
7. Fire dampers.
8. Smoke or combination fire and smoke dampers.
10. Turning vanes (prohibited)
11. Duct-mounting access doors.
12. Flexible connectors.
14. Flexible ducts.
15. Duct accessory hardware.

1.02 SUBMITTALS

A. Product Data: For the duct accessories to be used on this project.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Motorized-control damper installations.
3. Fire-damper, smoke-damper, and combination fire and smoke-damper installations, including sleeves and duct-mounting access doors.

C. Submittal shall include published leakage, pressure drop and maximum pressure data for a full range of damper sizes based on AMCA Standard 500 testing. Data from one size sample test is prohibited.

D. Submittal:

1. Product data: Documentation indicating that units comply with ASHRAE 62.1.
1.03 QUALITY ASSURANCE


B. Comply with AMCA 500-D testing for damper rating.

C. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181.

D. Fire, Smoke, and Combination Fire-Smoke dampers shall conform to the California State Fire Marshal Listing for Fire Damper and Smoke Damper.

E. Fire dampers shall be listed by Underwriters Laboratories, Inc., complying with UL 555, Smoke, and Combination Fire-Smoke dampers shall be listed by Underwriters Laboratories, Inc., complying with UL 555S.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; exposed ducts shall have mill-phosphatized finish for paint adhesion.

C. Stainless Steel: ASTM A480/A480M, type 304, and having a No. 2 finish for concealed ducts and exposed ducts.

D. Extruded Aluminum: ASTM B221, alloy 6063, temper T5.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for stainless steel ducts.

F. Tie Rods are prohibited.
2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Rectangular Manual Volume Balancing Dampers:

1. Manufacturers:
   a. Air Balance Inc.
   b. American Warming and Ventilating
   c. McGill AirFlow LLC.
   d. Nailor Industries Inc.
   e. Pottorff
   f. Ruskin Company.
   g. Or equal.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Frame: Hat-shaped, 0.094 inch thick, galvanized sheet steel or 0.05 inch thick stainless steel.
   b. Welded corners
   c. Flanges for attaching to walls, flangeless frame for installing inside ducts, and flanged frames for installing in ducts

5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized or Stainless-steel, 0.064 inch thick.
   e. Blade Axles: Galvanized steel or Stainless steel.

6. Bearings:
   a. Oil-impregnated bronze, oil-impregnated stainless-steel sleeve, or ball bearing as specified for the project conditions
   b. Dampers in ducts with pressure classes of 3 inches water gauge or greater shall have full-length axles. That is, the damper shafts shall be solid and pass completely through from one side to the other without any form of coupling. Both ends shall be supported by bearings.
   c. Tie Bars and Brackets: Galvanized steel.

7. Jackshaft (jackshafts are rarely used on manual volume dampers consult with University’s Representative):
   a. Size: 1 inch diameter or larger
   b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

8. Damper Hardware:
   a. Include center hole to suit damper operating-rod size.
   b. Include elevated platform for insulated duct mounting.

B. Standard, Steel, Round Manual Volume Balancing Dampers

1. Manufacturers
   a. Air Balance Inc.
   b. American Warming and Ventilating
   c. McGill AirFlow LLC.
   d. Nailor Industries Inc.
   e. Pottorff
   f. Ruskin Company.
   g. Or equal.

2. Standard leakage rating.
3. Suitable for installation at any angle
4. Blades
   a. Single blade or multi-blade
   b. Stiffen damper blades for stability.
   c. Galvanized or Stainless-steel, 0.064 inch thick.
   d. Blade Axles: Galvanized steel or Stainless steel.

5. Bearings:
   a. Oil-impregnated bronze, oil-impregnated stainless-steel sleeve, or ball bearing as specified for the project conditions
   b. Dampers in ducts with pressure classes of 3 inches water gauge or greater shall have full-length axles. That is, the damper shafts shall be solid and pass completely through from one side to the other without any form of coupling. Both ends shall be supported by bearings.
   c. Tie Bars and Brackets: Galvanized steel.

6. Damper Hardware:
   a. Include center hole to suit damper operating-rod size.
   b. Include elevated platform for insulated duct mounting.
   c. Provide locking quadrant or remote actuator by Young Regulator

C. Motorized Control Dampers may be used as manual volume dampers where the dual application is suitable.
2.04 AUTOMATIC BALANCING DAMPERS

A. Manufacturers:
   1. Ruskin Model ABD
   2. Or equal

B. Pressure independent, 4, 5 and 6 inch round, automatically balance airflow to set point ±10% at 0.5 inch water gauge differential across the damper.

C. Shall comply with UL2043.

D. Warranty: 5 years, minimum.

2.05 BACKDRAFT DAMPERS (PROHIBITED UNLESS SPECIFICALLY DIRECTED)

A. Manufacturers:
   1. TAMCO Series 7000 CW
   2. Or equal

B. Description: Multiple-blade, parallel action, weighted gravity balanced, factory fabricated with silicon-sealed blades and edges with adjustment device to permit setting for varying differential static pressure. The damper shall be limited to 4 inches static pressure and 2500 fpm velocity unless otherwise certified and warranted by manufacturer.

C. Frame: 0.06 inch thick extruded aluminum, 2.5 inches deep.

D. Blades: 0.06 inch thick, extruded aluminum.

E. Blade Axles: Aluminum

F. Mounting style shall be either rear flange, front flange, or in duct.

G. Linkage system shall consist of aluminum crank arms fastened to aluminum pivot rods. Aluminum alloy linkage rod shall connect crank arms by means of trunnion.

H. Provide access door for maintenance of adjustment device when access is not readily available.

2.06 ACTUATED CONTROL DAMPERS

A. Low-Leakage Outside Air, Return and Exhaust or Relief Dampers:
   1. Manufacturers:
      a. TAMCO Series 1000 SW Air-Foil Control Damper with Salt Water Resistance Option
      b. Or equal.
2. Dampers shall be manufactured of aluminum or stainless steel. Carbon steel components are prohibited in the damper construction.
3. If damper is to be aluminum, aluminum parts shall be clear anodized to a minimum thickness of 0.7 mil.
4. There shall be two mechanically-fastened damper blade seals at each blade sealing point to assure maintenance of long-term leakage resistance. Blade seals shall be of extruded silicone.
5. Frame seals shall be of extruded silicone and factory tested to over 500,000 cycles to ensure durability.
6. Bearings shall be maintenance free. Metal-to-metal contact is prohibited.
7. Damper drive rod shall be mechanically maintained in drive blade, and shall incorporate hex flats to prevent slippage.
8. Leakage shall not exceed 3 cfm/ft² against 1” water gauge differential static pressure (AMCA Class 1A).
9. Dampers shall be made to size required without blanking off free area.
10. Dampers shall have opposed blade action or parallel blade action, depending on application.
11. Dampers shall be available in three mounting types: "Installed in Duct", “Extended Rear Flange”, or "Flanged to Duct" as required for installation.
12. Intermediate or tubular steel structural support shall be provided by installer to resist applied pressure loads for dampers that consist of two or more sections in height or width.
13. Air handling units with 100% outside air intended for continuous operation do not require outside air dampers. Systems with standby units require fan isolation control dampers at the discharge sides of the units.

2.07 FAN ISOLATION AND BYPASS CONTROL DAMPERS

A. AMCA rated, parallel blade for open and closed design and opposed blade for modulation control design, airfoil shape, for fan isolation under dynamic conditions. Dampers shall be low leakage industrial grade control dampers that meet the following minimum construction standards. Carbon steel components are prohibited.

1. Manufacturers:
   a. Tamco model 8800 with Salt Water Resistance Option (Basis of Design)
   b. Ruskin model CD80AF3
   c. Greenheck model HCD-230
   d. Or equal.

2. Frame shall be 8 inches deep by 2 inch flanged anodized 6063-T5 aluminum channel, or 316 stainless steel channel. Blades shall be double skin airfoil, maximum 8 inches wide and minimum 0.08” aluminum, or 14-gage stainless steel. Axles shall be minimum 3/4” diameter anodized aluminum or stainless steel rod. Provide dampers with low-leakage blade and jamb seals.
3. Except for Basis of Design, provide external ball bearings mounted outboard external of frame. Bearings shall have provisions for lubrication (Zurk fitting).
4. Linkage shall be located out of air stream. Standard construction shall include crank lever for motor operation. Linkage in air stream is prohibited. Each damper panel shall have separate drive actuator.

5. Submittal data must include published leakage, pressure drop, and maximum pressure data for full range of damper sizes based on AMCA standard 500 testing. Performance data for 48” x 48” damper at 1 inch water gauge shall be less than 4.0 cfm per square foot.

6. Bolts, nuts, screws, linkage components, and appurtenances shall be anodized aluminum or stainless steel.

7. Damper shall be rated for minimum of 15 inches water gauge pressure.

2.08 BUBBLE TIGHT DAMPERS

A. Bubble tight dampers shall be Flanders model PB-2000-1099 or equal.

1. Tested for 10,000 open/close cycles.

2. Damper leakage to max 60 inches water gauge after cycle testing.

3. Round type.

B. The standard construction for model number shall be as follows. Flanges shall be minimum 1½ inches wide by 0.1875 inch thick. Factory drilled holes (7/16” diameter) shall be 4” or less apart as recommended in ERDA 76-21, “Nuclear Air Cleaning Handbook”. The frame material shall be minimum 11-gage unainted Type 304 stainless steel. Shafts shall be minimum ¾” diameter stainless steel rod with shaft seals.

C. The dampers shall be positive seal, isolation type that shall be bubble-tight at the minimum differential pressure of 10 inches water gage. The blade shall consist of two (2) 0.1875 inch thick type 304 stainless steel plates with a replaceable solid silicone gasket between them. Blade seal shall occur when the gasket seats against the inside of the 11 gage housing wall. The damper shall be of welded construction. Pressure-retaining welded joints and seams shall be continuously welded, pores are prohibited. As a minimum, weld joints and seams shall be wire brushed or buffed to remove heat discoloration, burrs and sharp edges.

D. The dampers shall be manufactured under a quality assurance program that meets the requirements of ASME NQA-1, “Quality Assurance Program Requirements for Nuclear Facilities”. Welding procedures, welders and welder operators shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX. Production welds shall be visually inspected per the Flanders/CSC standard procedure number P-122, “Visual Inspection of Welds,” which incorporates the workmanship acceptance criteria described in Sections 5 and 6 of ANSI/AWS D9.1-1990, “Specifications for Welding Sheet Metal”.

E. The damper blade shall be tested in the closed position at 10 inches water gage and shall be bubble-tight when tested in accordance with ASME N509-1996 “Reaffirmed” paragraph 5.9.7.3. The complete pressure boundary (damper housing) shall be leak tested by the “Pressure Decay Method” in accordance with ASME N510-1995 “Reaffirmed”, “Testing of Nuclear Air Treatment Systems”, Paragraphs 6 and 7. Pressure readings are recorded once a minute until pressure decays to 75% of the test pressure or for 5 minutes. There shall be
a maximum leak rate of 0.0005 CFM per cubic foot of housing volume at 10 inches water gage.

F. Actuators

1. Manual actuators shall be quarter-turn, worm-gear or scotch yoke actuators with hand wheels. Rated output torque shall be 2,000 inch-pounds up to 22 inch diameter size dampers with a gear ratio of 30:1 and 7,000 inch pounds on dampers 24” to 36” diameter size, with a gear ratio of 40:1. Actuator shall be fully lubricated and self-locking to hold in any position.
2. Pneumatic actuator shall be rotary type with flow control valves.

2.09 FIRE DAMPERS

A. Manufacturers:

1. Air Balance Inc.
2. Cesco Products
4. Nailor Industries Inc.
5. Potterff
6. Prefco; Perfect Air Control, Inc.
7. Ruskin Company.
8. Vent Products Company, Inc.
9. Or equal.

B. Fire dampers shall be static type labeled according to UL 555 by an NRTL and CSFM listed.

C. Fire Rating: 1½ hours.

D. Frame: Curtain type with blades outside airstream or Multiple-blade type with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.05 or 0.138 inch thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as required.

G. Blades: Roll-formed, interlocking, 0.034 inch thick, galvanized sheet steel, or stainless steel. In place of interlocking blades, use full-length, 0.034 inch-thick, galvanized-steel blade connectors.

H. Provide access doors for the dampers. Doors shall be sufficiently large for the application. That is, if a human must climb inside to work, they shall be not less than 28 inches x 28
inches. Scale openings to the necessary work of inspection, service, and repair. Openings smaller than 6 inches by 4 inches are prohibited. Provide multiple openings, as necessary to ensure full and complete access without removing dampers from the ductwork.

I. Horizontal Dampers: Include blade lock and stainless-steel closing spring.

J. Fusible Links: Replaceable, 165°F or 212°F rated as applicable.

K. Size dampers to limit pressure loss to 0.05 inch water gauge or less at the maximum designed air flow for the particular duct.
   1. Dampers less than duct size are prohibited.
   2. Dampers located in small ducts may need to be increased in size to minimize pressure loss.
   3. Account for effects of upstream and downstream transition fittings in pressure loss calculations.
   4. Construct transitions in accordance with SMACNA and ASHRAE standards.
   5. The total pressure loss through the assembly including any transitions shall not exceed 0.05 inches water gauge.

L. Multi-leaf fire dampers shall have airfoil blades. Damper design shall have a maximum pressure drop 0.05 inch water gauge at the designed system airflow or 2,000 feet per minute whichever is greater.
   1. Dampers less than duct size are prohibited.
   2. Dampers located in small ducts may need to be increased in size to minimize pressure loss.
   3. Account for effects of upstream and downstream transition fittings in pressure loss calculations.
   4. Construct transitions in accordance with SMACNA and ASHRAE standards.
   5. The total pressure loss through the assembly including any transitions shall not exceed 0.05 inch water gauge.

2.10 SMOKE, OR COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Air Balance, Inc.
   2. CESCO Products.
   4. Nailor Industries Inc.
   5. Potterff.
   6. Prefco Products Co.
   7. Ruskin Company.
   8. Tamco (smoke dampers only)
   10. Or equal.
B. General Description: Labeled according to UL 555S by an NRTL. Combination fire and smoke dampers shall be labeled according to UL 555 for 1½-hour rating. Leakage: Class I.

C. Fusible Links: Replaceable, 165 °F or, and 212 °F rated as applicable.

D. Frame and Blades: 0.094 inch-thick, galvanized sheet steel, or stainless steel for stainless steel duct installation.

E. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Provide for modulating or two-position action.
   1. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 inch-pounds and breakaway torque rating of 150 inch-pounds.
   3. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof NEMA 3R.
   5. Electrical Connection: 115 V, single phase, 60 Hz.

G. Provide access doors for the dampers. Doors shall be sufficiently large for the application. That is, if a human must climb inside to work, they shall be not less than 28 inches x 28 inches. Scale openings to the necessary work of inspection, service, and repair. Openings smaller than 6 inches by 4 inches are prohibited. Provide multiple openings, if necessary.

H. Size dampers to limit pressure loss to 0.05 inch water gauge or less at the maximum designed air flow for the particular duct.
   1. Dampers less than duct size are prohibited.
   2. Dampers located in small ducts may need to be increased in size to minimize pressure loss.
   3. Account for effects of upstream and downstream transition fittings in pressure loss calculations.
   4. Construct transitions in accordance with SMACNA and ASHRAE standards.
   5. The total pressure loss through the assembly including any transitions shall not exceed 0.05 inches water gauge.

I. Multi-leaf fire dampers shall have airfoil blades. Damper design shall have a maximum pressure drop 0.05 inch water gauge at the designed system airflow or 2000 feet per minute whichever is greater.
   1. Dampers less than duct size are prohibited.
2. Dampers located in small ducts may need to be increased in size to minimize pressure loss.
3. Account for effects of upstream and downstream transition fittings in pressure loss calculations.
4. Construct transitions in accordance with SMACNA and ASHRAE standards.
5. The total pressure loss through the assembly including any transitions shall not exceed 0.05 inch water gauge.

J. Dampers shall bear the UL and CSFM listed labels.

2.11 DUCT SILENCERS (NORMALLY PROHIBITED)

A. Manufacturers:
   1. Metal Form Manufacturing Inc.; Commercial Acoustics.
   2. Industrial Noise Control, Inc.
   3. McGill AirFlow LLC.
   4. Ruskin Company.
   5. Vibro-Acoustics.
   6. Industrial Acoustics Company (IAC).
   7. Or equal

B. General Description: Factory-fabricated and -tested, round or rectangular silencers with performance characteristics and physical requirements as indicated.

C. Fire Performance: Adhesives, sealants, packing materials, and accessory materials shall have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84.

D. Rectangular Units: Fabricate casings with a minimum of 0.034 inch thick, solid galvanized sheet metal for outer casing and 0.022 inch thick, ASTM A653/A653M, G90, perforated galvanized sheet metal for inner casing. Attenuators in 100% outside air or fume hood exhaust system shall have a solid stainless steel internal lining.

E. Round Units:
   1. Outer Casings:
   2. Interior Casing, Partitions, and Baffles:
      b. At least 0.034 inch thick and designed for minimum aerodynamic losses.
      c. Attenuators in 100% outside air or fume exhaust system shall have a solid stainless steel internal lining.

F. Sheet Metal Perforations: Not more than one eighth (⅛) inch diameter for inner casing and baffle sheet metal.
G. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.
   1. Erosion Barrier: Polymer bag enclosing fill and heat-sealed before assembly.

H. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.
   1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
   2. Lock form and seal or continuously weld joints.
   3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
   4. Reinforcement: Cross or trapeze angles for rigid suspension.

I. Source Quality Control:
   1. Acoustic Performance: Test according to ASTM E 477.
   2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 2000 fpm face velocity.
   3. Leak Test: Test units for air tightness at 200 percent of associated fan static pressure or 6 inches water gauge static pressure, whichever is greater.

J. Size attenuators to limit pressure loss to the specified value on the equipment schedule or less at the maximum designed air flow for the particular duct.
   1. Attenuators less than duct size are prohibited.
   2. Attenuators located in small ducts may need to be increased in size to minimize pressure loss.
   3. Account for effects of upstream and downstream transition fittings in pressure loss calculations.
   4. Construct transitions in accordance with SMACNA and ASHRAE standards.
   5. The total pressure loss through the assembly including any transitions shall not exceed the value on the equipment schedule.
   6. If there is not a silencer specified on the equipment schedule, consult with the University's representative before proceeding.
   7. Do not install silencers unless specifically directed.

2.12 TURNING VANES

A. Turning vanes are prohibited. Provide short radius elbows with splitter vanes per SMACNA or long radius elbows.

2.13 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class. Include vision panel where indicated.
B. Access Door: Double wall, duct mounting, for round or rectangular ducts; fabricated of galvanized sheet metal, or stainless steel, closed cell neoprene gasket, closure knobs with zinc plated springs and bolts. Provide accessory safety chain.

1. Manufacturers:
   a. Ductmate Industries, Inc.
   b. Greenheck Fan Corporation.
   c. Pottorff; a division of PCI Industries, Inc.
   d. Ruskin Company.
   e. Or equal.

2. Frame: None. Sandwich type configuration with outer door galvanized sheet steel, notched frame
3. Hinge: None
4. Gasket location: shall be interchangeable for positive and negative pressure applications, in accordance with manufacturer’s guidelines.
5. Pressure Rating: Ultra low leakage for positive or negative 8 inches water gauge

C. Pressure Relief Access Door: Double wall and duct mounting; fabricated of galvanized sheet metal, or stainless steel, with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Warming and Ventilating
   b. Ductmate Industries, Inc.
   c. Greenheck Fan Corporation.
   d. McGill AirFlow LLC.
   e. Ruskin Company.
   f. Or equal.

2. Frame: Galvanized sheet steel, with bend-over tabs and neoprene gaskets.
3. Provide negative pressure and positive pressure relief doors design to open automatically to prevent exploding or imploding ductwork in the event dampers close or some other event may occur while the fan is still operating. The door shall automatically close and reset when the pressure is equalized or the system shuts down. Ruskin models PRD18, NRD18 or ADHP-3. Provide insulated doors in supply air systems, stainless steel construction for hazardous air exhaust systems and construction shall be appropriate for the pressure class.
4. Seal around frame attachment to duct and door to frame with neoprene rubber.
5. Insulation: 1 inch thick, fibrous-glass or polystyrene-foam board.

2.14 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Duro Dyne Inc.
2. Ventfabrics, Inc.
3. Ward Industries, Inc.
4. Or equal.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5¾ inches wide attached to two strips of 2¾ inches wide, 0.028 inch thick, galvanized sheet steel.

   1. Minimum Weight: 22 ounces per square yard.
   2. Tensile Strength: 475 lbf/inch in the warp and 360 lbf/inch in the filling.
   3. Service Temperature: Zero to plus 200 °F

   1. Minimum Weight: 23 ounces per square yard
   2. Insulation: fiberglass.
   3. Tensile Strength: 250 lbf/inch in the warp and 275 lbf/inch in the filling.
   4. Service Temperature: Zero to plus 240 °F

   1. Minimum Weight: 16 ounces per square yard.
   2. Tensile Strength: 200 lbf/inch in the warp and 185 lbf/inch in the filling.
   3. Service Temperature: Zero to plus 500 °F

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with Teflon chemical-resistant coating including gasoline grease and acetone, UL 214 listed.
   1. Minimum Weight: 14 ounces per square yard.
   2. Pressure Rating: 8 inch water gauge positive and 5 inches water gauge negative.
   3. Tensile Strength: 300 lbf/inch in the warp and 275 lbf/inch in the filling.
   4. Service Temperature: Zero to plus 500 °F

2.15 DRAWBAND CONNECTORS

A. Manufacturers:
   1. Ductmate
   2. Phoenix Controls Corp.
   3. Or equal.

B. General Description: Formed galvanized steel cylindrical sleeve with internal gasket and external drawband bolts. Flame-retardant or noncombustible gaskets and adhesives complying with UL 181, Class 1.
1. Pressure Rating: 10 inches water gauge positive and 5 inches water gauge negative.
3. Temperature Range: Minus 20 to plus 200 °F
4. Fume Hood or Corrosive Application: Chemically resistant gasket material. Galvanized metal shall not contact airstream.

2.16 FLEXIBLE DUCTS

A. Manufacturers:

1. ANCO Products, Inc.
2. ATCO Rubber Products, Inc.
4. CASCO; Cal-Flex
5. Flexmaster U.S.A., Inc.
6. Quietflex Manufacturing Co.
7. Or equal.

B. Noninsulated, Non-Metallic Flexible Duct: UL 181, Class 1, black polymer reinforced sheeting or coated fiberglass cloth fabric supported by helically wound, spring-steel wire.

1. Pressure Rating: 4 inches water gauge positive and 0.5 inch water gauge negative.
3. Temperature Range: Minus 20 to plus 175 °F

C. Noninsulated, Non-Metallic Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil, or coated heavy fiberglass cloth fabric.

1. Pressure Rating: 8 inches water gauge positive and 5 inches water gauge negative.
3. Temperature Range: Minus 100 to plus 435 °F

D. Insulated, Non-Metallic Flexible Duct: UL 181, Class 1, black polymer film or coated fiberglass cloth fabric supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene fire retardant vapor-barrier film.

1. Pressure Rating: 4 inches water gauge positive and 0.5 inch water gauge negative.
3. Minimum Installed R-Value: R4.2
4. Temperature Range: Minus 20 to plus 175 °F

E. Insulated, Non-Metallic Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil or coated fiberglass cloth fabric; fibrous-glass insulation; polyethylene fire retardant vapor-barrier film.

1. Pressure Rating: 8 inches water gauge positive and 5 inches water gauge negative.
3. Minimum Installed R-Value: R4.2
4. Temperature Range: Minus 20 to plus 250 °F
F. Flexible Duct Connectors:
   1. Clamps: Stainless-steel band clamps with stainless hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
   2. Sheet Metal Screws: For flexible duct connectors with metal collars, use minimum three sheet metal screws and duct sealer.

2.17 DUCT ACCESSORY HARDWARE

A. Instrument Test Ports or Holes: Cast aluminum, cast zinc, or zinc-plated cast iron to suit duct material, including screw cap and rubber gasket. Size to allow insertion of Pitot tube and other testing instruments and of length to suit duct insulation thickness. Basis of design is VentLok 699, or VentLok 699-2 (where there is 2 inches of external insulation), or equal.

B. Adhesives: High strength, quick setting, waterproof, antimicrobial agent, and resistant to gasoline and grease, complying with UL 181 and approved for use inside of ducts.

C. Remote Damper Actuators: Manually operated Bowden Cable Design Model 270 series by Young Regulator or equal.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards-- Metal and Flexible" for metal ducts.

B. Provide duct accessories and components of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, and stainless-steel accessories in stainless-steel ducts.

C. Where permitted, install weighted backdraft dampers only on general low volume (less than 2,500 cfm) exhaust fans or exhaust ducts nearest to outside discharge.

D. 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.

E. Provide manual volume dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Provide balancing volume dampers at duct takeoff serving ceiling diffusers and registers. Install at a minimum of two duct widths from branch takeoff. Provide 12" long neon color flags hanging from damper handle for locating dampers. Flags shall remain after balancing unless ductwork is exposed.

F. Provide instrument test holes in ductwork at fan inlets and outlets and elsewhere as required by Testing, Adjusting and Balancing contractor for testing and balancing purposes. Factory install instrument test holes for air handling units.

G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.
H. When approved by the University's representative in writing, install duct silencers rigidly to ducts and provide supports.

I. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. Upstream side of duct coils.
2. Downstream from volume dampers, and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; at base of risers or bottom of multi-story drops.
5. On sides of ducts where adequate clearance is available.
6. For access to backdraft dampers adjustable device and to visual see position of dampers.
7. Control devices requiring inspection.
8. Elsewhere as indicated.

J. Install access doors to maintain seal when under duct static pressure.

K. Install the following sizes for rectangular duct-mounting, rectangular access doors:

1. 8 by 5 inches for 6-inch duct size and smaller.
2. 12 by 6 inches for 8-inch to 10-inch duct sizes.
3. 12 by 8 inches for 11 to 13-inch duct sizes.
4. 12 by 12 inches for 14-inch to 24-inch duct sizes by maximum of 18 inches wide.
5. 20 by 12 inches for 14-inch to 24-inch duct sizes by 19 inches and wider.
6. 24 by 24 inches for larger duct sizes than listed above.

L. Install the following sizes for round duct-mounting, round access doors:

1. 8 inches in diameter for up to 12-inch diameter duct size.
2. 12 inches in diameter for 13-inch to 19 inch duct sizes.
3. 18 inches in diameter for 20-inch to 25 inch duct sizes.
4. 24 inches in diameter for larger duct sizes than listed above.

M. Label access doors according to Division 23 Section "Identification for HVAC."

N. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. Units with internal fan isolation are prohibited to have a flexible connector.

O. For fans developing static pressures of 5 inches water gauge and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

P. For air systems with fire or smoke dampers in the mains provide pressure relief dampers when fan static exceeds pressure class of ductwork.

Q. Connect terminal units to hard metal supply ducts directly.
R. Connect diffusers, registers and grilles with lengths of flexible duct clamped or strapped in place without kinks and not exceeding an angular layout sum of 135 degrees. Do not use flexible ductwork above hard lid gypsum or similar inaccessible ceilings. Do not use flexible ducts to change directions more than 45 degrees, and with 90 degrees or less turn down from horizontal duct to diffuser, register or grille in ceiling.

S. Connect flexible ducts to metal ducts with adhesive and band clamps. Flexible ducts with galvanized sheet metal collars shall be connected with duct sealant and sheet metal screws.

T. Provide bubble tight dampers for BSL-3 isolation dampers. Provide pneumatic actuators except at HEPA filters provide manual wheel handle actuators.

3.02 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. Operate remote damper operators to verify full range of movement of operator and damper.

B. Adjusting:

1. Adjust duct accessories for proper settings.
2. Adjust fire and smoke dampers for proper action.
3. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION
SECTION 23 3600
AIR TERMINAL UNITS

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes the following:
   1. Single-duct air terminal units.
   2. Fan powered air terminal units.

1.02 SUBMITTALS
A. Product Data: For each type of product indicated, include rated capacities, pressure loss, furnished specialties, liner/insulation, sound-power ratings, and accessories.

B. Submittal:
   1. Product Data: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 - "Systems and Equipment."

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
   2. Wiring Diagrams: Power, signal, and control wiring.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:
   1. Instructions for resetting minimum and maximum air volumes.
   2. Instructions for adjusting software set points.

1.03 QUALITY ASSURANCE
A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01.

B. Sound Performance: Air Terminal Unit sizing and selection shall include sound performance characteristics. Terminal selection shall be limited to a maximum of 80% of nominal air flow range.

C. UL Listing: Meeting UL 181 requirements flame spread, smoke developed, and erosion.


E. Performance: Rate air terminal unit performance characteristic data according to ARI 880.
1.04 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate control wiring, transformer requirements, electrical wiring and electrical disconnect installation.

C. Coordinate DDC controller, automatic temperature controls and instrumentation installation.

D. Coordinate CBC equipment anchorage and seismic bracing requirements.

E. Structural Seismic Performance: Refer to Division 23 Section “Vibration and Seismic Controls for HVAC.”

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Manufacturers:
   a. Anemostat
   b. Krueger.
   c. Nailor Industries
   d. Price Industries
   e. Titus.
   f. Or equal.

B. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 SINGLE-DUCT AIR TERMINAL UNITS

A. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.

B. Casing: Minimum 22-gauge galvanized steel, 304 stainless steel, or 0.04-inch thick aluminum.


2. Casing Lining: Adhesive attached, 3/4-inch-thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread
index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

3.  Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.

C.  Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
   1.  Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 6 inches w.g. inlet static pressure.

2.03  FAN-POWERED AIR TERMINAL UNITS

A.  Not for new installations on campus, replacements only with permission from University.

B.  Configuration: Volume-damper assembly and fan in series or in parallel arrangement inside unit casing with control components inside a protective metal shroud.

C.  Casing: Minimum 22-gage galvanized steel or minimum 0.04-inch thick aluminum.
   2.  Casing Lining: Adhesive attached, 3/4-inch thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
   3.  Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
   5.  Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

D.  Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
   1.  Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 6 inches w.g. inlet static pressure.

E.  Fan Section: Galvanized-steel plenum, with direct-drive fan with air filter and backdraft damper.
   1.  Lining: 1-inch-thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil and perforated metal.
   2.  Casing Lining: Adhesive attached, 3/4-inch-thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
3. Fan motor assembly shall be centrifugal fan with a direct drive motor. Motors shall be ECM, variable-speed, DC, brushless motors specifically designed for use with single phase, 120 or 277 volt, 60 hertz electrical input.
   
a. Motor shall be complete with and operated by a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. Motors shall be designed for synchronous rotation.
b. Motor rotor shall be permanent magnet type with near zero rotor losses.
c. Motor shall have built-in soft start and soft speed change ramps.
d. Motor shall be able to be mounted with shaft in horizontal or vertical orientation.
e. Motor shall be permanently lubricated with ball bearings.
f. Motor shall be direct coupled to the blower. Motor shall maintain a minimum of 70% efficiency over its entire operating range.
g. Provide remote fan speed output control for field adjustment of the fan airflow setpoint.


F. Factory-Mounted and -Wired Controls: Electrical components shall be mounted in control box with removable cover. Incorporate single-point electrical connection to power source.
   
1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
2. Wiring Terminations: Fan and controls to terminal strip, and terminal lugs shall match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to CEC.
3. Disconnect Switch: Factory-mounted, fused type.

G. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

H. Control Sequence:
   
1. With central system fan operating in occupied mode, sequence the controls as follows:
   
a. When primary duct is pressurized, modulate volume damper to maintain room temperature.
b. On reduced-cooling demand, close volume damper. At a field-adjustable point, air terminal fan is energized.
c. As cooling demand increases, increase air terminal fan speed.
d. If central duct system pressure varies, modulate volume damper to maintain constant primary airflow.
e. If no cooling or heating demand, control enters field-adjustable, no-load band.
f. On heating demand, actuate heating coil control valve.
2. With central system fan operating in unoccupied mode, sequence the controls as follows:
   a. On heating demand, energize air terminal unit fan and operate reheat coil control valve.
   b. Maintain field-adjustable setback temperature.
   c. Close volume damper.

2.04 REQUIRED ACCESSORIES

A. DDC Controls: Single terminal unit controller and actuator specified in Division 23 Section "Instrumentation and Controls".

B. Control Transformer: For control voltage on electronic control units.

C. Hot-Water Heating Coil:
   1. Fins in systems with no return air (100% outside air): 0.008" thick copper fins with stainless steel casing.
   2. Fins with recirculated air systems: 0.010" thick phenolic coated aluminum fins, or 0.010" aluminum fins, with galvanized casing.
   3. Tubes: 0.035” thick copper ½” or 5/8” diameter tube, mechanically expanded into plate fins; and factory installed casings.
   4. Factory test coils at 350 psi.

D. Attenuator Section: Similar to terminal casing, as specified above. For multi-outlet attenuator section: provide collars; each with locking butterfly balancing damper.

E. Access: Removable panels for access to dampers, and other parts requiring service, adjustment, or maintenance; with airtight gasket.

F. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

2.05 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install air terminal unit’s level and plumb. Maintain sufficient clearance for normal service and maintenance.

B. Install air terminal units with seismic bracing where required by code.

3.02 CONNECTIONS
A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Shop drawings shall show specific installation locations.

B. Install piping adjacent to air terminal units to allow service and maintenance.

C. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping and Valves," connect heating coils to supply with shutoff valve, strainer, and union or flange; and to return with control valve, automatic flow limiting valve, shutoff valve and union or flange, in accordance with UCR Campus Standard details.

D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

E. Connect DDC control wiring and control devices according to Division 23 “Instrumentation and Controls.”

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

G. 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.

3.03 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
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.

B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION
SECTION 23 3713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes ceiling- and wall-mounted diffusers, registers, and grilles some of which may not be applicable to this project.

1.02 SUBMITTALS

A. Product Data: For each product indicated, include the following:

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, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, 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. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

C. Samples for Verification: For diffusers, registers, and grilles to be provided in other than baked white enamel the University’s Representative may request a sample in the manufacturer's standard sizes to select and verify alternate color.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

   a. Anemostat; a Mestek Company.
   b. Krueger.
   c. Nailor Industries of Texas Inc.
   d. Price Industries.
   e. Titus
f. Trox

g. Or equal.

2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 SUPPLY AIR OUTLETS

A. Louver Face Diffuser - CD:

1. Titus model MCD.
3. Finish: Baked enamel, white.
4. Panel Size: 24" x 24".
7. Dampers: None.
8. Accessories: Square to round neck adaptor, if needed.
9. Adjust modules in field to provide air pattern required.
10. For hard ceilings, provide surface mount beveled drop face border type 6. Panel size not required.

B. Ceiling Diffuser – optional type to CD specified above:

1. Titus model OMNI.
3. Finish: Baked enamel, white.
4. Panel Size: 24" x 24".
6. Pattern: horizontal air with directional blow clip.
7. Dampers: None.
9. Provide blow clips in field to provide air pattern required.
10. For hard ceilings, provide surface mount full face border type 1. Panel size not required.

C. Sidewall Supply Register – SWR (if needed on project):

1. Titus model 300RL.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Adjustable horizontal or vertical to suit installation and air flow with blades spaced at 3/4 inch apart unless otherwise required.
5. Rear Blade Arrangement: alternate of face blade with same blade spacing.
7. Mounting: Wall with concealed screws.
8. Damper Type: None.
D. Round Ceiling Diffuser:

1. Material: Steel or Aluminum.
2. Finish: Baked enamel, white or Anodized aluminum to match existing

2.03 RETURN, TRANSFER AND EXHAUST AIR INLETS

A. Perforated Face Ceiling Grille - CR:

1. Titus model PAR.
3. Finish: Baked enamel, white.
5. Panel Size: 24" x 24".
7. Damper: None.
8. Accessories: Square to round neck adaptor, if needed.
9. For hard ceilings, provide surface mounting face border type 1. Panel size not required.

B. Fixed Face Wall Grille or Register – TG & SWE (if needed on project):

1. Titus model 350RL.
2. Material: Steel, or Stainless steel.
4. Face Blade Arrangement: Fixed horizontal or vertical to suit installation at 3/4 inch apart at 35° angle.
5. Rear Blade Arrangement: Alternate of face blade with same blade spacing.
7. Mounting: Wall with concealed screws.
8. Damper Type: none.

C. Eggcrate Ceiling Grille - TG & EG (if needed on project):

1. Titus model 50F.
3. Finish: Natural anodized.
4. Face: ½" x ½" x ½" grid.
5. Panel Size: 24" x 24".
7. Damper: None.
8. Accessories: Square to round neck adaptor, if needed.
9. For hard ceilings, provide plaster frame with concealed screws. Panel size not required.

D. Adjustable Bar Grille or Register:

4. Damper Type: only for registers, opposed blade.

2.04 THERMALLY POWERED VAV DIFFUSERS

A. Manufacturers:
   1. Acutherm Therma-Fuser model TF-HC
   2. Or equal.

B. Thermally powered heating and cooling VAV diffusers shall be a complete VAV terminal and thermostat self-contained in a nominal 2’ X 2’ diffuser. They shall be thermally powered with one room thermostat/actuator and one changeover thermostat/actuator. Provide with white baked enamel finish.

2.05 LINEAR SLOT OUTLETS

A. Linear Bar Grille or Diffuser (Replacement Only match existing specifications, no new Linear slot outlets unless approved by University):

B. Linear Slot Diffuser (Replacement Only match existing specifications, no new Linear slot outlets unless approved by University)

2.06 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be 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.

3.02 INSTALLATION

A. Install diffusers, registers, and grilles 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 practicable. For units installed in lay-in ceiling panels, units shall be furnished with metal panel. Where architectural features or other items conflict with installation, notify the University’s Representative for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
D. Provide stainless steel exhaust grilles in showers, dark rooms, sterilizer area, glass wash areas, and other moisture areas.

E. Provide outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage.

F. Furnish diffusers, registers, and grilles with an electrostatically applied finish including heads of screw or concealed screws.

G. Grilles and diffusers shall match qualities, including appearance, throw, noise level, adjustability, etc.

H. Locations of diffusers, registers and grilles shall be coordinated as not to interfere with light fixtures and sprinkler heads and also be located in accordance with the following:
   1. Supply and return grilles shall create efficient cross ventilation in the room.
   2. Exhaust grilles in restrooms shall be located near water closets.
   3. Transfer air inlets in restrooms shall be located as farthest from exhaust grille.
   4. Airflow within the room shall minimize the effects of door operation.
   5. Return grilles shall be located near windows to offset heat gain/loss.

I. Air Distribution within the laboratories is critical. Supply diffusers shall be positioned such that air discharge does not affect the operation of the fume hoods. The terminal velocity shall not exceed 50 fpm at 2 feet from the face of any fume hood and 50 fpm at 6 feet above the floor. Provide a laminar flow ceiling panel if these requirements can be met with design layout.

J. Dampers in ceiling diffusers are a source of noise and shall not be provided. Provide volume damper upstream to balance airflow. Provide remote damper actuators where diffusers are installed in hard-lids or other areas where accessing damper may be difficult.

K. Air throw from supply air diffusers shall not be directed towards the face of laboratory hoods. Re-orient the throw on existing diffusers where necessary for remodeling projects.

L. Grilles, registers and diffusers shall be selected to perform without distracting noise. Throw, drop, and NC values shall be analyzed during design layout.

M. Painting inside of ducts behind grilles is prohibited to avoid any IAQ issues.

3.03 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION
SECTION 23 7413

ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following rooftop air conditioners:
   1. Cooling and heating units larger than 20 tons.

B. Related Sections include the following:
   1. Division 23 Section “Instrumentation and Controls.
   2. Division 23 Section “Vibration and Seismic Controls for HVAC”, for fan systems, and roof curb system.

1.02 SUBMITTALS

A. Product Data: Include manufacturer’s technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
   1. Product data: shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics and efficiency, gages and finishes of materials.
   2. Shop drawings shall include assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements, location of access doors, size of access doors, service light locations, arrangement of unit sections, duct size and connection location.
   3. Provide manufacturer’s typical performance rating table or chart for each fan.
   4. Provide fan curves clearly plotted and operating point showing cubic feet per minute, static pressure, efficiency, and horsepower for both present and future design points of operation and at maximum of present and future design cfm and 110% of design static pressure.
   5. Submit sound power levels in each octave band for fan and at entrance and discharge of AHU at both present and future scheduled conditions. Include sound attenuator capacities if internal to unit and itemized internal component attenuation.
   6. Submit itemized list of specified and unspecified internal AHU pressure losses at present and future conditions. Determine total fan static pressure, including external static pressure, AHU including total, inlet discharge pressures losses and dirty filters.
   7. Submit certification that each coil meets or exceeds the design capacities.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:
1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.

C. Manufacturer Seismic Qualification Certification: Submit certification that rooftop air conditioners, accessories, and components will withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls for HVAC." 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."
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.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For rooftop air conditioners to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.03 QUALITY ASSURANCE

A. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."


C. Comply with NFPA 54 for gas-fired furnace section.


1.04 COORDINATION

A. Coordinate size, location, and installation of rooftop air-conditioner manufacturer's roof curbs and equipment supports with roof installer, and structural steel contractor.
1.05  WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fails in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than four years from date of Substantial Completion.

1.06  EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Bearings: One set of supply fan bearings.
2. Bearings: One set of return fan bearings.

PART 2 - PRODUCTS

2.01  ROOFTOP AIR CONDITIONERS

A. Manufacturers:
   1. York
   2. Carrier
   3. Trane
   4. Or equal.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, blow or draw-through supply fan, return fan, condenser fans, roof-curb, VFD's, refrigeration and temperature controls, filters, and dampers.

C. Base: Corrosion resistant structural steel base, with two coats of rust inhibiting primer and two coats of epoxy paint or galvanized steel construction.

D. Casing: Manufacturer's standard 2” thick insulated double-wall G-90 galvanized sheet metal construction with non-chalking powdered paint finish, 2-inch thick insulated hinged access doors. Casing requirements:
   1. Roof: the roof shall be sloped away from the access doors, and shall have raised seams to avoid low points.
   2. Insulation: 1-1/2-pound per cubic foot density fiberglass insulation, conforming to NFPA 90A flame spread and smoke generation.
   4. Accessories: Unit shall have knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.
E. Supply Fan, and Return Fan: Airfoil, centrifugal plug fan, belt driven:
   1. Wheel: Fan wheel shall be double inlet type with forward curve blades, dynamically balanced to operate smoothly throughout the entire range of operation. Airflow design shall be constant volume. Bearings shall be sealed and permanently lubricated.

F. Condenser Fan: Propeller type, directly driven by permanently lubricated motor and aluminum fan blades.

G. Evaporator and Condenser Refrigerant Coils: Aluminum fin and seamless copper tube in stainless steel casing with equalizing-type vertical distributor and thermal expansion valve; pressure tested to 450 psig and leak tested to 150 psig with air under water. Insulate coil section. Provide stainless-steel drain pan under indoor coil.

H. Refrigeration System:
   1. Outside coil and fan.
   2. Indoor coil and fan.
   3. Expansion valves with replaceable thermostatic elements.
   4. Refrigerant dryers.
   5. High-pressure switches.
   7. Thermostats for coil freeze-up protection during low-ambient temperature operation or loss of air.
   8. Independent refrigerant circuits.
   9. Service gauges for both suction and discharge lines.
   10. Full charge of “CFC-free” environmentally friendly refrigerant.
   11. Timed Off Control: Automatic-reset control shuts compressor off after five minutes.
   12. Refrigerant Circuits: Interlaced refrigerant-coil circuiting with circuit for each compressor.
   13. Capacity Control: Multiple compressors, and modulating scroll compressors.
   15. Adjustable, Low-Ambient, and Head-Pressure Control: Designed to operate at temperatures as low as 0 deg F by cycling outside coil fans and controlling speed of last fan of each circuit.

I. Heat Exchanger: Stainless-steel or Aluminized Steel construction for natural-gas-fired burners with the following controls:
   2. Staged gas valves.

J. Outside-Air Damper: Linked damper blades, for 0 to 25 percent outside air, with fully modulating, spring-return damper motor and hood.

K. Economizer: Return, relief, and outside-air dampers with neoprene seals.
   1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses outside-air enthalpy to adjust mixing dampers.

L. Power Connection: Provide for single connection of power to unit with externally mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

M. Unit Controls: Solid-state control board and components contain at least the following features:
   1. Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side. Default control to ensure proper operation after power interruption.
   2. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit, should any of the following standard safety devices trip and shut off compressor. Unit diagnostics and diagnostic code storage.
   3. Loss-of-charge/Low-pressure switch. (1) High-pressure switch, (2) Freeze-protection thermostat, evaporator coil. If any of the above safety devices trip, a LED (light-emitting diode) indicator shall flash a diagnostic code that indicates which safety switch has tripped.
   4. Unit shall incorporate "AUTO RESET" compressor over temperature, over current protection.
   5. Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.
   6. Unit control board shall have on-board diagnostics and fault code display.
   7. Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to 0 °F.
   8. Control board shall monitor each refrigerant safety switch independently.
   9. Control board shall retain last 5 fault codes in non volatile memory, which will not be lost in the event of a power loss.

N. DDC Temperature Control: Install stand-alone control module providing link between unit controls and DDC temperature-control system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Instrumentation and Controls."

O. Roof Curb: Steel with corrosion-protection coating, gasketing, insulation, and factory-installed wood nailer; complying with NRCA standards; minimum height of 14 inches, meeting seismic requirements.

P. Isolation Curb: Rigid upper and lower steel structure with vibration isolation springs having 2-inch static deflection and vertical and horizontal restraints.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances. Install according to ARI Guideline B.
B. Curb Support: Install roof curb on roof structure, level and secure, according to ARI Guideline B. Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support, per the recommendations of the rooftop unit manufacturer, complying with the seismic requirements of CBC.

C. Isolation Curb Support: Install units on isolation curbs according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts."

D. Install restrained vibration isolation roof-curb rails on roof structure according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure rooftop air conditioners on rails and coordinate roof penetrations and flashing with roof construction. Restrained isolation roof-curb rails are specified in Division 23 Section "Mechanical Vibration and Seismic Controls for HVAC."

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Division 22 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.

D. 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.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
B. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
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.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

3.04 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean outside coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
13. Inspect operation of barometric dampers.
14. Lubricate bearings on fan.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Perform final field balance of fan wheels.
17. Start unit according to manufacturer's written instructions.
   a. Start refrigeration system.
   b. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
   a. Measure gas pressure on manifold.
   b. Measure combustion-air temperature at inlet to combustion chamber.
c. Measure flue-gas temperature at furnace discharge.
e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

22. Adjust and inspect high-pressure limits of fans.
23. Inspect outside-air dampers for proper stroke and interlock with return-air and relief dampers.
24. Start refrigeration system and measure and record the following:
   a. Coil leaving-air, dry- and wet-bulb temperatures.
   b. Coil entering-air, dry- and wet-bulb temperatures.
   c. Outside-air, dry-bulb temperature.
   d. Outside-air-coil, discharge-air, dry-bulb temperature.

25. Inspect controls for correct sequencing of cooling, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
   a. Supply-air volume.
   b. Return-air volume.
   c. Relief-air volume.
   d. Outside-air intake volume.

27. Simulate maximum cooling demand and inspect the following:
   a. Compressor refrigerant suction and hot-gas pressures.
   b. Short circuiting of air through outside coil or from outside coil to outside-air intake.

28. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:
   a. High-limit heat exchanger.
   b. Warm-up for morning cycle.
   c. Freezestat operation.
   d. Economizer to limited outside-air changeover.
   e. Alarms.

29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.05 ADJUSTING
A. Adjust initial temperature and humidity 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 site outside normal occupancy hours for this purpose, without additional cost.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train University's maintenance personnel to adjust, operate, and maintain rooftop air conditioners.

*** END OF SECTION ***
SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Supporting devices for electrical components.
   2. Electrical demolition.
   3. Cutting and patching for electrical construction.

B. Related sections include the following:
   1. Division 07 Section “Penetration Firestopping” for firestopping materials and requirements for penetrations through fire and smoke barriers.

1.02 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC (NFPA 70), Article 100, by a testing agency acceptable to the University, and marked for intended use.

B. Comply with CEC (NFPA 70).

1.03 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to the University.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches O.C., in webs.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

G. Expansion Anchors: Carbon-steel wedge or sleeve type.

H. Toggle Bolts: All-steel springhead type.

I. Powder-Driven Threaded Studs: Heat-treated steel. Not allowed within building with occupants except by prior approval, before installation, with the University's Representative.

2.03 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. 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.

3.03 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.04 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.
B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods.

G. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

H. Simultaneously install vertical conductor supports with conductors.

I. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

J. Install metal channel racks for mounting cabinets, panel boards; disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

K. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

L. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

   1. Wood: Fasten with wood screws or screw-type nails.
   2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
   3. New Concrete: Concrete inserts with machine screws and bolts.
   4. Existing Concrete: Expansion bolts.
   5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete when prior approval is received from the University’s Representative.
   6. Steel: Welded threaded studs or spring-tension clamps on steel.

   a. Field Welding: Comply with AWS D1.1.
7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.05 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 07 Section “Penetration Firestopping”.

3.06 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring. When approval by the University’s Representative raceway can be abandoned in place a minimum of 4 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.07 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing fire stopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.08 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:
   1. Supporting devices for electrical components.
   2. Concrete bases.
   3. Electrical demolition.
   4. Cutting and patching for electrical construction.
5. Touchup painting.

3.09 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 09 Section "Interior Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.10 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

*** END OF SECTION ***
SECTION 26 0501
MINOR ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Electrical demolition.

B. Related sections include the following:
   1. Section 26 0553 - Identification for Electrical Systems.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Owner before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with Owner.

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 qualified personnel in such operations.
1. Obtain permission from Owner at least 72 hours before partially or completely disabling system.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply. Install pull rope and cap conduit ends.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Remove abandoned wiring from underground conduits and install pull rope and conduit caps. Label abandoned conduits with "from and to" identifiers.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work. Repair of themed finishes shall match existing finish.

G. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

H. Protect adjacent equipment during demolition.

I. Maintain existing emergency circuits and equipment to maintain power continuity.

3.04 CLEANING AND REPAIR

1. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

2. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

***END OF SECTION***
SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.02 SUBMITTALS
A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC (NFPA 70), Article 100, by a testing agency acceptable to the University, and marked for intended use.

B. Comply with CEC (NFPA 70).

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 CONDUCTORS AND CABLES
A. Manufacturers (Building Wire and Cable):

2. General Cable Corporation.
4. Or equal

B. Manufacturers (Control Cable):
1. Alpha.
2. Belden.
3. Or equal.

C. Manufacturers (MC cable):
   1. AFC Cable Systems.
   2. Southwire Company.
   3. Or equal.

D. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

E. Conductor Material: Copper complying with ICEA S-95-658 / NEMA WC 70 Non-Shielded 0-2 kV Cables.

F. Conductor Insulation Types: Type THW, THHN-THWN, XHHW, UF, USE, and SO complying with NEMA WC 70.

G. Multi-Conductor Cable: Not allowed.

2.03 CONNECTORS AND SPLICES

A. Manufacturers:
   1. AFC Cable Systems, Inc.
   2. AMP Incorporated/Tyco International.
   3. Hubbell/Anderson.
   4. O-Z/Gedney; EGS Electrical Group LLC.
   5. 3M Company; Electrical Products Division.
   6. Or equal.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR AND INSULATION APPLICATIONS

A. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

B. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
D. Lighting Circuits Concealed in Ceiling, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

E. Outdoors and below grade: Compression types with heat shrink style watertight splice covers. Raychem CTE series, T&B "Shrink-Kon" series or equal. Cables with multiple conductors shall include a waterproof housing with a non-hardening encapsulating material.

F. Fire Alarm Circuits: Type THHN-THWN, in raceway, Power-limited, fire-protective, signaling circuit cable.

G. Class 1 Control Circuits: Type THHN-THWN, in raceway.

H. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.02 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not use oil, grease, graphite or similar substances. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway. Pulling of large conductors in raceways shall be done with an approved cable pulling machine. Other methods such as block and tackle to install conductors are not acceptable.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Common Work Results for Electrical."

F. Seal around cables penetrating fire-rated elements according to Division 07 Section “Penetration Firestopping”. Provide separate sleeves and/or fire barriers for cable fire wall penetration, unless cable is UL listed for the application.

G. Identify and color-code conductors and cables according to Division 26 Section "Common Work Results for Electrical". Identification for Electrical System. Color-coded conductor sleeves are not permitted.

H. Metal Clad (MC) Cable Installation Requirements:
   1. Not allowed.

3.03 CONNECTIONS

A. Provide steel with insulated throat cable connectors, OZ/Gedney AMC series or equivalent. Die cast or pressure cast fittings are not permitted.
B. 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.

C. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.04 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

*** END OF SECTION ***
SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.02 SUBMITTALS
A. Product Data: None.

1.03 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC (NFPA 70), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   1. Comply with UL 467.

B. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.01 ManufacturerS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Grounding Conductors, Cables, Connectors, and Rods:
      a. Boggs, Inc.
      b. Chance/Hubbell.
      c. Copperweld Corp.
      d. Dossert Corp.
      e. Erico Inc.; Electrical Products Group.
      f. Framatome Connectors/Burndy Electrical.
      g. Hastings Fiber Glass Products, Inc.
      h. Heary Brothers Lightning Protection Co.
      i. Ideal Industries, Inc.
      j. ILSCO.
      k. Or equal.
B. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Grounding Electrode Conductors: Stranded cable.

E. Bare Copper Conductors: Comply with the following:

F. Copper Bonding Conductors: As follows:
   1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
   2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
   3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
   4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.03 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.
PART 3 - EXECUTION

3.01 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.02 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with CEC (NFPA 70), Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by CEC (NFPA 70) are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1. Feeders and branch circuits.
2. Receptacle circuits.
4. Three-phase motor and appliance branch circuits.
5. Flexible raceway runs.
6. Armored and metal-clad cable runs.

D. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

E. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 2 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

F. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

C. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

D. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

E. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

3.04 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
D. Tighten screws and bolts for grounding and bonding 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.

E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

*** END OF SECTION ***
SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Seismic restraints for electrical equipment and systems.

1.02 DEFINITIONS
A. CBC: California Building Code
B. EMT: Electrical metallic tubing.
C. IMC: Intermediate metal conduit.
D. RMC: Rigid metal conduit.
E. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.03 SUBMITTALS
A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.

1.04 QUALITY ASSURANCE
A. Comply with seismic-restraint requirements in the California Building Code
B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3 and in Division 26 Section "Common Work Results for Electrical."
C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.05 PROJECT CONDITIONS
A. Project Seismic Zone as Defined in the CBC: Zone 4.
B. Project Seismic Zone Factor as Defined in the CBC: Zone Factor 0.40.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Manufacturers:
   a. Cooper B-Line; a division of Cooper Industries.
   b. ERICO International Corporation.
   c. Allied Support Systems; Power-Strut Unit.
   d. GS Metals Corp.
   e. Michigan Hanger Co., Inc.; O-Strut Div.
   f. National Pipe Hanger Corp.
   g. Thomas & Betts Corporation.
   h. Unistrut; Tyco International, Ltd.
   i. Wesanco, Inc.
   j. Or equal.

2. Finishes:
   a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
   b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
   c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.

3. Channel Dimensions: Selected for structural loading and applicable seismic forces.

C. Raceway and Cable Supports: As described in NECA 1.
D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. 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.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Shall not be used in University occupied areas and then only for non-seismic restraints.
2. Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers:
      1) Hilti, Inc.
      2) ITW Construction Products.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co. Inc.
      5) Or equal.
3. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated 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. Manufacturers:
      1) Cooper B-Line; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti, Inc.
      4) ITW Construction Products.
      5) MKT Fastening, LLC.
      6) Powers Fasteners.
      7) Or equal.
4. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
5. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
7. Toggle Bolts: All-steel springhead type.

2.03 SEISMIC-RESTRAINT COMPONENTS

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to the University.

1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Manufacturers:
   a. Amber/Booth Company, Inc.
   b. Loos & Co., Inc.
   c. Mason Industries, Inc.
   d. Or equal.

2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.

3. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod, of design recognized by an agency acceptable to the University. Retain both subparagraphs below for projects subject to seismic design requirements; delete if bushing requirements are included in details or charts on Drawings.

4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.

5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 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, and RMC as scheduled in NEC A 1, where Table 1 lists maximum spacing less than stated in. Minimum rod size shall be 1/4 inch in diameter.

C. For individual conduit runs not directly fastened to the structure, use rod hangers.

D. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split galvanized hangers.

E. Do not fasten conduit with wire or perforated pipe straps. Remove wire used for temporary conduit support during construction before conductors are pulled. Do not use ceiling wire to support conduit.

F. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits. Supports should be spaced for maximum deflection of conduit not greater than 1/8”.
   1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to the University.

3.02 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, RMC may be supported by openings through structure members, as permitted in CEC (NFPA 70).

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolts and mounting hole in concrete base.

B. 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.

C. Restraint Cables: Provide slack within maximums recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.
E. Provide raceway fixtures and equipment systems with appropriate longitudinal and cross bracing to satisfy Seismic Zone 4 requirements.

*** END OF SECTION ***
SECTION 26 0533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:
   1. Division 07 Section "Penetration Firestopping" for firestopping materials and installation at penetrations through walls, ceilings, and other fire rated elements.
   2. Division 26 Section "Hangers and Supports for Electrical Systems" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
   3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.02 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. ENT: Electrical Non-metallic Tubing.

C. FMC: Flexible Metal Conduit.

D. IMC: Intermediate Metal Conduit.

E. LFMC: Liquid-Tight Flexible Metal Conduit.

F. LFNC: Liquid-Tight Flexible Non-metallic Conduit.

G. RGS: Rigid Galvanized Steel Conduit.

H. RNC: Rigid Nonmetallic Conduit

1.03 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.
1.05 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section “Product Options and Substitutions”. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 METAL CONDUIT AND TUBING

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.
10. Or equal.

B. Rigid Galvanized Steel Conduit (RGS): ANSI C80.1.


D. EMT and Fittings: ANSI C80.3.

1. Fittings: Compression type, Set Screw not allowed.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.
2.03 METAL WIREWAYS

A. Manufacturers:
   1. Hoffman.
   2. Square D.
   3. Or equal.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1 and 3R.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters,
   hold-down straps, end caps, and other fittings to match and mate with wireways as
   required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to
   comply with NFPA 70.

E. Wireway Covers: Screw-cover type.

F. Finish: Manufacturer’s standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:
   1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
   2. Emerson/General Signal; Appleton Electric Company.
   3. Erickson Electrical Equipment Co.
   6. O-Z/Gedney; Unit of General Signal.
   7. RACO; Division of Hubbell, Inc.
   10. Spring City Electrical Manufacturing Co.
   14. Or equal

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.05 FACTORY FINISHES

A. Finish: For raceway, enclosures, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

B. Finish: For raceway, enclosures, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply Raceways products as specified below, unless otherwise indicated:
   1. Exposed: RGS or IMC is acceptable for 600V or Below.
   2. Concealed, Above ground: EMT, RGS or IMC.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors: Comply with the following applications, unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT
   2. Exposed, Not Subject to Severe Physical Damage: EMT
   3. Exposed, Subject to Severe Physical Damage: RGS
   4. Exposed, Include Raceways in the following Locations: RGS
      a. Loading Docks.
      b. Corridors used for traffic or mechanized carts, forklifts, and pallet handling Units.
c. Mechanical Rooms.
d. Hazardous/Corrosive Locations.

5. Concealed in Ceilings and Interior Walls and Partitions: EMT

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: RGS

8. Raceways for Signal System or Communications Cable in spaces for Environmental Air: Plenum-Type, Signal System/Communications Cable Raceways and/or EMT

9. Raceways for Signal System or Communications Cable Risers in Vertical Shafts: Riser-Type, Signal System/Communications Cable Raceways and/or EMT

10. Raceways for concealed general purpose distribution for Signal System or Communications Cable: General-Use, Signal System/Communications Cable raceway [Riser-Type, Signal System/Communications Cable raceways; Plenum-Type, Signal System/Communications Cable raceways], and/or EMT

11. Boxes and Enclosures: NEMA 250, Type 1, except in damp or wet locations, use NEMA 250, Type 4, Stainless Steel.

C. Minimum Raceway Size Indoors: 3/4-inch trade size.


E. 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.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

F. 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.

3.02 INSTALLATION

A. 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.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

D. Install temporary closures to prevent foreign matter from entering raceways.
E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Install NO more than the equivalent of (3) three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

H. Concealed Raceways:
   1. Conceal conduits and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
   2. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

I. Raceways Embedded in Slabs:
   1. Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
   2. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   3. Space raceways laterally to prevent voids in concrete.
   4. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   5. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, RGS, or IMC before rising above the floor.

J. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
   1. Run parallel or banked raceways together on common supports.
   2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

K. Join raceways with fittings designed and approved for that purpose and make joints tight.
   1. Use insulating bushings to protect conductors.

L. Tighten set screws of thread less fittings with suitable tools.

M. Threaded Conduit Joints, exposed to wet, damp, corrosive, or outdoor conditions: Apply compound to threads of raceways and fittings before making up joints. Follow compound’s manufacturers written instructions.

N. Terminations:
1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

3. Where raceway terminations are subjected to moisture or vibration: use insulating bushing to protect conductors, including conductors smaller than No. 4 AWG.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

P. Signal System or Communications Cable: Install Raceways, metallic and nonmetallic, rigid and flexible, as follows:
   1. 2-Inch Trade Size and Smaller: Install raceways in maximum lengths of 150 feet.
   2. 1-Inch Trade Size and Smaller: Install raceways in maximum lengths of 75 feet.
   3. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
   4. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless drawing show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

Q. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-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 at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

R. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

S. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where temperature change may exceed 30 degrees F, and that has a straight-run length that exceeds 25 feet.
   1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 degrees F temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 degrees F temperature change.
c. Indoor Spaces: Connected with the outdoors without physical separation, 125 degrees F temperature change.
d. Attics: 135 degrees F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer’s written instructions for conditions at specific location at the time of installation.

T. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Install separate ground conductor across flexible connections.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

U. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

V. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.04 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

*** END OF SECTION ***
SECTION 26 0548
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

1.02 DEFINITIONS
A. CBC: California Building Code.
B. Seismic Restraint: A fixed device used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.
C. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.

1.03 SUBMITTALS
A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.

1.04 QUALITY ASSURANCE
A. Comply with seismic restraint requirements in California Building Code/Code of Regulations, unless requirements in this Section are more stringent.

1.05 PROJECT CONDITIONS
A. Project Seismic Zone and Zone Factor as Defined in CBC: Zone 4, Zone Factor 0.40.
B. Occupancy Category as Defined in CBC: I=1.0 standard occupancy.
C. Acceleration Factor: 8 Km from seismic source B.
D. Soil profile Type SC.
E. For additional criteria, see Structural Drawings.
1.06 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-Line Systems, Inc.
2. Erico, Inc.
3. Powerstrut.
4. Thomas & Betts Corp.
5. Unistrut Corporation.
6. Or equal.

B. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.

2.03 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to University’s Representative.

1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

C. Concrete Inserts: Steel-channel type.
D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
E. Welding Lugs: Comply with MSS SP-69, Type 57.
F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.04 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2-inches O.C. in webs, and flange edges turned toward web.
1. Materials for Channel: ASTM A 570, GR 33.
3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
2. Wire Rope Cable: Comply with ASTM 603. Use 49 or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Install seismic restraints according to applicable codes and regulations and as approved by the University’s Representative, unless more stringent requirements are indicated.
3.02 STRUCTURAL ATTACHMENTS

A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses in accordance with the structural engineer of record approval.

B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.

C. Attachments to Existing Concrete: Use expansion anchors.

D. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

G. Attachments to Wood Structural Members: Install bolts through members.

H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

3.03 ELECTRICAL EQUIPMENT ANCHORAGE

A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.

B. Anchor panel boards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:

1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
2. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.
3. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or studs and mounting hole in concrete.
4. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.
3.04 SEISMIC BRACING INSTALLATION

A. Install bracing according to spacing and strengths indicated by approved analysis.

B. Expansion and Contraction: Install to allow for thermal movement of braced components.

C. Cable Braces: Install with maximum cable slack recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

*** END OF SECTION ***
SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   4. Equipment identification labels.

1.02 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.03 QUALITY ASSURANCE

B. Comply with NFPA 70.

1.04 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.
PART 2 - PRODUCTS

2.01 MATERIALS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.
3. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 POWER RACEWAY IDENTIFICATION MATERIALS

A. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field
2. Legend: Indicate voltage and system or service type.

B. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high letters on 20-inch centers.

C. Write-On Tags: Polyester tag, 0.015-inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.03 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high letters on 20-inch centers.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2-inches wide; compounded for outdoor use.

2.04 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.015-inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2-inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.05 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

C. Write-On Tags: Polyester tag, 0.015-inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.06 EQUIPMENT IDENTIFICATION LABELS


B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.
2.07 CABLE TIES

A. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.
   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.

2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location
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

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.
B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
C. Apply identification devices to surfaces that require finish after completing finish work.
D. Secure nameplates to equipment fronts using screws, rivets or adhesive. Secure nameplate to inside face of recessed panel board doors in finished locations. Use weatherproof adhesive for outdoor installation. Do not use tape for nameplates or legend plates.
E. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations. Use consistent designations throughout project.
   1. Based on the University's Electrical Equipment Numbering and Identification Scheme included in this section.
F. Self-Adhesive Identification Products: Clean surfaces before applying.
G. Install nameplates and labels parallel to equipment lines.
H. Color Coded Raceways: Junction Boxes for Fire Alarm System shall be red.
I. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
J. Circuit Identification Labels on Receptacles:
   1. Public View Areas (lobbies, atrium, etc.): Stencil circuit information on back of plate.
   2. All Other Areas: Engraved or permanently stencil circuit information on front of plate.

K. Conduit installed below grade shall have underground hazard tape (non-adhesive) installed a minimum of 12 inches above the conduit or top layer of conduits in a duct bank. The tape shall be 6-inches wide and 4-millimeters thick yellow polyethylene for low voltage conduits and red for medium voltage conduits. The tape shall be marked “Caution Buried Electric Line” for low voltage and “Danger High Voltage Line” for medium voltage. Tracer wire shall be used for PVD conduits and non-metallic tape for metallic conduits. The tape shall be installed the entire length of conduit below grade.

L. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder and branch-circuit phase conductors. Wiring shall be color coded, see Division 26 "Low Voltage Electrical Power Conductors and Cables". Low voltage wire markers shall be adhering, preprinted, self-laminating vinyl wrap-around strips. Wire shall be marked with opposite end termination and shall include panel source and circuit numbers. Phasing shall be indicated by colored wire or tape. For other system voltages consult the University:
   1. 208/120-V Conductors:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
      d. Switch Leg: Pink.
      e. Switch Traveler: Same as Hot Leg.
   2. 480/277-V Conductors:
      b. Phase B: Orange.
      c. Phase C: Yellow.
      d. Switch Leg: Purple
      e. Switch Traveler: Same as Hot Leg.
   3. Neutral and Ground Conductors:
      b. Ground: Green.
   4. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
      a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-
inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.

b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

M. Power-Circuit Identification: Brass tags wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.

1. Legend: 1/4-inch steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
2. Tag Fasteners: Nylon cable ties.

N. Apply identification to conductors as follows:

1. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
2. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

O. Apply warning, caution, and instruction signs as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butylate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

P. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch-high lettering on 2" high label. Use black lettering on white field. Use white lettering on red field for emergency circuited equipment. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Panel boards, electrical cabinets, and enclosures.
2. Disconnect switches.
3. Enclosed circuit breakers.
5. Control devices.
Q. Low Voltage Identification

1. Equipment nameplates shall be engraved three-layer laminated plastic with white background and black letters. Letters shall be 1/4” minimum size. Identifications shall match plan designations and based upon the University’s Numbering Scheme.

2. Legend plates for control panels and indicators shall be provided on disconnect and safety switches and indicating lights. The plates shall be die-stamped metal with mounting hole and positioning key.

3. For panel board directories provide the following:
   
   a. Provide typewritten directories arranged in numerical order showing number of room in which each device is located.
   
   b. Verify room numbers to be used with the University’s Representative prior to typing, since room numbers will most likely not be those shown on the drawings.
   
   c. Mount directories under a clear plastic cover inside each panelboard door.

4. The following low voltage equipment numbering scheme shall be followed:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP</td>
<td>208/120V Distribution Panelboard</td>
</tr>
<tr>
<td>LP</td>
<td>208/120V Panelboard – Receptacles &amp; Lighting</td>
</tr>
<tr>
<td>HDP</td>
<td>480/277V Distribution Panelboard</td>
</tr>
<tr>
<td>HLP</td>
<td>480/277 V Panelboard – Lighting</td>
</tr>
<tr>
<td>ATS</td>
<td>Automatic Transfer Switch</td>
</tr>
<tr>
<td>CB</td>
<td>Circuit Breaker</td>
</tr>
<tr>
<td>DS</td>
<td>Disconnect Switch</td>
</tr>
<tr>
<td>EDP</td>
<td>Emergency 208/120V Distribution Panelboard</td>
</tr>
<tr>
<td>ELP</td>
<td>Emergency 208/120V Panelboard</td>
</tr>
<tr>
<td>EHDP</td>
<td>Emergency 480/277V Distribution Panelboard</td>
</tr>
<tr>
<td>EMCC</td>
<td>Emergency Motor Control Center</td>
</tr>
<tr>
<td>MSB</td>
<td>Main Switchboard</td>
</tr>
<tr>
<td>MCC</td>
<td>Motor Control Center</td>
</tr>
<tr>
<td>T</td>
<td>Transformer</td>
</tr>
<tr>
<td>US</td>
<td>Unit Substation</td>
</tr>
</tbody>
</table>

5. Utilize numbering convention as follows:

   a. First letter or number = floor designation; B = basement, 1, 2, 3, etc. (B).
   
   b. Subsequent lower case letter = panel number on each floor; a, b, c, etc. (Ba).
1) Example: Emergency 277/480V Distribution panelboard installed in basement is “EHDP-B”.

*** END OF SECTION ***
SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Duplex receptacles, ground-fault circuit interrupter receptacles.
3. Device wall plates.
4. Control and signal transformers.

1.02 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. UTP: Unshielded twisted pair.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Occupancy sensors shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1 percent.

C. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC (NFPA 70), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with CEC (NFPA 70).
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:

Toggle switches and receptacles shall be of the same manufacturer. Only one manufacturer shall be used in a building. Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

   b. Hubbell Incorporated; Wiring Device-Kellems.
   c. Leviton Mfg. Company Inc.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
   e. Acuity Controls - nLight
   f. Or equal.

Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498, "Decora or style line" type in white color.

B. Straight-Blade Receptacles: Specification grade/Institutional grade.

C. GFCI Receptacles: Straight blade, feed-through type, specification grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter.

2.03 SWITCHES

Minimum rating for all electrical contacts shall be 10 amps @ 125 volts AC. The switch used shall be a UL/CSA approved type, supplied with color coded spade leads. The switch assembly shall be modular, allowing for up to six district functions upon activation of the push button. The mounting shall employ a bayonet assembly, so that no set screws are required to secure the free spinning button.

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20. “Decora or style line” type in white color.

B. Snap Switches: Heavy -Duty grade, quiet type.
2.04 WALL PLATES

Single and combination types to match corresponding wiring devices.

A. Plate-Securing Screws: Metal with head color to match plate finish. Minimum of two screws per outlet box gang section.

B. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch-thick, satin-finished stainless steel. When approved by the University cover plates may be non-metallic, shatter resistant nylon in lieu of stainless steel.

C. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.

D. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.05 CONTROL AND SIGNAL TRANSFORMERS

A. Description: 120/24V. Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.

B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

C. See mechanical Equipment Schedule for exact equipment/device required voltage.

D. Provide (1) low voltage control transformer for each mechanical device/equipment or provide a larger low voltage control transformer for several devices and provide low voltage control wiring to mechanical devices.

2.06 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: White or as selected by the University's Representative, unless otherwise indicated or required by CEC (NFPA 70).

2. Coordinate final cover plate style and color with the University's Representative. The following is a general guide:

   1. White or almond in office areas
   2. Stainless steel in laboratories, vivariums, and other high use areas.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

D. 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, multi-gang wall plates.

E. Remove wall plates and protect devices and assemblies during painting.

F. Coordinate locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

G. Switches shall be installed in a minimum 4-inch by 4-inch outlet boxes.

3.02 IDENTIFICATION

A. Comply with Division 26 Section “Identification for Electrical Systems”.

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

2. Cover plates for receptacles shall be engraved or permanent stenciled on the front side with the device circuit number and panelboard source name. Use of an engraving on the front of the device plate is not required for housing projects.

3. Cover plates for receptacles in locations of public view such as lobbies and atriums shall have the circuit numbers and source feed point stenciled on the back of the plate.

3.03 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for electrical systems."

B. Connect wiring according to Division 26 Section "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.
3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer’s written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

*** END OF SECTION ***
SECTION 26 2813

FUSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Cartridge fuses rated 600 V and less for use in switches and controllers.

1.02 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC (NFPA 70), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with CEC (NFPA 70).

1.04 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 degrees F or more than 100 degrees F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.05 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Quantity equal to 5 percent of each fuse type and size, but no fewer than 3 of each type and size.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussman, Inc.
3. Ferraz Shawmut, Inc.
5. Or equal.

B. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

A. Motor Branch Circuits: Class RK1, time delay.

B. Other Branch Circuits: Class RK1, time delay.

3.03 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).
3.04 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

*** END OF SECTION ***
SECTION 26 2816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following individually mounted, enclosed switches and circuit breakers:
   1. Fusible switches.
   2. Non-Fusible Switches.
   3. Molded-Case Circuit Breakers (MCCBs).
   5. Enclosures.

B. Related Sections:
   1. Refer to Section 26 2413 for Circuit Breaker requirements.

1.02 DEFINITIONS

A. HD: Heavy Duty.
B. NC: Normally closed.
C. NO: Normally open.
D. SPDT: Single pole, double throw.

1.03 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers’ technical data on features, performance, electrical characteristics, ratings, and finishes.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC (NFPA 70), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with CEC (NFPA 70).
C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
1.05 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 degrees F and not exceeding 104 degrees F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify University’s Representative no fewer than 10 days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without University's Representative’s written permission.
4. Comply with NFPA 70E.

1.06 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:

   b. Fuses for Fusible Switches: 3.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2. Or Equal: Where products are specified by manufacturers name and accompanied by the term "or equal", comply with provisions in Division 01 Section "Product Options and Substitutions". Specific procedures must be followed before use of an unnamed product or manufacturer.

2.02 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
4. Square D/Group Schneider.
5. Or equal.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Non-Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Type GD, General Duty, Single Throw, 240-Vac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with fuse interiors to accommodate fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Single Throw, 240-600Vac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Type HD, Heavy Duty, Six Pole, Single Throw, 240-600Vac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

G. Type HD, Heavy Duty, Double Throw, 240-600Vac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

H. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades. If more than one type or rating of receptacle-switch combination is required, consider showing location of each on Drawings and deleting subparagraph below; otherwise, insert required information.

2.03 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CONCRETE BASES

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Common Work Results for Electrical", and concrete materials and installation requirements are specified in Division 03.

3.03 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Work".

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
3.04  IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section “Common Work Results for Electrical” and Identification for Electrical Systems”.

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section “Common Work Results for Electrical” and “Identification for Electrical Systems”.

3.05  CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

*** END OF SECTION ***
SECTION 28 3112
ZONED (DC LOOP) FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and system operating description.

B. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals, make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72.

B. UL listed and labeled.

C. 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.

2.02 SYSTEM DESCRIPTION

A. Non-coded, conventional, hardwired, zoned, 24-V dc loop system.

2.03 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements and approval of the University’s Representative, provide products compatible with the existing Campus GCC and Network:

1. FACP Equipment and enclosures:
   a. SimplexGrinnell.
   b. WSA.
   c. Hoffman (weatherproof applications only).

2. Wire and Cable:
   a. Comtran Corporation.
   b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
   c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
   d. West Penn Wire/CDT; a division of Cable Design Technologies.
3. Audible and Visual Signals:
   a. SimplexGrinnell.
   b. Wheelock (weatherproof applications only).

2.04 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit: Modular, power-limited design with electronic modules, UL 864 listed.

B. Alphanumeric Display and System Controls: Display alarm, supervisory, and component status messages and the programming and control menu.

C. Circuits:
   1. No Fewer Than [Five] <Insert number> Initiating Device Circuits:
      a. [Four] <Insert number> circuits, NFPA 72, Class B.
      b. [One] <Insert number> circuit(s), NFPA 72, Class A, Style 6.
   2. No Fewer Than [Two] <Insert number> Notification Appliance Circuits: NFPA 72, Class B, Style Y.

D. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall [be] [not be] connected to fire-alarm system.

E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, and trouble signals, shall be powered by the 24-V dc source.
   1. Alarm current draw of the entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

H. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.05 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.
1. Single-action mechanism, breaking-glass or plastic-rod type.
2. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod type.
3. Station Reset: Key- or wrench-operated switch.

### 2.06 SYSTEM SMOKE DETECTORS

A. Photoelectric Smoke Detectors: Comply with UL 268.
B. Duct Smoke Detectors: Photoelectric type, complying with UL 268A.

### 2.07 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.
B. Heat Detector, Combination Type: Actuated by either a fixed temperature or a rate of rise that exceeds 15 degrees F per minute unless otherwise indicated.

### 2.08 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
B. Horns: Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch high letters on the lens.

1. Rated Light Output:
   a. Indicated on Drawings.
   b. [15] [30] [75] [110] [177] <Insert value> cd.
   c. 15/30/75/110 cd, selectable in the field.

### 2.09 MAGNETIC DOOR HOLDERS

A. Description: Equipped for wall or floor mounting, complete with matching doorplate.
B. Material and Finish: Match door hardware.

### 2.10 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Connect new equipment to the existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement the existing [control] [monitoring] equipment as necessary to extend the existing [control] [monitoring] functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

3.02 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by [University’s Representative] [authorities having jurisdiction] <Insert names or titles of witnesses>.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visual Inspection: Conduct the visual inspection prior to testing.
   a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
   b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.


D. Prepare test and inspection reports.
E. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

F. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with the visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

*** END OF SECTION ***