NORTHERN ARIZONA UNIVERSITY

Fieldhouse HVAC Replacement

1050 S KNOLES DR / 800 S OSBORNE DR
FLAGSTAFF, AZ 86011

P R O J E C T M A N U A L

VOLUME 1 OF 1

LIGHTVOX

4602 EAST THOMAS ROAD
PHOENIX, AZ 85018

100% CD ISSUANCE

NAU PROJECT NO.: 09.300.251
LIGHTVOX PROJECT NO.: 3001.18.01

DATE: 03.16.2026

DOCUMENT 00 01 10

TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

Introductory Information
00 01 01 Project Title Page
00 01 07 Seals Page
00 01 10 Table of Contents

NAU DIVISIONS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS
Table of Contents included in Division

DIVISION 01 – GENERAL REQUIREMENTS
Table of Contents included in Division

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

Division 01 – General Requirements
01 10 00 Summary
01 25 00 Substitution Procedures
01 31 00 Project Management and Coordination
01 33 00 Submittal Procedures
01 40 00 Quality Requirements
01 42 00 References
01 60 00 Product Requirements
01 73 00 Execution
01 77 00 Closeout Procedures
01 78 23 Operation and Maintenance Data
01 78 39 Project Record Documents
01 79 00 Demonstration and Training
01 91 13 General Commissioning Requirements

Division 02 – Existing Conditions
02 41 19 Selective Demolition

Division 03 – Concrete – Not used

Division 04 – Masonry – Not used

Division 05 – Metals
05 12 00 Structural Steel Framing
05 52 13 Pipe and Tube Railings

Division 06 – Wood, Plastics, and Composites – Not Used

Division 07 – Thermal and Moisture Protection
07 84 13 Penetration Firestopping
07 92 00 Joint Sealants

Division 08 – Openings – Not used

Division 09 – Finishes
09 91 23 Interior Painting

Division 10 – Specialties – Not used

Division 11 – Equipment –Not Used

Division 12 – Furnishings – Not used

Division 13 – Special Construction – Not Used

Division 14 – 19 – Not Used

FACILITY SERVICES SUBGROUP

Division 20 – Not Used

Division 21 – Fire Suppression – Not Used

Division 22 – Plumbing – Not Used

Division 23 – Heating, Ventilating, and Air Conditioning
23 05 00 Basic HVAC Requirements
23 05 05 HVAC Demolition for Remodeling
23 05 13 Motors
23 05 16 HVAC Expansion Compensation
23 05 29 HVAC Supports and Anchors
23 05 53 HVAC Identification
23 05 93 Testing, Adjusting and Balancing
23 07 13 Ductwork Insulation
23 07 19 HVAC Piping Insulation
23 21 00 Hydronic Piping
23 31 00 Ductwork
23 33 00 Ductwork Accessories
23 34 16 Centrifugal Fans
23 37 00 Air Inlets and Outlets
23 73 13 Indoor Modular Air Handling Units

Division 24 – 25 – Not Used

Division 26 – Electrical

26 05 00 Basic Electrical Requirements
26 05 03 Through Penetration Firestopping
26 05 05 Electrical Demolition for Remodeling
26 05 13 Wire And Cable
26 05 26 Grounding and Bonding
26 05 27 Supporting Devices
26 05 33 Conduit and Boxes
26 05 53 Electrical Identification
26 27 26 Wiring Devices
26 28 13 Fuses
26 28 16 Disconnect Switches

Division 27 – Communications – Not Used

Division 28 – Electronic Safety and Security – Not Used

Division 29 – Not Used

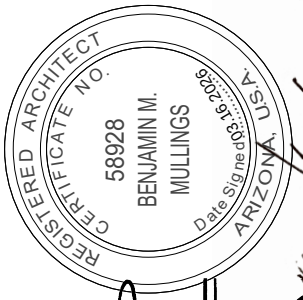
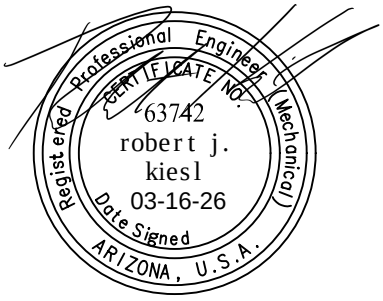
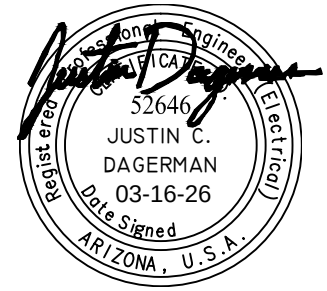
SITE AND INFRASTRUCTURE SUBGROUP – Not Used

PROCESS EQUIPMENT SUBGROUP – Not Used

END OF DOCUMENT

SECTION 00 0107 – SEALS PAGE

1.01 DESIGN PROFESSIONALS OF RECORD

ARCHITECT Lightvox Studio PLLC 4602 E Thomas Rd Phoenix, Arizona 85018 Phone: (602) 604–6626 Contact: Benjamin Mullings	Responsible for Divisions 01–12 except where indicated as prepared by other design professionals of record.	
STRUCTURAL ENGINEER Rudow + Berry 4032 N. Miller Rd Suite A100 Scottsdale, Arizona 85251 Phone: (480) 946–8171 Contact: Mark Rudow	Responsible for Divisions: 033000, 042200, 051200, 054000, 055100, 055213	 EXPIRES 3/31/2028
MECHANICAL & PLUMBING ENGINEER IMEG Corporation 9000 E Pima Center Parkway Suite 320 Scottsdale, Arizona 85258 Phone: (480) 566–2265 Contact: Robbie Kiesl	Responsible for Divisions 21–23	 EXP. 03-31-2029
ELECTRICAL ENGINEER IMEG Corporation 9000 E Pima Center Parkway Suite 320 Scottsdale, Arizona 85258 Phone: (480) 566–2265 Contact: Justin Dagerman	Responsible for Division 26&28	 EXP. 09-30-2026

END OF SECTION

Section Number	Title
00 00 00	**PROCUREMENT AND CONTRACTING REQUIREMENTS**
00 01 01	Project Title Page
00 01 15	List of Drawing Sheets
00 10 00	**Solicitation/Advertisements and Invitations**
00 11 16	Invitation to Bid
00 20 00	**INSTRUCTIONS FOR PROCUREMENT**
00 21 00	**Instructions**
00 21 13	Instructions to Bidders
00 21 13.1	Correspondence
00 21 13.2	Sealed Bids
00 21 13.3	Execution of Contract and Bonds
00 21 13.4	Bidding Documents
00 21 13.5	Interpretation or Correction of Bidding Documents
00 21 13.6	Bidder's Representation
00 21 13.7	Bid Period
00 21 13.8	Contractor Qualifications
00 21 14	Bidding Procedure
00 21 14.1	Form and Style of Bids
00 21 14.2	Bid Bond
00 21 14.3	Bidders Qualifications
00 21 14.4	Subcontractors
00 21 14.4.1	Subcontractor List Form
00 21 14.4.2	Subcontractor Bonds
00 21 14.4.3	Subcontractor Insurance
00 21 14.5	Addenda
00 21 14.6	Submittal of Bids
00 22 00	**Supplementary Instructions**
00 22 11	Drawings and Schedules
00 22 11.1	Complimentary Drawings
00 22 11.2	Interpretation of Drawings and Specifications
00 23 00	**Definitions**
00 24 00	**Scopes**
00 24 13	Scopes of Bids
00 24 13.1	Base Scope
00 24 13.2	List of Alternates
00 25 00	**Procurement Meetings**
00 25 13	Pre-Bid Meeting
00 25 13.1	Pre-Bid Site Inspection
00 25 13.1.1	Supplementary Site Visits
00 26 00	**Substitution Procedures**

Section Number	Title
00 30 00	**AVAILABLE INFORMATION**
00 31 00	**Available Project Information**
00 31 13	Preliminary Schedule
00 31 13.13	Preliminary Project Schedule
00 31 13.16	Preliminary Construction Schedule
00 31 19	Existing Condition Information
00 31 21	Survey Information
00 31 24	Environmental Assessment Information
00 31 25	Existing Material Information
00 31 26	Existing Hazardous Material Information
00 31 31	Geophysical Data
00 31 32	Geotechnical Data
00 31 43	NAU Permit Application
00 31 46	Other Permits
00 40 00	**PROCUREMENT FORM AND SUPPLEMENTS**
00 41 00	**Bid Forms**
00 41 13	Bid Form
00 43 00	**Procurement Form Supplements**
00 43 13	Bid Security Form
00 43 25	Substitution Request Form (During Procurement)
00 43 36	Proposed Subcontractors Form
00 43 83	Proposed Construction Schedule Form
00 45 00	**Representations and Certifications**
00 45 13	Bidder's Qualifications
	Contractor Statement of Qualifications (FS#2)
00 50 00	**CONTRACTING FORMS AND SUPPLEMENTS**
00 52 00	**Agreement Forms**
00 60 00	**PROJECT FORMS**
00 61 00	**Bond Forms**
00 61 13	Performance and Payment Bond Forms
00 61 13.13	Performance Bond Form (FS#4)
00 61 13.16	Payment Bond Form (FS#5)
00 62 00	**Certificates and Other Forms**
00 62 11	Submittal Transmittal Form
00 62 16	Certificate of Insurance Form (FS#6)
00 62 23	Construction Waste Diversion Form
00 62 34	Recycled Content of Materials Form
00 62 76	Application for Payment Form
00 63 00	**Clarification and Modification Forms**
00 63 13	Request for Interpretation Form

Section Number	Title
00 63 19	Clarification Form
00 63 25	Substitution Request Form (During Construction)
00 63 33	Supplemental Instruction Form
00 63 36	Field Order Form
00 63 43	Written Amendment Form
00 63 46	Construction Change Directive Form
00 63 57	Construction Change Proposal Request
00 63 63	Change Order Form
00 63 66	Contingency Use Authorization Form
00 63 69	Allowance Use Authorization Form
00 65 00	**Closeout Forms**
00 65 14	Punchlist Form (FS#24)
00 65 15	Project Inspection Form (FS#15)
00 65 16	Certificate of Substantial Completion Form (FS#81)
00 65 17	Schedule of Required Maintenance Form (FS#88)
00 65 19	Certificate of Final Completion Form (FS#81A)
00 65 19.13	Affidavit of Payment (FS#99)
00 65 19.16	General Contractor Lien Release Form (FS#89)
00 65 19.17	Subcontractor Lien Release Form (FS #84)
00 65 19.19	Consent of Surety to Final Payment Form (FS#87)
00 65 19.19	Final Subcontractor List (FS#82)
00 65 36	Warranty Form (FS#80)
00 70 00	**CONDITIONS OF THE CONTRACT**
00 71 00	**Contracting Definitions**
00 72 00	**General Conditions**
00 73 00	**Supplementary Conditions**
00 73 15	Bonds and Certificates
00 73 16	Insurance Requirements
00 73 19	Health and Safety Requirements
00 73 34	Affirmative Action for Disabled Workers
00 73 35	Veteran's Preference
00 73 36	Equal Employment Opportunity Requirements
00 73 37	Legal Worker Requirements
00 73 38	Participation in Boycott of Israel (FS#113)
00 73 39	Minority Business Enterprise Requirements
00 73 50	Liquidated Damages
00 73 60	Value Engineering Change Proposals

Section Number	Title
00 00 00	**PROCUREMENT AND CONTRACTING REQUIREMENTS**
00 01 01	Project Title Page

ARIZONA BOARD OR REGENTS
NORTHERN ARIZONA UNIVERSITY
FLAGSTAFF, ARIZONA

PROJECT MANUAL
BIDDING DOCUMENTS AND SPECIFICATIONS
FOR
FIELDHOUSE HVAC REPLACEMENT
NAU PROJECT NUMBER 09.300.251

Section Number | Title

00 01 15 List of Drawing Sheets

Labeling of drawing sheets is defined in the DP contract.

G0.00	COVER
G0.01	INDEX, LEGEND & GENERAL PROJECT DATA
AD2.00	LEVEL 01 DEMOLITION CEILING PLAN
A2.00	LEVEL 01 OVERALL CEILING PLAN
A4.00	BUILDING ELEVATIONS & SECTIONS
S0.00	GENERAL STRUCTURAL NOTES
S1.02	ENLARGED FLOOR PLANS
S3.00	FRAMING DETAILS
M0.00	MECHANICAL COVER SHEET
MD1.00	MECHANICAL DEMOLITION PLAN
M1.00	MECHANICAL DUCTWORK PLAN
M1.01	MECHANICAL PIPING PLAN
M3.00	MECHANICAL SCHEDULES & DETAILS
M3.01	MECHANICAL CONTROLS
M3.02	MECHANICAL CONTROLS
E0.00	ELECTRICAL COVER SHEET
ED1.00	ELECTRICAL POWER PLAN
E1.00	ELECTRICAL POWER PLAN
E5.00	ONE LINE DIAGRAM
E5.01	ELECTRICAL SCHEDULES

Section Number | Title

00 10 00 **Solicitation**

00 10 00 **Advertisements and Invitations**

00 11 16 Invitation to Bid

Sealed bids are being solicited by Facility Services, Office of Planning, Design and Construction, Northern Arizona University, for and on behalf of the Arizona Board of Regents, for the furnishing of all labor, materials, transportation and services required for **Project Number: 09.300.251, Project Name: Fieldhouse HVAC Replacement** on the Campus of Northern Arizona University, Flagstaff, Arizona, in accordance with the plans and specifications on file with Facility Services, Office of Planning, Design and Construction.

Bids will be received at Facility Services, Building #77, Main Reception Desk, Northern Arizona University, Flagstaff, Arizona, until May 1, 2026, at 11am.

Bids will be opened publicly directly thereafter and read aloud via a MS Teams meeting. The MS Teams meeting invitation for the bid opening is provided in Section 00 21 14.6 of the Division 00 bidding document.

A **mandatory** Pre-Bid Conference will be held in person and via MS Teams on April 21, 2026, at 11am. Pre-registration for the Pre-Bid Conference (in person or via MS Teams meeting) is required. Individuals who wish to attend the pre-bid conference shall email Judith.scholarwinfield@nau.edu no later than **April 20, 2026, at 4pm** to indicate if they plan to attend in person or online. A link to the online MS Teams meeting will be provided to respondents prior to the meeting. In-person attendance is limited and contractors are requested to send only one person to the in-person pre-bid conference.

Plans and Specifications for the proposed work may be inspected online at https://in.nau.edu/facility-services/pdc/bids-rfqs/ ***The scope of work for this project is selective demolition and removal of existing mechanical units and platforms. New construction includes the installation of reinforced mechanical platform frames, new air handling units (AHUs), comprehensive ductwork and piping upgrades, and associated electrical power and control systems. A more detailed scope of work is included in the plans and specifications and will be reviewed at the mandatory pre-bid conference.***

A **mandatory** site visit is scheduled immediately following the pre-bid conference on April 21, 2026, and is expected to start no later than 12:00pm. All attendees for the site visit shall assemble at the entrance to the University Union Fieldhouse (Building 30) at 1050 S Knoles Dr, Flagstaff, AZ 86011. PDC staff and the Design Professional will accompany the Offerors. There will be an opportunity to ask and

have questions answered during the site visit.

Pre-registration for the site visit is required. Offerors interested in attending the site visit shall contact judith.scholarwinfield@nau.edu) to pre-register on or before **April 20, 2026, at 4pm.** Offerors shall bring no more than **3** attendees to the site visit and will need to notify NAU of the number of attendees at the time of registering.

All vehicles parking on campus **must** have a permit. Parking permits for the pre-bid conference and site visit are available for purchase online in advance. See https://in.nau.edu/university-transit-services/guest-parking/ for more information and to purchase a parking permit. The closest parking lot to the Fieldhouse with public parking is P16. The Knoles Parking Garage is also located within close proximity to the Fieldhouse. A map of campus visitor parking can be found here.

A certified check, cashier's check or NAU Bid Bond Form FS#9 for ten percent (10%) of the amount of bid, must accompany each proposal, as a guarantee that the Contractor will enter into a contract to perform the proposal in accordance with the plans and specifications or as Liquidated Damages in the event of failure or refusal of the Contractor to enter into the contract. Checks or bonds will be returned to the unsuccessful bidders, and to the successful bidder upon the execution of a satisfactory bond and contract, as prescribed by Arizona Revised Statutes.

The Contractor, to whom the contract is awarded, shall, after receipt of Notice of Intent to Award, furnish to the aforesaid Board of Regents a satisfactory performance and payment bond in an amount equal to one hundred percent (100%) of the full amount of the bid, such bond not to be expressly limited as to time in which action may be instituted against the surety company for possible nonperformance of the Contractor. Bonds must be from a corporate surety company licensed to issue surety bonds in the State of Arizona. Individual sureties will not be accepted.

Work shall commence immediately after receipt of an executed contract or a Notice to Proceed and shall be Substantially Complete by August 7, 2026, and shall be Finally Complete by October 30, 2026. Bonds and insurance certificates must be submitted and approved prior to commencement of work.

The Board of Regents reserves the right to reject any or all bids, to waive or decline to waive irregularities in any bid, or to withhold the award for any reason it may determine, and also reserves the right to hold any or all bids for a period of **60**

Section Number | Title

calendar days after the date of the opening thereof. No bidder may withdraw a bid during this **60 calendar day** period without forfeiture of the bid bond.

Women-owned and minority-owned firms are encouraged to apply. Persons with a disability may request a reasonable accommodation by contacting Facility Services, (928) 523-4227.

ARIZONA BOARD OF REGENTS
Bids should be addressed to:
NAU Planning, Design and Construction
Attention: Judith Scholar Winfield
PO Box 5637
Flagstaff, Arizona 86011
Phone: (928) 523.4468
Email address: judith.scholarwinfield@nau.edu

Publication Date: April 16, 2026

00 20 00 INSTRUCTIONS FOR PROCUREMENT

00 21 00 Instructions

00 21 13 Instructions to Bidders

00 21 13.1 Correspondence

Address all correspondence relating to the project to:
Facility Services
Planning, Design, and Construction
Attn: Judith Scholar Winfield
Northern Arizona University
P.O. Box 5637
Flagstaff, AZ 86011
judith.scholarwinfield@nau.edu

Reference the Project by both name and NAU project number in all correspondence.

00 21 13.2 Sealed Bids

Owner (Northern Arizona University) will receive sealed bids (at the time and place specified in Section 00 11 16, Invitation to Bid) for the labor, equipment and materials necessary to perform all functions and work indicated on the drawings and specified herein. Proposals shall be submitted on the required forms included in Section 00 43 00 of these specifications.

Section Number | Title

00 21 13.3 Execution of Contract and Bonds

The Contract Agreement, which the successful bidder, as Contractor, will be required to execute, is referenced in Section 00 52 00 of this manual. The form of Bonds and insurance certificates required to be furnished are included in Section 00 62 16 of this manual and shall be carefully examined by the bidder. The successful bidder will be required to execute the Standard Form Agreement between Owner and Contractor (Contract) and submit completed bonds and insurance certificates within five (5) working days after Notice of Intent to Award. Failure to execute a Contract Agreement and to file satisfactory payment and performance bonds and insurance certificates issued by companies deemed qualified by the Owner shall be just cause for the cancellation of the Award of Project and the forfeiture of the Bid Bond which shall become the property of the Owner, not as a penalty, but in liquidation of damages sustained. Award may then be made to the next lowest responsible bidder, canceled, or re-advertised as the Owner may elect.

Owner reserves the right to waive irregularities in consideration of award to the lowest responsive and responsible bidder.

00 21 13.4 Bidding Documents

Bidders may obtain from Owner (Planning, Design, and Construction), a complete set of Bidding Documents stated in the Invitation to Bid, Section 00 11 13 of this document. Electronic copies of these documents can be downloaded from: https://in.nau.edu/facility-services/bids-rfq/

General Contractors shall be responsible for distribution of bidding documents to Subcontractors.

Complete sets of bidding documents are to be used in preparing Bids. Neither Owner nor Design Professional (DP) assumes any responsibility for errors or misinterpretations resulting from using incomplete sets of bidding documents.

Owner or DP, in making copies of bidding documents available on above terms, does so only for purpose of obtaining bids on the work and does not confer a license or grant for any other use.

00 21 13.5 Interpretation or Correction of Bidding Documents

Bidders shall notify Owner and/or DP promptly of any ambiguity, inconsistency or error discovered upon examination of bidding documents or of site and local conditions. **Failure to so notify Owner/DP is deemed a waiver of any claim by Contractor,** based upon any such ambiguity, inconsistency or errors. The DP shall

maintain a log of all inquiries and shall provide written notification of such to Owner (Facility Services Project Manager).

Interpretation, correction or change of bidding documents will be made by written Addendum. Interpretations, corrections or changes of bidding documents made in any other manner will not be binding; Bidders may not rely upon such interpretations, corrections and changes.

00 21 13.6 Bidder's Representation

Each Bidder by making their Bid represents that:

They have read and understand the bidding documents and all Contract Documents and that Bid is made in accordance therewith.

They have visited the site and are familiar with local conditions under which Work is to be performed, including verification of all field measurements, and have inspected all accessible spaces.

They have thoroughly familiarized themselves with all specific products and their proposed uses.

Their bid is based upon the materials, systems and equipment described in the bidding documents without exceptions.

They have satisfied themselves that the products specified are appropriate for the uses proposed.

Their subcontractors with project involvement exceeding $100,000 are bondable.

They have advised each subcontractor to become thoroughly familiar with the Contract Documents, including the specifications and referenced standards, insofar as they affect each subcontractor.

They will install all Work properly, will place their warranty on the Work, and provide guarantees required.

00 21 13.7 Bid Period

Unless otherwise noted, all bids and bid prices shall remain firm for a period of sixty (60) calendar days after the date of Bid opening and the Contractor shall be prepared to begin construction within ten (10) calendar days of receipt of notice of intent to award.

Section Number | Title

00 21 13.8 Contractor Qualifications

The Contractor shall submit with bid package the Statement of Qualifications (FS #2) included in Section 00 45 13 of these specifications.

The competency and responsibility of Bidders, of their proposed Subcontractors, and of the Surety issuing the Contractor's performance and payment bonds, will be reviewed prior to award.

00 21 14 Bidding Procedure

00 21 14.1 Form and Style of Bids

Bids must be submitted on Form of Bid (FS#1) provided in Section 00 41 13 of these specifications.

Blanks on the Form of Bid shall be typed in or printed legibly in ink.

Where indicated on Form of Bid, express sums both in words and digits; in case of discrepancy between the two, the amount written in words shall govern.

Where blanks on the Form of Bid (FS#1) are not filled-in, Owner reserves the right to reject the Bid on the basis of incompleteness.

Signer of Bid must initial any insertion, alteration or erasure.

Each copy of Bid shall include (on the Contractor Statement of Qualifications - FS #2) the legal name of Bidder and statement whether Bidder is sole proprietor, partnership, corporation or other legal entity. Each copy shall be signed by person, or persons, legally authorized to bind Bidder to a contract. Bid by a corporation shall give the state of incorporation and have corporate seal affixed.

Bid bonds submitted by agent must have current Power of Attorney attached certifying agent's authority to bind Bidder.

The list of **required bid forms** is:

1. Form of Bid (FS#1)
2. Contractor Statement of Qualifications (FS#2)
3. Subcontractor List (FS#3)
4. Bid Bond (FS#9)
5. Notification & Confirmation of Asbestos Containing Materials (FS#13)
6. Participation in Boycott of Israel (See also 00 73 38)-(FS#113)

All additional forms that are standard for Owner that must be used throughout the Contract for Construction are noted in Section 00 52 00 and 00 60 00 of these

specifications and available through the office of Facility Services, Planning, Design and Construction.

00 21 14.2 Bid Bond

A Certified or Cashier's Check or Bid Bond (NAU form FS#9, see Section 00 43 13) of a corporate surety acceptable to the Arizona Board of Regents, payable to Northern Arizona University for Ten (10%) percent of the amount of the bid, is required as a guarantee that the bidder will enter into the contract if awarded. It shall be declared forfeited as Liquidated Damages if the successful bidder refuses to enter into said contract after being requested to do so by the Arizona Board of Regents/Northern Arizona University.

00 21 14.3 Bidders Qualifications

Bids will be accepted only from those Contractors who are licensed in the State of Arizona and qualified under the laws of the State of Arizona to perform the work specified. All work performed under the Contract by such licensed Contractors must be made to comply with all applicable laws and requirements of any governing bodies or regulatory agencies having jurisdiction over such Work.

The Contractor shall determine that subcontractors are licensed, insured, and qualified to perform their respective work under the contract and shall determine, that they are bondable, as required in Section 00 43 36. Each Bidder shall also submit a Subcontractor List (form FS #3 - included in Section 00 43 36 of these specifications) as outlined below in Section 00 21 14.31.

00 21 14.4 Subcontractors

00 21 14.4.1 Subcontractor List Form

In compliance with Contract, the Contractor shall list on the Subcontractor list form provided in Section 00 43 36, the names of **all** qualified subcontractors and/or suppliers he will employ for the various portions of the work indicated for this Project. **All technical sections of this specification** shall be included. Failure to provide a complete list of subcontractors (FS#3) may be considered non-responsive. In addition to the general information required on that form, the Contractor shall provide the license number and class for each subcontractor proposed to do work under the contract. Failure on the part of the Contractor to completely list the names of all anticipated subcontractors will constitute sufficient grounds to reject the bid.

If the Contractor is going to do any portions of the work himself, he shall enter the word "Self" opposite that item in the list; list only one name for each item.

The Subcontractor List must be included inside the bid packet. No subcontractor substitutions will be permitted without prior written approval by the Owner.

A complete up-to-date revised list of Subcontractors shall be submitted to the Owner with indications of any work performed by Subcontracting firms classified as minority owned or small businesses, and final contract values, as part of the close-out procedures prior to Final Payment.

The Owner will promptly reply to the Contractor in writing stating if the Owner or the DP, after due investigation, has any objection to any such proposed subcontractor or supplier. The Contractor shall not employ any subcontractor or supplier against whom the Owner or the DP has reasonable objection. If, prior to the award of the Contract, the Owner or DP has a reasonable objection to any subcontractor or supplier and refuses in writing to accept such person or organization, the apparent low bidder may, prior to the award, either withdraw his bid without forfeiture of bid security or may propose an acceptable substitution thereof provided that same results in no change in the bid price. Failure of the bidder to submit an acceptable substitute in a timely manner shall render its bid non-responsive.

No substitution or change shall be made by the Contractor in the subcontractor/supplier list after its submission to the Owner without prior written approval by the Owner. Unapproved or untimely substitutions may be cause for invalidation of the Contractor's bid in the Owner's discretion, thereby rendering the Contract voidable.

All work performed for the Contractor by a subcontractor shall be pursuant to an appropriate written agreement which specifically binds the subcontractor to all applicable terms and conditions of the Contract Documents, but no contractual relationship shall exist between any subcontractor or supplier of any tier and the Owner. Upon request, the Contractor shall provide fully executed copies of any subcontracts and purchase orders to the Owner.

00 21 14.4.2 Subcontractor Bonds

The Owner may require each Subcontractor whose subcontract amount will be $100,000 or more to furnish payment and performance bonds on Owner’s form or on a form approved by Owner, which provides equal or better coverage, for the full amount of its subcontract. These bonds shall be obtained by the Subcontractor as a separate entity and the cost shall be included in the Subcontractor’s bid to the Contractor. Bonds will guarantee the faithful performance of the subcontract and the payment of all obligations thereunder by the subcontractor. The Contractor shall provide Owner with a copy of each required Subcontractor's

bond, within fourteen (14) calendar days after the Notice to Proceed is issued by the Owner. Copies of all applicable bonds must be received before processing of the first pay application will occur.

00 21 14.4.3 Subcontractor Insurance

All Subcontractors are required to maintain insurance in force according to the Construction Agreement.

00 21 14.5 Addenda

Any addenda issued by the Owner during the time of bidding shall be deemed to be included in the bid and will become a part of the executed contract. Acknowledgement of receipt of Addenda shall be made on the Form of Bid (FS #1) in the space provided.

Final Addenda shall be issued a minimum of three (3) days prior to the bid date.

If a Bidder should fail to receive any addendum, or should fail to acknowledge receipt of same, the Bidder shall have the option of accepting a contract, if offered, including all addenda, at the Bid price, or withdrawing the bid without penalty. NAU and/or the DP are not responsible for ensuring delivery of addenda to any Bidder. Failure to receive addenda or failure to acknowledge receipt shall not constitute a basis for claim, protest, or re-issue of the invitation to bid.

00 21 14.6 Submittal of Bids

Copies of the Form of Bid (FS#1), Bid Bond (FS#9) or Certified Check or Cashier's Check for ten percent of the amount of the bid, Subcontractors List (FS#3), and other documents required to be submitted with Bid per Section 00 43 13 (see required forms, Section 00 43 13) shall be enclosed in sealed, opaque envelope. Address envelope to Facility Services, identifying project name, Bidder's name and address.

If Bid is sent by mail to PO Box 5637, Flagstaff, AZ 86011, a sealed envelope shall be enclosed within a separate mailing envelope with "BID ENCLOSED" and identification of the Project and date and time for bid opening plainly indicated on the face thereof.

Bids must be received at the designated location prior to time and date for receipt of Bids indicated in advertisement. If received after the time and date for receipt of Bids, or any extension thereof made by Addendum, the bid package will be returned unopened.

Section Number | Title

Bidder assumes full responsibility for timely delivery of bids. Bids sent by mail that have not been delivered to Facility Services, Building 77, Main Reception Desk, PO Box 5637, Flagstaff, AZ 86011 by the designated time of the bid opening will not receive consideration; including specifically, but not limited to, bids received by NAU Post Office but not delivered to the bid opening location.
Electronic, oral, telephonic, FAXES, or telegraphic Bids are invalid and will be considered non-responsive.

Bidders dropping off their bids in person to Facility Services, Building 77, Main Reception Desk are required to observe State and Local guidance with regards to public health matters such as Covid-19, including wearing a mask, observing social distancing and other protocols as mandated.

00 22 00 Supplementary Instructions

00 22 11 Drawings and Schedules

00 22 11.1 Complimentary Drawings

Upon award of Contract, the Contractor will be furnished any available sets of Plans, Specifications, and project manuals, if any. Additional sets may be printed from: https://in.nau.edu/facility-services/pdc/bids-rfqs/ .

00 22 11.2 Interpretation of Drawings and Specifications

The Contractor shall study and compare the Contract Documents sufficiently in advance of bidding the work to be performed and immediately report any material error, inconsistency, conflict, ambiguity, or omission that is discovered.

The Contract Document specifications for the applicable Contract in use can be found at https://in.nau.edu/facility-services/dp-contract/

The Drawings are intended to show general arrangements, design and extent of Work and are not intended to serve as Shop Drawings. Where required, the Contractor shall perform no portion of the Work without approved Shop Drawings, Product Data or Samples; any Work performed in violation of this provision will be solely at the Contractor's risk regardless of DP's and/or Owner's knowledge of such Work.

Contract Documents shall be interpreted as being complementary, requiring a complete project or designated portion thereof. Generally, the specifications address quality, types of materials and contract conditions while the drawings show placement, sizes, and fabrication details of materials. In the event of conflict in the Contract Documents, the priorities stated below shall govern:

A. Addenda shall prevail over all other Contract Documents;

B. Subsequent addenda shall govern over prior addenda, but only to the extent modified;
C. In case of conflict between drawings and specifications, the specifications shall govern;
D. Conflicts within the plans:
   (1) Schedules, when identified as such, shall govern over all other portions of the plans.
   (2) Specific notes shall govern over all other notes and all other portions of the plans, except the schedules described in 00 22 11.2 D (1) above.
   (3) Larger scale drawings shall govern over smaller scale drawings.
   (4) Figured or numerical dimensions shall govern over dimensions obtained by scaling.
E. Conflicts within the specifications:
   Contract General Conditions shall govern over all sections of the specifications except for specific Modifications thereto that may be stated in Supplementary General Conditions or addenda. No other section of the specifications shall modify the Contract General Conditions.
F. In the event provisions of codes, safety orders, Contract Documents, referenced manufacturer's specifications or industry standards are in conflict, the more restrictive or higher quality shall govern.
G. In the event of any conflict or ambiguity, the Contractor shall request an interpretation by the DP before performing the Work.
H. In the event of any conflict between the Specifications and Northern Arizona University Technical Standards, the Contractor shall notify the Owner for direction prior to bid. Otherwise, the more restrictive or higher quality shall govern.

If the Contract Documents are not complete as to any minor detail of a required construction system or with regard to the manner of combining or installing of parts, materials, or equipment, but there exists an accepted trade standard for good and skillful construction, such detail shall be deemed to be an implied requirement of the Contract Documents in accordance with such standard.

“Minor detail” shall include the concept of substantially identical components, where the price of each such component is small even through the aggregate cost or importance is substantial, and shall include a single component which is incidental, even though its cost or importance may be substantial.

The quality and quantity of the parts or material so supplied shall conform to trade standards and be compatible with the type, composition, strength, size, and profile of the parts or materials otherwise set forth in the Contract Documents.

Section Number | Title

00 23 00 **Definitions**

Definitions set forth in General Conditions of the Standard Form Agreement Between Owner and Contractor, or in other Contract Documents are applicable to Bidding Documents. Definitions below are in addition to the definitions of the Contract Documents and are not considered a replacement.

Alternate Bid(s): A sum stated in addition to the Base Bid for which Bidder offers to perform Work described as the alternate. The Owner may select all, none or any combination of alternates.

Approved: Where used in conjunction with the DP's response to Submittals, requests, applications, inquiries, reports and claims by the Contractor, the meaning of the term "approved" will be held to the limitations of the DP's responsibilities and duties as specified in the General and Supplementary Conditions. In no case will "approval" by the DP be interpreted as a release of the Contractor from responsibilities to fulfill the requirements of the Contract Documents.

Base Bid: A sum stated in the Bid for which Bidder offers to perform Work described as base, to which Work may be added or deducted for sums stated in Alternate Bid(s).

Bid: A complete and properly signed proposal to do the Work or designated portion thereof for some stipulated sum therein supported by data required in Bidding Documents.

Bidder: One who submits a Bid for prime Contract with Owner for Work described in the Contract Documents.

Bidding Documents: Include Advertisement for Bids, Instructions to Bidders, Bid Form, other bidding and Contract forms and Contract Documents including Addenda issued prior to receipt of bids.

Contract Documents: Are further defined per Agreement at the following link: https://in.nau.edu/facility-services/dp-contract/, and also include, but are not limited to, the Agreement, amendments, change orders, these Design-Builder General Conditions, any supplementary or special conditions referenced in the Agreement and any other items stipulated to as being included in the Contract Documents, including the complete design as accepted by the Owner.

Section Number | Title

Furnish: Except as otherwise defined in greater detail, the term "furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

Install: Except as otherwise defined in greater detail, the term "install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

Installer: The entity (person or firm) engaged by the Contractor or its subcontractor or sub-subcontractor for the performance of a particular unit of work at the project site, including installation, erection, application, cleaning and similar required operations.

Provide: Except, as otherwise defined in greater detail, the term "provide" means furnish and install, complete and ready for the intended use, as applicable in each instance.

Work: Is comprised of all activities (including design, other related services and construction activities) required to complete the Project as defined by the Project Criteria and Contract Documents, including procuring and furnishing all materials, equipment, services, and labor reasonably inferable from the Contract Documents, or from prevailing trade usage and custom.

00 24 00 Scopes

00 24 13 Scopes of Bids

00 24 13.1 Base Scope

Selective demolition and removal of existing mechanical units and platforms. New construction includes the installation of reinforced mechanical platform frames, new air handling units (AHUs), comprehensive ductwork and piping upgrades, and associated electrical power and control systems.

00 24 13.2 List of Alternates

N/A

00 25 00 Procurement Meetings

00 25 13 Pre-Bid Meeting

A Mandatory Pre-Bid Conference will be held in person and via MS Teams on April 21, 2026, at 11:00AM Arizona Local Time, for benefit of all prospective Bidders. Pre-Registration for the Pre-Bid Conference meeting is required. Bidders shall contact Judith.scholarwinfield@nau.edu by 4:00PM on April 20, 2026 to indicate their interest in attending.

After registering, those who wish to attend via MS Teams will be sent a link to the meeting. For in person attendance, as seating is extremely limited only one attendee per Bidder will be allowed.

Planning, Design, and Construction Staff and DP will be present to discuss technical aspects of the project. **All Bidders are required to be represented in order for their bid to be accepted by Owner.**

00 25 13.1 Mandatory Pre-Bid Site Inspection

The mandatory pre-Bid Site inspection will be held on April 21, 2026, immediately following the Pre-Bid Meeting. Pre-registration for the site visit is required. Bidders interested in attending the site visit shall contact Judith Scholar Winfield (O: 928-523-4468, judith.scholarwinfield@nau.edu) to pre-register on or before 4:00PM on April 20, 2026. Bidders shall bring no more than 3 attendees and will need to notify NAU of the number of attendees at the time of registering for the site visit. Each Bidder must be represented.

No other formal inspection tours should be anticipated. Bidders should come prepared to gather all on-site information necessary for preparing their proposal. It is the responsibility of the Bidders to thoroughly familiarize themselves with all conditions and matters, which may in any way affect the Work or cost thereof.

No allowance shall be made on behalf of any contractor or subcontractor for errors due to his/her negligence in not being familiar with existing site and/or project conditions.

00 25 13.1.1 Supplementary Site Visits

Arrangements for supplemental visits to the job site are to be made through:
NAU Facility Services
Planning, Design and Construction
(928) 523-4468
Northern Arizona University
Flagstaff, Arizona 86011

00 26 00 Substitution Procedures

For Competitive Sealed Bid Procurements (Hard Bid and Task Order Procurement):
If Bidder wishes to submit a product for consideration, refer to the Substitution Request Form (located in 00 43 25). Product Substitution Requests must be received 10 calendar days before bid opening. Product Substitution Requests shall be submitted in accordance with 00 21 13.1. All other processes of the below section will be followed.

Requests shall clearly describe the product for which approval is asked, including data necessary to demonstrate acceptability. The Owner and DP shall consider and either approve or reject proposals submitted. The Bidder's request for approval shall include the following:

a. Complete data substantiating compliance of the proposed substitution with the Contract Documents.
b. Product identification, including manufacturer's name, address and phone number.
c. Manufacturer's literature showing complete product description, performance, warranty and test data, and all reference standards.
d. Samples and colors in the case of articles or products, as appropriate.
e. Name and address of similar projects on which the product was used and date of installation.
f. For construction methods, include a detailed description for proposed method and drawings illustrating same.
g. Itemized comparison of proposed substitution with product or method specified.

Substitution requests shall be made on the Substitution Request Form included with the Bid Forms.

The decision of the Owner or DP regarding the approval of items for which substitution is requested will be final. In the event an approved substitution is later determined by the Owner or Design Professional to be unacceptable for any reason, including the necessity to perform extended redesign or rework of the project in order to accommodate the substitution, or if it becomes apparent to the Design Professional that the substituted item will not perform or function as well as the specified item, the Bidder will be required to furnish the original specified item or request approval to use another substitution. The Bidder will pay all costs, expenses or damages associated with or related to the unacceptability of a substitution and the resultant utilization of any item. The Bidder further understands and agrees that a time extension will not be granted due to delays associated with or related to the unacceptability of a substitution.

If a substitution is approved, no subsequent change in brand or make will be permitted unless satisfactory written evidence is presented to the Design Professional and approved by the Owner that the manufacturer cannot make scheduled delivery of the approved substitute item.

****END OF SECTION****

Section Number	Title	
00 30 00	**Available Information**	
00 31 00	**Available Project Information**	
00 31 13	Preliminary Schedule	
00 31 13.13	Preliminary Project Schedule	
	Advertisement:	April 16, 2026
	Pre-Bid Conference & Sit Walk:	April 21, 2026
	Bid Date:	May 1, 2026
	Construction Start (approximately):	June 1, 2026
	Substantial Completion:	August 7, 2026
	Final Completion:	October 30, 2026
00 31 13.16	Preliminary Construction Schedule	
	N/A	
00 31 19	Existing Condition Information	
	Existing conditions information includes existing site photos as well, a FMF HVAC Platform measurement request drawing and the most recent Fieldhouse remodel drawings.	
00 31 21	Survey Information	
	N/A	
00 31 24	Environmental Assessment Information	
	N/A	
00 31 25	Existing Material Information	
	N/A	
00 31 26	Existing Hazardous Material Information	

Worksite Hazard Inspection/Hazard Communication (FS-13) Results

Request Info

Requestor Information

Requestor First Name	Requestor Last Name	Requestor Email	Requestor Phone
Gabriel	Gurrola	GABRIEL.GURROLA@NAU.EDU	9285230365

Project Information

Request Type	Project #	Project Name
Contractor	09.300.251	FIELDHOUSE HVAC REPLACEMENT
Start Date	**Date of Request**	
4/30/2026	4/7/2026	

Building Information

Building #	Building Name	Room/Area
030	UNIVERSITY UNION FIELD HOUSE	140

Disturbed Areas

___Ceiling _X_Wall ___Floor _X_Mechanical System ___Exterior _X_Roof ___Other

N/A

NAU Authorized EH&S Representative

First Name	Last Name	Email Address
Scott	Halle	Scott.Halle@nau.edu

INITIAL INSPECTION IS AT NO COST TO THE REQUESTOR. SAMPLE ANALYSIS AND PROJECT/ABATEMENT MANAGEMENT FEES MAY BE CHARGED, AT THE STANDARD RATE TO THE CLIENT DEPARTMENT OR PROJECT

This inspection does not waive the supervisor/contractor responsibility to provide adequate worker training/ppe

The Requestor is responsible for submitting an inspection request with adequate time prior to commencing work to arrange and complete any necessary hazard abatement activities BEFORE other work begins. Inspection request form is located on the Engineering/Inspections website. Supervisors shall make this form or the information contained within it available for review by all employees present at the work site.

Affected Facility/Area Information

Location/Room Number included in scope of work:

140

Describe in detail the nature of the work required:

Replacement of aging HVAC equipment and installation of new units.

Describe any demolition of load bearing components:

n/a

Report Reviewed By

Certified Inspector	Date
Scott Halle	04/07/2026 11:28:38 AM

Hazard Communication

Hazard Communication

Hazard Type

_X_Silica/Asbestos/Lead/PCB ___Radiation ___Biological ___Chemical _X_Other

Additional Hazard Inspection(s)

___Chemical ___Biological ___Work Site ___Environmental ___Industrial Hygiene

The purpose of this form is to notify Contractors and Subcontractors and their employees working at Northern Arizona University of known or anticipated workplace hazards. NAU maintains comprehensive material/safety inspections and safety programs for campus buildings. Test results and safety programs are available for review in the NAU offices of Material Safety or Environmental Health and Safety. The following known and assumed hazards have been identified to be present in the work area located in Building(s):

Building Information

Building #	Building Name	Room/Area
030	UNIVERSITY UNION FIELD HOUSE	140

Known / Assumed Hazards

The presence of and potential for exposure to asbestos and silica are noted in the hazardous building material section of this report. Please review this information before proceeding. Other Potential hazards may include (not limited to) lift hazards, falls (same or lower level), struck/crushed by falling or swinging objects, electrical shock, Hazardous energy/LOTO hazards, hand hazard/pinch points, moving components/unguarded machinery, pinch/caught-between moving objects, and hazards related to the work practices, materials, or equipment used. It is the vendor/supervisors responsibility to adhere to any applicable worker safety or environmental compliance regulations while performing this work. If the scope or location of work changes, additional hazards may arise. Please request inspection of any added materials or locations before commencing new or changed work activities.

THIS FORM IS INFORMATIONAL FOR NAU EMPLOYEES AND MUST BE SHARED WITH ALL INVOLVED STAFF, BUT NO SIGNATURE IS REQUIRED. ANY VENDORS INVOLVED IN THIS WORK MUST SIGN AND RETURN A COPY OF THIS FORM PRIOR TO THE START OF WORK FOR OSHA COMPLIANCE AND PURCHASING DOCUMENTATION.

NAU is responsible for informing you of the presence of hazards in your project work area on the NAU campus. If you encounter any previously unidentified hazards, stop all work immediately and contact the NAU Project Manager or NAU Safety Official (928-523-6435). By law, Employers must provide adequate training and protection for employees who will be exposed to hazards including those in this notification. The responsible party signing below agrees that it is the responsibility of the Contractor or Subcontractor to be knowledgeable of and comply with all applicable local, state, and federal safety regulations, and with university policies related to the hazards detailed in this form.

Your signature below acknowledges that you have received notice from NAU that hazardous materials or conditions are or may be present in your work area(s), NAU is responsible for informing you of the presence of hazards in your project work area on the NAU campus. If you encounter any previously unidentified hazards, stop all work immediately and contact the NAU Project Manager or NAU Safety Official (928-523-6435). Vendors must acknowledge that you agree to fully assume the responsibility for ensuring the safety of yourself and your employees, which includes ensuring that you comply with all applicable local, state, and federal laws, and with university policies governing hazardous materials or conditions.

Company Acknowledgement

Name of Responsible Party: Signature _____	Title: Date:

Hazardous Building Materials

Ceiling Materials

Material Summary	Asbestos	Lead	PCB	Silica	Special Work Controls

Wall Materials

Material Summary	Asbestos	Lead	PCB	Silica	Special Work Controls
block and mortar	No	N/A	N/A	Assumed	See Comments
Drywall materials	No	N/A	N/A	Assumed	See Comments

Flooring Materials

Material Summary	Asbestos	Lead	PCB	Silica	Special Work Controls

Thermal System Insulation (TSI) Materials

Material Summary	Asbestos	Lead	PCB	Silica	Special Work Controls
Plaster pipe elbow and fitting insulation	Yes	N/A	N/A	Assumed	Yes
Fiberglass pipe run insulation	No	N/A	N/A	Assumed	See Comments

Other Materials

Material Summary	Asbestos	Lead	PCB	Silica	Special Work Controls
Roofing materials	No	N/A	N/A	No	None
Concrete roof deck	No	N/A	N/A	Assumed	See Comments

Comments / Special Requirements

Plaster pipe elbow insulation is documented to contain asbestos, and is suspect for the presence of silica, removal of this material by taping and then cutting pipe at non-asbestos sections will not result in disturbance or hazard to workers and may proceed. Please contact the EHS department to collect waste pipe once removal has been completed. Straight pipe run insulation contains fiberglass (fused silica) and may pose an irritation or inhalation hazard for workers. Other building materials are suspect for the presence of silica, and should be treated appropriately if disturbance is anticipated to generate airborne dust. Basic controls for dust (wet work methods, HEPA vacuums dust collection, etc) are adequate to control silica dust for minor disturbance events. If significant disturbance becomes necessary, additional training or work controls may be required. Please contact EHS for guidance if significant dust is anticipated.

Other hazards may exist. Please review the general hazard communication section of this report before proceeding.

If any materials not listed above are scheduled for disturbance or are discovered to be in a disturbed state, contact the Material Safety Official at 928-523-6435 for guidance or a supplemental inspection before proceeding with any additional work.

Section Number	Title
00 31 31	Geophysical Data *N/A*
00 31 32	Geotechnical Data *N/A*
00 31 43	NAU Permit Application The NAU permit application and procedure can be found at https://in.nau.edu/facility-services/dp-contract/.
00 31 46	Other Permits *None known at this time.*

****END OF SECTION****

Section Number | Title

00 40 00 PROCUREMENT FORM AND SUPPLEMENTS
00 41 00 Bid Forms
00 41 13 Bid Form

FORM OF BID (FS#1)
FIELDHOUSE HVAC REPLACEMENT
NAU PROJECT NO. 09.300.251

The undersigned hereby proposed, and agrees to furnish all labor, material, transportation, supervision and services necessary to complete all work as called for in the plans and specifications, and that the lump sum bid includes all applicable costs of bonds, insurance, permits, and fees, and sales tax, or any applicable taxes. **The Owner's selection will be made on a Bid (pre-tax) price per ABOR policy 3-803 A 7. The contract will be issued for the lump sum amount, inclusive of the tax.**

We acknowledge the following addenda and have included their provisions in this proposal.

Addendum No. _____ Dated _____
Addendum No. _____ Dated _____
Addendum No. _____ Dated _____
Addendum No. _____ Dated _____

BASE BID: The undersigned proposes to complete all work as required per the Specifications, for a Lump Sum of:

Bid (pre-tax): _____Dollars
($_____).
Taxes: _____Dollars
($_____).
Cumulative Bid: _____Dollars
($_____).

Enclosed herewith is a cashier's check or Bid Bond (NAU form FS#9) made payable to the Owner in the amount of $_____, which is not less than 10% of the amount of the total bid proposal, as a guarantee that the undersigned will furnish required Performance Bond and Labor and Material Bond, and enter into contract, on basis of above proposal.

Undersigned further agrees that said check (or Bid Bond) shall be forfeited as Liquidated Damages (no penalty) if undersigned fails to enter into contract after requested to do so by Owner.

Bids shown above are valid for a period of 60 days after the date of opening bids and may be withdrawn following that date if no contract has been awarded.

The undersigned understands that the Owner reserves the right to reject any or all bids, or to waive any informality in receipt of the above Proposal. **Owner reserves the right to award by Base Bid alone, by the sum of Base Bid and any combination of Additive Alternate Amounts, or as the sum of the Base Bid and all the Additive Alternate Amounts, whichever is deemed most advantageous to Owner.**

It is hereby understood and mutually agreed by and between the Contractor and the Owner that the date of beginning, rate of progress, and time of completion of the Work as set forth in the contract documents are of the essence of the contract. The amount of **$**100.00 **per calendar day** will be assessed against the contract for work not completed at the Substantial Completion date. Said amounts shall accrue until such time that the Work covered under this contract is complete, not as a penalty, but as Liquidated Damages.

In addition, it is mutually agreed by and between the Contractor and the Owner, the amount of **$**50.00 **per calendar day** will be assessed against the contract for work not completed at the Final Completion date. Said amounts shall accrue until such time that the Work covered under this contract is complete, not as a penalty, but as Liquidated Damages.

The Proposer hereby certifies that he/she is the holder of a valid Contractor's License in accordance with Arizona State Law and that such license classification allows the Contractor to perform the type of construction identified by these Bid Documents. The proposer also certifies that he/she holds all of the required certifications and licenses outlined in the bidding documents and shall provide proof of all certifications, licenses and warranties within 5 days of Owner notification to the apparent low bidder with the Intent to Award.

If corporation,

_____
Company/Corporation

Seal

_____
Signature

_____
Date

_____
Arizona License Class and Number

Section Number | Title

00 43 00 **Procurement Form Supplements**
00 43 13 Bid Security Form

BID BOND (FS#9)

KNOW ALL MEN BY THESE PRESENTS, that we _____
(Here insert full name and address or legal title of Contractor)
as Principal, hereinafter called the Principal, and _____
(Here insert full name and address or legal title of Surety)
a corporation duly organized under the laws of the State of _____
as Surety, hereinafter called the Surety, are held and firmly bound unto_____
(Here insert full name and address or legal title of Owner)
as Obligee, hereinafter called the Obligee, in the sum of Dollars ($), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.
WHEREAS, the Principal has submitted a bid for the Fieldhouse HVAC Replacement project (#09.300.251), located at 1050 S. Knoles Drive, Flagstaff, AZ 86011.

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contractor and give such bond or bonds, it the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null. and void, otherwise to remain in full force and effect.
Signed and sealed this _____ day of _____, 20__.

_____
(Principal) (Seal)

_____
(Witness)

_____
(Title)

_____
(Surety company) (Seal)

_____
(Witness)

Section Number | Title

00 43 25 | Substitution Request Form

MATERIAL/EQUIPMENT SUBSTITUTION REQUEST FORM

TO: _____

_____

PROJECT: _____

_____

We hereby submit for your consideration the following product instead of the specified item for the above project:

Section	Page	Paragraph/Line	Specified Item

Proposed Substitution: Product Identification – include manufacturer's name, address, and phone number _____

_____

_____

_____

Attach complete product descriptions, drawings, photographs, performance and test data, manufacturer literature, samples and colors in the case of articles or products, and other information necessary for evaluation.

Similar projects on which the product was used (include Project, Owner, Owner's Contact information, Location, and date):

1. _____
2. _____
3. _____

A. Will changes be required to building design in order to properly install proposed substitution? Yes ___ No ___ . If Yes, explain: _____

_____

B. Will the undersigned pay for changes to the building design, including engineering and drawing costs, caused by requested substitution? Yes ___ No ___.

C. What differences exist between proposed substitution and specified item?

_____

_____

D. Does substitution affect Drawing dimensions: Yes ___ No ___. If yes, explain. _____

_____

E. What effect does substitution have on other trades? _____

_____

_____

F. Does Manufacturer's warranty of proposed substitution differ from that specified?
Yes ___ No ___ If yes, explain. _____

G. Will substitution affect progress schedule? Yes ___ No ___. If yes, explain:

_____

H. Will substitution require more license fees or royalties than specified product?
Yes ___ No ___. If Yes, explain _____

_____

I. Will substitution differ in cost from the specified product? Yes ___ No
If yes, explain how much _____

_____

_____

J. Will maintenance and service parts be locally available for substitution?
Yes ___ No ___. If no, explain _____

_____

K. What is the code impact of this substitution request? Specify the section(s) of the applicable code(s) this impacts.

Section Number Title

Submitted By:

Signature

Firm

Address

Date

Telephone

For DP's Use Only:

_____ Accepted ___ Accepted as Noted

_____ Not Accepted

Remarks:

DP Signature:

Date:

For Owner's Use Only:

_____ Accepted ___ Accepted as Noted

_____ Not Accepted

Remarks:

Owner Signature:

Date:

Section Number Title

00 43 36 Proposed Subcontractors Form

SUBCONTRACTOR LIST FS #3

PROJECT NAME: FIELDHOUSE HVAC REPLACEMENT

PROJECT NO.: 09.300.251

Proposer is to list **every** subcontractor and supplier proposed to be employed on the above project as required by the bidding documents. **All Sections of the specifications must be included below.** Any work proposed to be done by the Bidder should be listed as a line item with the word "Self" inserted under firm name. Designation of subcontractors is subject to University approval. No change in subcontractor's list will be permitted without the University's prior written consent. **Failure to provide a complete list with all information may be considered non-responsive. Subcontractor List must be enclosed inside bid package per Section 00 43 36. All bidders must sign page 2 of this subcontractor list, even if all work will be self-performed.**

[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]

Section Number Title

[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]
[WORK]	[LICENSE #]	[CLASS]	[CONTACT PERSON]
[FIRM NAME]	[ADDRESS]	[CITY/STATE/ZIP]	[PHONE]

I submit that the preceding is correct and current as of _____.
[BID OPENING DATE]

[COMPANY]	[AUTHORIZED REPRESENTATIVE]	[DATE]

Section Number	Title
00 43 83	Proposed Construction Schedule Form TBD

Section Number | Title

00 45 00 **Representations and Certifications**
00 45 13 Bidder's Qualifications

CONTRACTOR STATEMENT OF QUALIFICATIONS FS#2

(**FAILURE TO INCLUDE THE STATEMENT OF QUALIFICATIONS WITHIN THE BID PACKET WILL BE CONSIDERED NON-RESPONSIVE**)

FILL IN ALL BLANKS. IF NOT APPLICABLE, INSERT "N.A."

COMPANY NAME:

CONTACT: PHONE: FAX:

YEARS IN BUSINESS UNDER ABOVE NAME: YEARS IN BUSINESS IN ARIZONA:

ADDRESS:

CITY, STATE, ZIP:

[ ] SOLE PROPRIETORSHIP [ ]PARTNERSHIP [ ] CORPORATION [ ] STATE OF INCORPORATION
[ ] WOMEN-OWNED BUSINESS [ ]MINORITY-OWNED BUSINESS [ ] SMALL BUSINESS (LESS THAN
CHECK ANY THAT APPLY TO YOUR BUSINESS $4M GROSS/YR OR LESS THAN100 FTE)

CONTRACTOR LICENSE NO: CLASS: STATE:

BONDING COMPANY: AGENT:

ANY OTHER BUSINESS NAMES USED: YEARS TO

PAST PROJECT SIZE EXPERIENCE:

1. $ 10,000 – $100,000 # OF PROJECTS COMPLETED IN PAST 5 YEARS
2. $100,000 – $500,000 # OF PROJECTS COMPLETED IN PAST 5 YEARS
3. $500,000 - $2,000,000 # OF PROJECTS COMPLETED IN PAST 5 YEARS
4. $2,000,000 + # OF PROJECTS COMPLETED IN PAST 5 YEARS

PERCENTAGE OF WORK NORMALLY ACCOMPLISHED WITH YOUR OWN FORCES:
PRESENT NUMBER OF PERSONNEL:
WILL YOU EXPAND YOUR WORK FORCE FOR THIS PROJECT? HOW MANY?
COMPUTER SOFTWARE USED FOR SCHEDULING PURPOSES:
COMPUTER SOFTWARE USED FOR DOCUMENT TRACKING PURPOSES:

REFERENCES: (BANK, TRADE, PROFESSIONAL)

1. [NAME] [ADDRESS] [PHONE NO.]

2. [NAME] [ADDRESS] [PHONE NO.]

3. [NAME] [ADDRESS] [PHONE NO.]

BY MY NOTARIZED SIGNATURE BELOW I HEREBY SWEAR THAT THE ANSWERS TO THE FOREGOING QUESTIONS AND ALL STATEMENTS HERE CONTAINED AND ATTACHED ARE TRUE AND CORRECT.

_____

[CONTRACTOR NAME OR AGENT] [DATE]

SUBSCRIBED AND SWORN BEFORE ME THIS_____DAY OF_____, 20___.

NOTARY PUBLIC:

MY COMMISSION EXPIRES:

Section Number	Title
00 50 00	**Contracting Forms and Supplements**
00 52 00	**Agreement Forms**
00 52 13	Agreement Form

The form of agreement between the Owner and Contractor shall be the Construction Agreement Between Owner and Contractor, Arizona Board of Regents. A copy of the latest version is available for review on the website for information purposes only.

The aforementioned forms are hereby made a part of this Document and shall be binding to the same extent as if they were written in full herein.

****END OF SECTION****

Section Number	Title
00 60 00	**Project Forms**
00 61 00	**Bond Forms**
00 61 13	Performance and Payment Bond Forms

ARIZONA BOARD OF REGENTS **PERFORMANCE BOND FS#4**
PURSUANT TO BOARD OF REGENTS POLICY 3-804E
(Penalty of this bond must be 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS:

That,_____
(hereinafter called the Principal), as Principal, and _____
a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ (hereinafter called the Surety), as Surety, are held and firmly bound unto the Arizona Board of Regents, (hereinafter called the Obligee), in the amount of ___ _____Dollars ($_____), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____day of _____, 20___, to construct and complete a certain work described as _____, which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extension thereof, with or without notice to the Surety and during the life of any guaranty required under the contract, and shall also perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; then the above obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Board of Regents Policy Section 3-804E, and all liabilities on this bond shall be determined in accordance with the provisions of the section, to the same extent as if copied at length herein.

The prevailing party in a suit on this bond, including any appeal thereof, shall recover as a part of his judgment such reasonable attorneys' fees as may be fixed by a judge of the Court.

Witness our hands this _____ day of_____, 20___.

_____	_____
PRINCIPAL SEAL	SURETY SEAL
By:_____	BY:
	_____
	Bond Number
_____	_____
Agent Name & Telephone	Bonding Company & Telephone
_____	_____
Agent Address	Bonding Company Address

Arizona Board of Regents **PAYMENT BOND FS#5**
PURSUANT TO BOARD OF REGENTS POLICY 3-804E
(Penalty of this bond must be 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS:

That,_____
(hereinafter called the Principal), as Principal, and _____
a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ (hereinafter called the Surety), as Surety, are held and firmly bound unto the Arizona Board of Regents, (hereinafter called the Obligee), in the amount of _____Dollars ($_____), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ day of _____, 20___, to construct and complete a certain work described as _____, which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall promptly pay all monies due to all persons supplying labor or materials to him/her or his/her subcontractors in the prosecution of the work provided for in said contract, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Board of Regents Policy Section 3-804E, and all liabilities on this bond shall be determined in accordance with the provisions of the section, to the same extent as if copied at length herein.

The prevailing party in a suit on this bond, including any appeal thereof, shall recover as a part of his judgment such reasonable attorneys' fees as may be fixed by a judge of the Court.

Witness our hands this_____ day of _____, 20___.

_____	_____
PRINCIPAL SEAL	SURETY SEAL
BY:_____	BY:
	_____
	Bond Number
_____	_____
Agent Name & Telephone	Bonding Company & Telephone
_____	_____
Agent Address	Bonding Company Address

Section Number | Title

00 62 00 Certificates and Other Forms

00 62 11 Submittal Transmittal Form (FS#27)

CONTRACTORS SUBMITTAL TRANSMITTAL FORM

PROJECT #: 09.300.251	**CONTRACTOR:**
PROJECT NAME: FIELDHOUSE HVAC REPLACEMENT	**DATE:**
TO (OWNER): Northern Arizona University Facility Services Planning, Design, & Construction PO Box 5637 Flagstaff, AZ 86011	**SUBMITTAL NO:** ☐ New Submittal ☐ Resubmittal

Specification Section No.: _____

Schedule Date of Submittal: _____

Submittal Type: ☐ Shop Drawing ☐ Sample ☐ Other: _____

THE FOLLOWING ITEMS ARE HEREBY SUBMITTED:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				Yes	No

CONTRACTOR hereby certifies that (i) CONTRACTOR has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

CONTRACTOR **SIGNATURE** **PRINT** **DATE**

Arizona Board of Regents

OWNER **SIGNATURE** **PRINT** **DATE**

Section Number | Title

00 62 16 Certificate of Insurance Form (FS#6)

ARIZONA BOARD OF REGENTS
CERTIFICATE OF INSURANCE (FS#6)

PROJECT NAME: FIELDHOUSE HVACE REPLACEMENT NAU PROJECT #: 09.300.251

PRODUCER	**COMPANIES AFFORDING COVERAGE** Insurance is to be placed with duly licensed or approved non-admitted insurers in the State of Arizona with an A.M. Best rating of not less than **A- VII**	**CURRENT A.M. BEST RATING**
	A	
	B	
INSURED	C	

Contractor shall furnish Northern Arizona University with certificates of insurance (ACORD form or equivalent approved by the State of Arizona). The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates of endorsements are to be received and approved by Northern Arizona University before work commences. Each insurance policy required by this Contract must be in effect at or prior to commencement of work under this Contract and remain in effect for the duration of the project. Failure to maintain the insurance policies as required by this Contract, or to provide evidence of renewal, is a material breach of contract.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
	GENERAL LIABILITY				GENERAL AGGREGATE	$ 2,000,000
	COMMERCIAL GENERAL LIABILITY				PRODUCTS-COMP/OP AGG.	$ 1,000,000
	: OCCURRENCE				PERSONAL & ADV INJURY	$ 1,000,000
					EACH OCCURRENCE	$ 1,000,000
					FIRE DAMAGE (Any one fire)	$ 50,000
	AUTOMOBILE LIABILITY				COMBINED SINGLE LIMIT	$ 1,000,000
	: ANY AUTO					
	PROFESSIONAL LIABILITY				EACH OCCURRENCE	$ 1,000,000
	ϒ TYPE: _____				AGGREGATE	
	ϒ CLAIMS MADE ϒ OCCURRENCE					
	EXCESS LIABILITY				EACH OCCURRENCE	$
	ϒ UMBRELLA FORM				AGGREGATE	
	ϒ OTHER THAN UMBRELLA FORM					
	WORKERS COMPENSATION AND				STATUTORY LIMITS	
	EMPLOYERS' LIABILITY				EACH ACCIDENT	$ 1,000,000
					DISEASE-POLICY LIMIT	$ 1,000,000
					DISEASE-EA EMPLOYEE	$ 1,000,000
	BUILDERS RISK				FACE AMOUNT OF CONTRACT	$

THIS CERTIFICATE APPLIES TO ANY AND ALL PROJECTS AT NORTHERN ARIZONA UNIVERSITY. DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS:

>THE POLICIES FOR GENERAL LIABILITY AND AUTOMOBILE LIABILITY SHALL BE ENDORSED TO INCLUDE THE FOLLOWING ADDITIONAL INSURED LANGUAGE: "THE STATE OF ARIZONA, ITS DEPARTMENTS, AGENCIES, BOARDS, COMMISSIONS, UNIVERSITIES AND ITS OFFICERS, OFFICIALS, AGENTS, AND EMPLOYEES SHALL BE NAMED AS ADDITIONAL INSUREDS WITH RESPECT TO LIABILITY ARISING OUT OF THE ACTIVITIES PERFORMED BY OR ON BEHALF OF THE CONTRACTOR.
>IT IS AGREED THAT COVERAGES AFFORDED UNDER THE POLICIES CERTIFIED IN THIS CERTIFICATE SHALL BE PRIMARY FOR THE PERSON OR ORGANIZATION SHOWN IN THE SCHEDULE, BUT ONLY WITH RESPECT TO LIABILITY ARISING OUT OF YOUR WORK FOR THAT INSURED BY OR FOR YOU. OTHER INSURANCE AFFORDED TO THAT INSURED WILL APPLY AS EXCESS AND NOT CONTRIBUTE AS PRIMARY TO THE INSURANCE AFFORDED BY THIS ENDORSEMENT.
>IT IS FURTHER AGREED THAT SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER. THIS CERTIFICATE IS NOT VALID UNLESS COUNTERSIGNED BY AN AUTHORIZED REPRESENTATIVE OF THE INSURANCE COMPANY.
>POLICIES FOR GENERAL LIABILITY, AUTO LIABILITY, AND WORKERS' COMPENSATION SHALL CONTAIN A WAIVER OF SUBROGATION AGAINST THE STATE OF ARIZONA, ITS DEPARTMENTS, AGENCIES, BOARDS, COMMISSIONS, UNIVERSITIES & ITS OFFICERS, OFFICIALS, AGENTS, & EMPLOYEES FOR LOSSES ARISING FROM WORK PERFORMED BY OR ON BEHALF OF THE CONTRACTOR.

CERTIFICATE HOLDER/ADDITIONAL INSURED	AUTHORIZED REPRESENTATIVE OF THE INSURANCE COMPANY
STATE OF ARIZONA, ARIZONA BOARD OF REGENTS **NORTHERN ARIZONA UNIVERSITY** BOX 4067 FLAGSTAFF, AZ 86011	**SIGNATURE DATE**

Section Number	Title
00 62 23	Construction Waste Diversion Form Owner participates annually in the best international sustainability assessment conducted by the Association for the Advancement of Sustainability in Higher Education (AASHE). Owner has been participating in AASHE's Sustainability Tracking, Assessment, and Rating System (STARS) since 2011 and currently maintains a Gold Ranking. Participation in this program continuously gets NAU great ratings in Sierra Club's "Cool Schools" issue and the Princeton Review's "Greenest Schools" issue. The latter report collects information including a school's Overall Waste Diversion Rate, which requires detailed tracking of all waste on campus. In addition, Owner requires Contractors to track waste on projects. Confirm with Owner at the beginning of each project on whether or not it is needed. The FS 49 Construction Waste Tracking Log is located online at: https://in.nau.edu/facility-services/forms-index/.
00 62 34	Recycled Content of Materials Form
00 62 76	Application for Payment Form All payments shall be made in accordance with the Agreement, and utilize the FS #11 for Contractors, the FS #60 for Design Builders, and the FS #98 for Design Professionals.

Section Number	Title
00 63 00	**Clarification and Modification Forms** Many of the NAU forms are located at: https://in.nau.edu/facility-services/forms-index/
00 63 13	Request for Interpretation Form
00 63 19	Clarification Form
00 63 25	Substitution Request Form (During Construction) Any substitutions to the specifications must be approved by Owner and DP using the Substitution Request Form in Section 00 43 25.
00 63 33	Supplemental Instruction Form
00 63 36	Field Order Form
00 63 43	Written Amendment Form
00 63 46	Construction Change Directive Form This form can be located on the NAU Facility Services website.
00 63 57	Construction Change Proposal Request This form can be located on the NAU Facility Services website, as FS #12.
00 63 63	Change Order Form
00 63 66	Contingency Use Authorization Form This form can be located on the NAU Facility Services website.
00 63 69	Allowance Use Authorization Form This form can be located on the NAU Facility Services website.

Section Number | Title

00 65 00 **Closeout Forms**

Closeout Forms and Other Project Closeout Requirements - may include but are not limited to the following:

A. Substantial Completion

1. Fire Marshal Acceptance Alarm/Sprinkler and State Fire Marshal Acceptance Report
2. State Elevator Inspection Report
3. Insurance Carrier Certificate for Boiler Inspection
4. Preliminary Balance Report
5. Preliminary As-Builts
6. Attic Stock
7. Substantial Completion Project Inspection (FS #15)
8. Punchlist Issued (FS#24)
9. Certificate of Substantial Completion (FS#81)
10. Schedule of Required Maintenance (FS#88)

B. Final Completion

1. Final Balance Report
2. Final As-Builts
3. First Season Commissioning Complete
4. Second Season Commissioning Complete
5. Operations and Maintenance Manuals
6. Electronic Copy of All Approved Submittals and Shop Drawings
7. Special Warranties
8. Keys Returned (FS#10)
9. Project Final Inspection (FS#15)
10. Punchlist Complete (FS#24)
11. Project Warranty (FS#80)
12. Certificate of Final Completion (FS#81A)
13. Affidavit Non Use Asbestos Certificate (FS#83)

C. Final Payment

1. Contractor Final Payment Application
2. Final Subcontractor List (FS#82)
3. All Subcontractor Lien Releases (FS#84)
4. Consent of Surety to Final Payment Received (FS#88)
5. General Contractor Lien Release (FS#89)
6. Contractor Affidavit of Payment (FS#99)

Templates of the forms (FS#) can be found at: https://in.nau.edu/facility-services/forms-index/.

Section Number	Title
00 65 14	Punchlist Form (FS#24)
00 65 15	Project Inspection Form (FS#15)
00 65 16	Certificate of Substantial Completion Form (FS#81)
00 65 17	Schedule of Required Maintenance Form (FS#88)
00 65 19	Certificate of Final Completion Form (FS#81A)
00 65 19.13	Affidavit of Payment (FS#99)
00 65 19.16	General Contractor Lien Release Form (FS#89)
00 65 19.17	Subcontractor Lien Release Form (FS #84)
00 65 19.19	Consent of Surety to Final Payment Form (FS#87)
00 65 19.19	Final Subcontractor List (FS#82)
00 65 36	Warranty Form (FS#80)

****END OF SECTION****

Section Number | Title

00 70 00 Conditions of the Contract

00 71 00 Contracting Definitions

00 72 00 General Conditions

The General Conditions of the Standard Form Agreement Between Owner and Contractor, Arizona Board of Regents are hereby made part of the Contract Documents, as if they are included in the following pages. A copy is appended to the construction agreement and available for review at https://in.nau.edu/facility-services/dp-contract/ for information purposes only.

The General Conditions are a part of the Contract and shall be binding on the General Contractor and all Subcontractors as if bound into this document.

00 73 00 Supplementary Conditions

00 73 15 Bonds and Certificates

The Bid price shall include the cost of Payment and Performance Bonds. Bonds shall cover the faithful performance, labor and material (100%) of the Contract and payment of all obligations (100%) arising thereunder in the form prescribed in Arizona Board of Regents Policy 3-804E(Contract Performance and Payment Bonds). Bonds shall be executed by Corporate Sureties licensed in Arizona. **Bonds must be submitted on the forms included in Section 00 61 13.**

Performance Bond

Pursuant to Arizona Board of Regents Policy, the Contractor shall file with the Owner, prior to the time of execution of the Contract, a Performance Bond on the Owner approved Form, referenced in, Section 00 61 13.13 in a penal sum equal to one hundred percent (100%) of the Contract. The Performance Bond must be executed on the above noted form. Substitutions will not be allowed. The Surety furnishing this bond shall be satisfactory to the Owner and shall be authorized to do business in the State of Arizona.

Payment Bond

Pursuant to Arizona Board of Regents Policy, the Contractor shall file with the Owner prior to the time of execution of the Contract, a Payment Bond on the Owner approved Form, referenced in Section 00 62 13, in a penal sum equal to one hundred percent (100%) of the Contract. The Payment Bond must be executed on the above noted form. Substitutions will not be allowed. The Surety furnishing this bond shall be satisfactory to the Owner and shall be authorized to do business in the State of Arizona.

Certificates of Compliance with Applicable Laws and Regulations

Lien Releases

Section Number | Title

Upon completion of this Project, and before final payment is made, the Contractor will furnish to the Owner one hundred percent (100%) Unconditional Lien Releases from all subcontractors, material dealers and other participants doing work under this Contract.
If payment to Subcontractors is outstanding pending final payment by the University to Contractor, or if for any other reason 100% Unconditional Lien Releases cannot be obtained from all subcontractors, the Contractor may provide the University with an indemnity bond.

00 73 16 Insurance Requirements

Insurance Requirements are defined by the contract.

00 73 19 Health and Safety Requirements

Beginning July 1, 2016, the use of all tobacco products, including those not approved by the FDA for cessation is prohibited on university property, facilities, grounds, parking structures, privately-owned vehicles and structures owned or leased by the University. This includes, but is not limited to, the use of cigarettes, e-cigarettes, hookah, e-hookah, chew, dip, snuff, cigars, pipes, vaporizers, etc.

00 73 34 Affirmative Action for Disabled Workers

Refer to https://in.nau.edu/facility-services/dp-contract/ for specific requirements within the Construction Agreement.

00 73 36 Equal Employment Opportunity Requirements

Northern Arizona University is an equal opportunity employer and all contracts with the University are subject to the conditions and requirements of Executive Order No. 99-4 as stated below.

EXECUTIVE ORDER No. 99-4

PROHIBITION OF DISCRIMINATION IN STATE CONTRACTS, NON-DISCRIMINATION IN EMPLOYMENT BY GOVERNMENT CONTRACTORS AND SUBCONTRACTORS

PART I:

Non-discrimination in employment by government contractors and subcontractors.

All government contracting agencies shall include in every government contract hereinafter entered into the following provisions:

A. The contractor will not discriminate against any employee or applicant for employment because of race, age, color, religion, sex or national origin. The contractor will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, age, color, religion, sex or national origin. Such action shall include but not be limited to the following: Employment, upgrading, demotion or transfer, recruitment or recruitment advertising, lay-off or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

B. The contractor will in all solicitations or advertisement for employees placed by or on behalf of the contractor state that all qualified applicants will receive consideration for employment without regard to race, age, color, religion, sex or national origin.

C. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding a notice to be provided by the agency contracting officer advising the labor union or workers' representative of the contractor's commitments under this Executive Order and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

D. The contractor will furnish all information and reports required by the contracting agency and will permit access to his books, records and accounts by the contracting agency and the Civil Rights Division for purposes of investigation to ascertain compliance with such rules, regulations and orders.

E. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations or order of the Arizona Civil Rights Division said noncompliance will be considered a material breach of the contract and this contract may be canceled, terminated or suspended in whole or in part, and the contractor may be declared ineligible for further government contracts until said contractor has been found to be in compliance with the provisions of this order and the rules and regulations of the Arizona Civil Rights Divisions, and such sanctions may be imposed and remedies revoked as provided in Part II of this order, and the rules and regulations of the Arizona Civil Right Division.

F. The contractor will include the provisions of paragraphs A through E in every subcontractor purchase order so that such provisions will be binding upon each

subcontractor or vendor. The contractor will take such action with respect in the subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in the event the contractor becomes involved in or is threatened with litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the contractor may request the State of Arizona to enter into such litigation to protect the interests of the State of Arizona.

G. Each contractor having a contract containing the provisions prescribed in this section shall file and shall cause each of his subcontractors to file compliance reports with the contracting agency or the Civil Rights Division, as may be directed. Compliance reports shall be filed within such ties and shall contain such information as the practices, policies, programs and employment policies, programs and employment statistics of the contractor and each subcontractor and shall be in such form as the Arizona Civil Rights Division may prescribe.

H. Bidders or prospective contractors or subcontractors shall be required to state whether they have participated in any previous contract subject to the provisions of this order or any preceding similar Executive Order and in that event to submit on behalf of themselves and the proposed subcontractors compliance reports prior to, or as an initial part of negotiation of a contract.

I. Whenever the contractor or subcontractor has a collective bargaining agreement or other
contract or understanding with a labor union or an agency referring workers or providing or supervising apprenticeship or training for such workers, the compliance report shall include such information from such labor unions or agency practices and policies affecting compliance as the contracting agency or Civil Rights Division may prescribe; provided that, to the extent such information is within the exclusive possession of a labor union or an agency referring workers or providing supervision apprenticeship or training and such labor union or agency shall refuse to furnish such information to the contractor, the contractor shall so certify the contracting agency as part of its compliance report and shall set forth what efforts he has made to obtain such information.

J. The contracting agency or the Civil Rights Division shall require that the bidder or prospective contractor or subcontractor shall submit as part of his compliance report a statement in writing signed by an authorized officer or agent on behalf of any labor union or any agency referring works or providing or supervising apprenticeship or other training with which the bidder or prospective contractor deals with supporting information to the effect that the signer's practices and

Section Number | Title

policies do not discriminate on the ground of race, color, religion, sex or national origin, and that the signer either will affirmatively cooperate in the implementation of the policy and provisions of this order or that it consents and agrees that recruitment employment and the terms and conditions of employment under the proposed contract shall be in accordance with the purpose and provisions of this order. In the event that the union or the agency shall refuse to execute such a statement, the compliance shall so certify and set forth what efforts have been made to secure such a statement and such additional factual material as the contracting agency or the Civil Rights Division may require.

PART II.

Enforcement

The parties to the contract agree that the Civil Rights Division may investigate the employment practices of the contractor or any subcontractor employed by the contractor or initiate an investigation by an appropriate contracting agency or determine whether or not any of the contractual provisions pertaining to discrimination in this contract have been violated. Such investigations shall be conducted in accordance with the procedures established by the Civil Rights Division, and the investigation agency shall report to the Civil Rights Division any action taken or recommended. The Civil Rights Division may receive and investigate or cause to be investigated complaints by employees or prospective employees of the contractor or subcontractor under this agreement which allege discrimination contrary to the contractual provisions of this agreement. If the investigation is conducted for the Civil Rights Division by an agency other than the Civil Rights Division, that agency shall report to the Civil Rights Division what action has been taken or is recommended with regard to such complaint.

00 73 37 Legal Worker Requirements

Refer to https://in.nau.edu/facility-services/dp-contract/ for specific requirements within the Construction Agreement.

Section Number | Title

00 73 38 | Participation in Boycott of Israel

Refer to https://in.nau.edu/facility-services/dp-contract/ for specific requirements within the Construction Agreement.

No Boycott of Goods or Services from Israel. If the Goods/Services provided under this Agreement include the acquisition of services, supplies, information technology or construction with a value of at least $100,000 and Supplier is engaged in for-profit activity and has 10 or more full-time employees, then, to the extent required by ARS § 35-393.01, Supplier certifies it is not currently engaged in, and during the term of this Agreement will not engage in, a boycott of goods or services from Israel.

By signing this form, Bidder certifies that it is not currently engaged in and agrees, for the duration of the Contract, to not engage in a Boycott of Israel.

Name of Bidder		
Name of Contact		Title of Contact
Address 1		Address 2
City	State	Zip Code
		-
Telephone Number		E-mail address, if available
( ) -		( ) -
Print Name of Bidder's Authorized Agent		Signature of Bidder's Authorized Agent
Title of Bidder's Authorized Agent		Date

Section Number	Title
00 73 39	Minority Business Enterprise Requirements Refer to https://in.nau.edu/facility-services/dp-contract/ for specific requirements within the Construction Agreement.
00 73 50	Liquidated Damages

It is hereby understood and mutually agreed, by and between Contractor and Owner, that the date of beginning, rate of progress and the time for completion of the work to be done hereunder are essential conditions of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on the date to be specified in the Notice to Proceed, Notice of Award, Contract and/or Agreement.

The Contractor agrees that said work shall be prosecuted regularly, diligently and uninterruptedly at such rate of time he specifies. It is expressly understood and agreed, by and between the Contractor and Owner, that the time for completion of the work will be set by the Substantial and Final completion dates as identified in Notice to Proceed, Notice of Award, Contract and/or Agreement.

Now, if the said Contractor shall neglect, fail, or refuse to complete the Work by the specified date, then the Contractor does hereby agree, as a part consideration for the awarding of the Contract, to pay the Owner a certain sum, as outlined hereafter, per calendar day, until the Project is completed, not as a penalty, but as Liquidated Damages for each breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work.

For each calendar day that any part of the work remains uncompleted after the expiration of the time specified and/or allowed for completion of the work stipulated in the contract or approved increase by the additional work or materials ordered after the contract is signed, effecting the critical path schedule of the project, the sum per day shall be deducted from any monies due the Contractor, or if no money is due the Contractor, the Owner shall have the right to recover said sum or sums from the Contractor, from the surety or from both.

It shall be understood that the time to complete the Project, beyond the contractual date of completion is in itself prima facie evidence of actual damages incurred, and the amount of these deductions are to cover the Liquidated Damages caused by the loss of use, or limited use, of the building and other additional Owner incurred losses, or expenses, including supervisory and consulting services, due to the failure of the Contractor to complete the work within the time specified.

The said amount is fixed and agreed upon by and between Contractor and Owner because of the impracticality and extreme difficulty of fixing and ascertaining the actual damages Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain.

It is further agreed that time is of the essence of each and every portion of this contract and of the specifications where a definite and certain length of time is fixed for the performance of any act whatsoever; and when under the Contract an additional time is allowed as hereinbefore mentioned for the completion of any Work, the new time limit fixed by such extension shall be of the essence of this Contract, provided that the Contractor shall not be charged with Liquidated Damages or any excess cost when the delay in completion of Work is due:

To unforeseeable cause beyond the control and without fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather. The unusualness of the weather shall be determined by statistics from the local Weather Bureau over a period of the last 10 years. Upon request of the DP, the Contractor shall obtain statistical information from the Weather Bureau to support his claim for extension caused by unusual weather condition.

If the Contractor is delayed at any time in the progress of the Work by any act or neglect of the Owner or the DP, or by any separate Contractor employed by the Owner, or by changes in the Work, or by labor disputes, fire, unusual delay in transportation, unusually severe weather conditions, adverse soil conditions, unavoidable casualties, delays specifically authorized by the Owner, or by causes beyond the Contractor's control, avoidance, or mitigation, and without any fault or negligence of the Contractor or Subcontractor or Supplier at any tier, then the Contract Time shall be extended by Change Order for such reasonable time as the Owner may determine that such event has delayed the critical path of the Work or individual milestone or overall completion of the Work after considering the advice of the DP, if the Contractor complies with the notice and documentation requirements set forth below. The Contractor shall pay any additional fees or costs incurred by the Owner or DP as the result of delays caused by the Contractor for circumstances not excused as provided herein.

Initial notice of any delay in the Work shall be made in writing to the DP and Owner immediately but in no event later than 24 hours after discovery of the event giving rise to the delay. Then, Contractor shall provide additional details of the delay in writing to the DP and the Owner within seven (7) calendar days from the beginning

Section Number | Title

of the delay. Failure to meet these time requirements shall absolutely bar any and all later claims. The detailed notice shall indicate the cause of the delay, the anticipated length of the delay, the probable effect of such delay upon the progress and cost of the Work, and potential mitigation plans. If the cause of the delay is continuing, the Contractor must give written notice every month at the same time it submits the updated progress Narrative Report to the DP. Within fifteen (15) days after the elimination of any such delay, the Contractor shall submit further documentation of the delay and, if applicable, a formal written request covering an extension of time for such delay. The written request for time extension shall state the cause of the delay, the number of days extension requested and provide a fully documented analysis of the Progress Schedule, including a fragment and any other data demonstrating a delay in the critical path of the Work or individual milestone or the overall project completion. If the Contractor does not comply with the notice and documentation requirements set forth above, the claim for delay is absolutely barred.

Schedule of Liquidated Damages shall be as follows:

Substantial Completion: One Hundred Dollars ($100.00)
for every day beyond the scheduled date of Substantial Completion through to and including the date indicated on the Official Certificate of Substantial Completion when issued by the DP.

Final Completion: Fifty Dollars ($50.00)
for every day beyond the date of Final Completion as established in the Contract Documents and per the Construction Agreement. Work to be completed prior to a determination of Final Completion includes the fulfillment of all Contractual requirements, including the completion of all punch list items and Contract Closeout documents.

00 73 60 Value Engineering Change Proposals (VECP)

General

This clause applies to any cost reduction proposal (hereinafter referred to as a Value Engineering Change Proposal (VECP)) initiated and developed by the Contractor for changing the drawings, designs, specifications, or other requirements of this contract. This clause does not, however, apply to any such proposal unless it is identified as a VECP by the Contractor at the time of its submission to the Owner.

Definition

All VECP's must:

Result in a savings to the Owner by providing a decrease in the cost of the performance of this contract without impairing any required functions and characteristics such as service life, reliability, economy of operation, ease of maintenance, desired appearance, standardized feature, fire protection features, safety features.

Require, in order to be applied to this contract, a change order to this contract.

Proposal Screening

The Contractor will present anticipated proposals to the DP for proposal screening. During this screening, the DP will render an opinion as to the relative merits of the proposal.

The DP will provide as a part of the screening, the minimum technical content requirements to be submitted by the Contractor as a part of the formal VECP.

Concurrence by the Owner and the DP with merits of the proposal during the screening is not to be assumed that the VECP will automatically be accepted.

In the event a VECP is received which has not had the proposal screening, it may be rejected without review.

VECP Content

As a minimum, the following information must be submitted by the Contractor with each VECP.

A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance. A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

A separate, detailed cost estimate for (I) the affected portions of the existing contract requirement and (2) the VECP.

A description and estimate of costs the University may incur in implementing the VECP, such as test and evaluation and operating and support costs.

A prediction of any effects the proposed change would have on collateral costs to the agency.

A statement of the time by which a Change Order accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous University actions, if known.

The Contractor may withdraw, in whole or in part, a VECP that has not been accepted by the Owner within the period specified in the VECP.

Owner Action

The DP shall notify the Contractor of the status of the VECP within 30 days after submitted for review. If additional review time is required, the DP shall notify the Contractor of this within the original 30-day period. The Owner or DP shall not be held liable for any delays in acting upon a VECP.

If a VECP is not accepted, the DP shall notify the Contractor in writing, explaining the reasons for rejection. The notice of rejection shall be submitted within the review period referenced above.

Any VECP may be accepted, in whole or in part by the Owner. The Owner may modify a VECP, with the concurrence of the Contractor, to make it more acceptable. If any modification increases or decreases the savings resulting from the VECP, the Contractor's fair share will be determined on the basis of the VECP as modified. Unless and until a change order applies a VECP to this contract, the Contractor will remain obligated to perform in accordance with the terms of the existing contract. The Owner may accept in whole or in part any VECP submitted pursuant to this clause by issuing a change order which will identify the VECP on which it is based.

****END OF SECTION****

Section Number	Title
01 00 00	**GENERAL REQUIREMENTS**
01 10 00	**SUMMARY**
01 11 00	**Summary of Work**
01 11 13	Work Covered by Contract Documents
01 11 16	Work by Owner
01 12 00	**Multiple Contract Summary**
01 14 00	**Work Restrictions**
01 14 13	Access to Site
01 14 16	Coordination with Occupants
01 14 19	Use of Site
01 18 00	**Project Utility Sources**
01 18 13	Utility Service Connections
01 20 00	**PRICE AND PAYMENT PROCEDURES**
01 21 00	**Allowances**
01 22 00	**Unit Prices**
01 23 00	**Alternates**
01 25 00	**Substitution Procedures**
01 25 13	Product Substitution Procedures
01 25 16	Execution Substitution Procedures
01 26 00	**Contract Modification Procedures**
01 26 13	Requests for Interpretation
01 26 46	Construction Change Directives
01 26 53	Proposal Requests
01 26 54	Proposal Worksheet Summaries
01 26 57	Change Order Request
01 26 63	Change Orders
01 29 00	**Payment Procedures**
01 29 73	Schedule of Values
01 29 76	Progress Payment Procedures
01 29 83	Payment Procedures for Testing Laboratory Services
01 30 00	**ADMINISTRATIVE REQUIREMENTS**
01 31 00	**Project Management and Coordination**
01 31 13	Project Coordination
01 31 14	Facility Services Coordination
01 31 16	Multiple Contract Coordination
01 31 19	Project Meetings
01 31 19.13	Preconstruction Meetings
01 31 19.16	Site Mobilization Meetings
01 31 19.23	Progress Meetings
01 31 19.33	Pre-installation Meetings

Section Number	Title
01 31 26	Electronic Communication Protocols
01 32 00	**Construction Progress Documentation**
01 32 13	Scheduling of Work
01 32 16	Construction Progress Schedule
01 32 19	Submittals Schedule
01 32 23	Survey and Layout Data
01 32 26	Construction Progress Reporting
01 32 33	Photographic Documentation
01 32 43	Purchase Order Tracking
01 33 00	**Submittal Procedures**
01 33 13	Certificates
01 33 16	Design Data
01 33 19	Field Test Reporting
01 33 23	Shop Drawings, Product Data, and Samples
01 33 29	Sustainable Design Reporting
01 33 29.06	Reused Product Form
01 35 00	**Special Procedures**
01 35 13	Special Project Procedures
01 35 13.26	Special Project Procedures for Clean Rooms
01 35 13.43	Special Project Procedures for Contaminated Sites
01 35 23	Owner Safety Requirements
01 35 26	Governmental Safety Requirements
01 35 29	Health, Safety, and Emergency Response Procedures
01 35 29.13	Health, Safety, and Emergency Response Procedures for Contaminated Sites
01 35 43	Environmental Procedures
01 35 43.13	Environmental Procedures for Hazardous Materials
01 35 43.16	Environmental Procedures for Toxic Materials
01 35 46	Indoor Air Quality Procedures
01 35 53	Security Procedures
01 35 63	Sustainability Certification Project Requirements
01 35 66	Sustainability Certification Project Procedures
01 35 91	Historic Treatment Procedures
01 40 00	**QUALITY REQUIREMENTS**
01 41 00	**Regulatory Requirements**
01 41 13	Codes
01 41 16	Laws
01 41 19	Rules
01 41 23	Fees
01 41 26	Permit Requirements
01 43 00	**Quality Assurance**
01 43 23	Installer Qualifications

Section Number	Title
01 43 26	Testing and Inspecting Agency Qualifications
01 43 29	Code-Required Special Inspector Qualifications
01 45 00	**Quality Control**
01 45 23	Testing and Inspecting Services
01 45 26	Plant Inspection Procedures
01 45 33	Code-Required Special Inspections and Procedures
01 50 00	**TEMPORARY FACILITIES AND CONTROLS**
01 51 00	**Temporary Utilities**
01 51 13	Temporary Electricity
01 51 16	Temporary Fire Protection
01 51 23	Temporary Heating, Cooling, and Ventilating
01 51 26	Temporary Lighting
01 51 29	Temporary Natural-Gas
01 51 33	Temporary Telecommunications
01 51 36	Temporary Water
01 52 00	**Construction Facilities**
01 52 13	Field Offices and Sheds
01 52 19	Sanitary Facilities
01 54 00	**Construction Aids**
01 54 13	Temporary Elevators
01 54 16	Temporary Hoists
01 54 19	Temporary Cranes
01 54 23	Temporary Scaffolding and Platforms
01 54 26	Temporary Swing Staging
01 55 00	**Vehicular Access and Parking**
01 55 13	Temporary Access Roads
01 55 19	Temporary Parking Areas
01 55 26	Traffic Control
01 55 29	Staging Areas
01 56 00	**Temporary Barriers and Enclosures**
01 56 16	Temporary Dust Barriers
01 56 19	Temporary Noise Barriers
01 56 26	Temporary Fencing
01 56 39	Temporary Tree and Plant Protection
01 58 00	**Project Identification**
01 58 13	Temporary Project Signage
01 58 16	Temporary Interior Signage
01 60 00	**PRODUCT REQUIREMENTS**
01 61 00	**Common Product Requirements**
01 61 13	Software Licensing Requirements

Section Number	Title
01 66 00	**Product Storage and Handling Requirements**
01 70 00	**EXECUTION AND CLOSEOUT REQUIREMENTS**
01 73 00	**Execution**
01 73 29	Cutting and Patching
01 74 00	**Cleaning and Waste Management**
01 74 13	Progress Cleaning
01 74 16	Site Maintenance
01 74 19	Construction Waste Management and Disposal
01 74 23	Final Cleaning
01 75 00	**Starting and Adjusting**
01 75 13	Checkout Procedures
01 75 16	Startup Procedures
01 77 00	**Closeout Procedures**
01 77 13	Preliminary Closeout Reviews
01 77 16	Final Closeout Review
01 77 19	Closeout Requirements
01 78 00	**Closeout Submittals**
01 78 23	Operation and Maintenance Data
01 78 23.13	Operation Data
01 78 23.16	Maintenance Data
01 78 29	Final Site Survey
01 78 36	Warranties
01 78 39	Project Record Documents
01 78 43	Spare Parts
01 78 46	Extra Stock Materials
01 78 53	Sustainable Design Closeout Documentation
01 79 00	**Demonstration and Training**
01 80 00	**PERFORMANCE REQUIREMENTS**
01 81 00	**Facility Performance Requirements**
01 81 13	Sustainable Design Requirements
01 90 00	**LIFE CYCLE ACTIVITIES**
01 91 00	**Commissioning**
01 91 13	General Commissioning Requirements
01 92 00	**Facility Operation**
01 92 13	Facility Operation Procedures
01 93 00	**Facility Maintenance**
01 93 13	Facility Maintenance Procedures

Section Number | Title

01 00 00 GENERAL REQUIREMENTS

01 10 00 SUMMARY

01 11 00 Summary of Work

01 11 13 Work Covered by Contract Documents

The Fieldhouse (Building 30) will be renovated to support a future multipurpose facility with a seasonal ice rink. This project's scope will include mechanical platforms and mechanical upgrades to space. The work will encompass selective demolition of the specific legacy mechanical units shown on the demolition plans, structural, mechanical, and electrical improvements. Specifically, the demolition work consists of the selective removal of existing mechanical units and platforms.

If using Division 1 for subcontractor bid packages the Contractor shall incorporate applicable language from Contractor's Construction Agreement with Owner.

01 11 16 Work by Owner

N/A

01 12 00 Multiple Contract Summary

N/A

01 14 00 Work Restrictions

01 14 13 Access to Site

Truck washing stations, truck tire scraping grates and street sweeping may be required. Access to site shall be provided as to keep construction activity, dirt and mud on site.

01 14 16 Coordination with Occupants

Communication with the occupants is to be sent through the Owner. Impact requests shall be requested a minimum of 5 business days prior to the proposed starting time. Requests may not be approved and may be rescheduled to meet occupant needs.

01 14 19 Use of Site

Use of the site is restricted to materials and equipment necessary for completion of the Work. It is the Contractor's responsibility to ensure enclosure of the site from the general public.

Section Number | Title

01 18 00 Project Utility Sources

01 18 13 Utility Service Connections

The Contractor shall prearrange time with the DP and Owner whenever it becomes necessary to energize new services or to interrupt any service to make connections, alterations or relocations; and shall fully cooperate with the Owner in doing Work so as to cause the least annoyance and interference with the continuous operation of the Owner's business or official duties. Following such a meeting the Contractor shall submit a work authorization request that will include a detailed description and procedure for each task, schedule for each task, any safety controls being implemented and signoff locations for tasks completed. The work authorization request will be similar to the document identified in 29 CFR 1910.147 App A and must be approved by the Owner (trade supervisor for the intended utility). The work authorization document is considered a submittal subject to the review periods indicated in the contract but in no case less than 5 business days and must be approved prior to scheduling work.

Any existing utility distribution or internal plumbing, heating, ventilating, air conditioning or electrical disconnections which may affect portions of existing buildings or other construction projects must be coordinated with the DP and Owner to avoid any disruption of operation. While bidding, the Contractor shall assume that all shutdowns shall occur during afterhours and/or weekends unless specifically stated otherwise in the contract documents. In no case, unless previously approved in writing by Owner, shall utilities be left disconnected at the end of a workday or over a weekend. Any interruption of utilities shall be reported immediately to the Owner (Project Manager). Such interruptions, whether negligently, intentionally, or accidentally, shall not relieve the Contractor's responsibility for the interruption or from liability for loss or damage caused by such interruption even though such loss or damage was not foreseeable by Contractor or subcontractor, or from responsibility for repairing and restoring the utility to normal service. Repairs and restoration shall be made before the Contractor leaves the project site.

****END OF SECTION****

Section Number | Title

01 20 00 PRICE AND PAYMENT PROCEDURES

01 21 00 Allowances

The Contractor's price for the Work shall include all of the Contractor's costs associated with such allowance or allowances. If the actual costs to the Contractor of such allowance or allowances is different from the specified sum, increases or decreases in the cost of the allowance and associated Contractor's cost shall be adjusted in accordance with the Construction Agreement.

Use of Allowances must be requested and approved through the Allowance Use Authorization form.

01 22 00 Unit Prices

N/A

01 23 00 Alternates

N/A

01 26 00 Contract Modification Procedures

01 26 13 Requests for Interpretation

Requests for Interpretation (RFI) will be sent electronically to the Owner (Project Manager) and the DP concurrently. The RFI must indicate the Owner's project number, RFI #, spec section and plan sheet impacted, trades involved, images if applicable, a proposed solution and potential cost or time impact.

01 26 46 Construction Change Directives

Use Owner form FS#16 for all Construction Change Directives (CCD).
No changes in the work shall be undertaken by the Contractor without written direction by the Owner and DP (if a DP is on the project), either as a CCD or a Change Order.

01 26 53 Proposal Requests

Refer to Section 01 26 57

01 26 54 Proposal Worksheet Summaries

Refer to Section 01 26 57

01 26 57 Construction Change Proposal Request

The CCPR form is required to be completed by the Contractor with a detailed description and cost breakdown for each individual requested change. Please

Section Number | Title

refer to FS#12 available at: https://in.nau.edu/facility-services/forms-index/. Refer to construction agreement for specific provisions.

01 26 63 Change Orders

No changes in the work shall be undertaken by the Contractor without written direction by the Owner and DP (if a DP on the project), either as a CCD or a Change Order. Any changes made without such written direction are done so at the Contractor's own risk. Change Orders shall be processed as identified in the construction agreement.

Change procedures must follow the requirements outlined in the Construction Agreement between Owner and Contractor. A copy of the latest version of the Construction Agreement between Owner and Contractor is available at https://in.nau.edu/facility-services/dp-contract/. Change orders are on Owner form FS#14.

01 29 00 Payment Procedures

01 29 73 Schedule of Values

Individual construction activities which are indicated by the Schedule of Values shall coincide with activities presented on the Contractor's Construction Schedule. Contractor shall submit proposed schedule of values for review and approval by DP and by Owner, per the Construction Agreement between Owner and Contractor, prior to submission of first pay application.

01 29 76 Progress Payment Procedures

Contractor will submit payments electronically to the Project Manager, DP and Owner (project manager and project assistant) concurrently. Payments will be measured against the Schedule of Values as approved by the DP, Owner and CM (as applicable).

For all Testing and Inspection Services, the Testing and Inspection Log (FS#105) shall be completed and shall accompany each pay app for that billing period.

Payment procedures shall be per the Construction Agreement. The Pay Application form can be found at: https://in.nau.edu/facility-services/dp-contract/.

****END OF SECTION****

Section Number	Title
01 30 00	**ADMINISTRATIVE REQUIREMENTS**
01 31 00	**Project Management and Coordination**
01 31 13	Project Coordination Project coordination and communication procedures will be discussed in detail at the preconstruction meeting. The minutes of this meeting shall serve as reference and documentation of proper coordination and communication channels.
01 31 14	Facility Services Coordination An emergency contact sheet will be provided to the Contractor with contacts for the Owner's different departments in Facility Services. The Contractor will fill out with their emergency numbers and return to the Owner for distribution.
01 31 16	Multiple Contract Coordination The Owner reserves the right to award other contracts related to the Project, or to perform certain work itself. Any such other work may or may not be known to the Owner or disclosed to the Contractor prior to execution of the Agreement. The Contractor shall allow the Owner and such other additional contractors to deliver and store the additional contractors' or Owner's materials and equipment and to execute the additional contractors' or Owner's work, and shall properly coordinate the Contractor's Work with the additional contractors' or Owner's work in such manner as the Owner or Design Professional may direct. The Contractor shall also ensure at the Contractor's own cost reasonable access of additional contractors to the Contractor's site and the Contractor's work.
01 31 19	Project Meetings Refer to the required project meetings in the Construction Agreement.
01 31 19.13	Preconstruction Meetings A preconstruction meeting shall be held for all projects. Notification of the time and date of such conference shall be made to the selected Contractor in the Notice of Intent to Award, or via other coordination methods. The preconstruction meeting agenda (FS#21) is located online at: https://in.nau.edu/facility-services/forms-index/.
01 31 19.14	Inspection Meeting A meeting will be held between Owner (including Project Manager, Building Official, and applicable Trades Inspectors) and the Contractor to discuss inspection procedures and to establish expectations. This may be a separate meeting from the preconstruction meeting or may be covered in the preconstruction meeting.

Section Number	Title

01 31 19.15 Blue Stake Meeting

Contractor and earthwork/underground foreman will coordinate a Blue Stake Kickoff Meeting prior to the start of Work to review the proposed schedule and blue stake requirements. This is a separate meeting from the preconstruction meeting.

01 31 19.16 Site Mobilization Meetings

01 31 19.23 Progress Meetings

Progress meetings shall occur on a regular basis (weekly) according to a schedule determined at the pre-construction conference or as established in the contract.

01 31 19.33 Pre-Installation Meetings

The Contractor shall schedule a pre-installation meeting before starting any trade work in the field, between the Owner's Trade Inspector(s), the Contractor and subcontractor(s). The contractor performing the work (which may be the Contractor if self-performing or a subcontractor) must be in attendance at this meeting. The pre-installation meeting will review the installation and inspection protocol (quality control, workmanship expectations, means and methods etc.) and review project specifications and drawings with the Contractor and subcontractor(s). The pre-installation meetings shall be specified when applicable for the following work:

- Concrete formwork and placing
- Waterproofing
- Mortar / masonry
- Flashing
- Roofing
- Sealant
- Vapor Barrier
- Painting and Drywall
- Fire Sprinkler
- Fire Alarm
- HVAC
- Plumbing
- Electrical
- Datacom/ITS
- Site Utilities
- Landscaping and Irrigation
- Refer to FS#15 for additional requirements.
- Owner may require additional pre-installation meetings depending on the scope of work.

Section Number | Title

Acknowledgement of the Pre-Installation Meeting is required on the FS#15 form prior to any inspections being performed.

Contractor shall schedule a subsequent inspection when 10 – 15% of the work reviewed in the pre-installation meeting to verify proper installation practices are implemented.

01 31 26 Electronic Communication Protocols

All communications on the project are to go through the Owner's Project Manager.

01 32 00 Construction Progress Documentation

01 32 13 Scheduling of Work

In general, hours of construction activity shall be limited to 7 a.m. until 7 p.m., Monday through Friday, unless written approval is obtained from Owner (Project Manager). Additionally, the Contractor shall agree to limit any noisy activities during "reading week" and "finals week". Reading Week and Finals Week generally occur during the first weeks of May and December.

Year-round, project work adjacent to or within Residence Halls shall be more strictly limited to the hours of 8:00 a.m. until 6:00 p.m., unless written approval is obtained from the Owner. In addition to these hours, work performed on weekends will not be permitted without prior authorization from Owner.

01 32 16 Construction Progress Schedule

The following requirements shall support and amplify the requirements of the Construction Agreement between Owner and Contractor.

In conjunction with the Contractor's construction schedule, the Contractor shall provide a procurement schedule for all major project components to be purchased and incorporated by the Contractor into the project.

The procurement schedule shall indicate scheduled delivery of major project components, both equipment and materials, in support of the activities included on the Contractor's construction schedule.

Revisions to the Contractor's construction schedule shall be coordinated with revisions to the procurement schedule.

In the event significant delays or lags in schedule, as determined by the Owner, are encountered, the Contractor shall provide to the Owner a revised Contractor's Construction Schedule indicating proposed rescheduling of subsequent activities to achieve project completion by the Contract Completion Time or Amended Completion Time.

Additions to or deletions from the Contract, authorized through Change Orders, shall be reflected in the Contractor's construction schedule.

Owner's Approval of Phasing

The Owner reserves the right to review and approve scheduling or phasing of construction activities.

Contractor shall be aware of the impact of construction activities on Owner's functions and operations and shall advise the Owner when they may be impacted by the schedule. The Contractor shall act to lessen or avert impact to Owner operations through alternative phasing of activities or other measures.

01 32 19 Submittals Schedule

The Contractor is required to make submittals for the DP and Owner review in a prompt and timely manner. A schedule of submittals is to be delivered to the Owner within *15 business* days of the notice to proceed. Submittals are required for each subsection detailed in the individual sections of Divisions 2 through 48.

01 32 23 Survey and Layout Data

All underground utilities installed or exposed by Contractor shall have survey points taken and indicated on the as-built drawings with utility descriptor, pipe size, material, and any other pertinent data. These need to be presented for review prior to backfilling a section, or as indicated in Division 33.

Points shall be taken at a minimum of every 20 feet plus at any connections, valves, bends, rises/falls and points where other utilities are crossed. In the event that existing utilities are exposed during construction then one point will be taken on the exposed utility at the exposed location or crossing for trench widths of 3 feet or less. Trench widths wider than 3 feet shall have a point taken on the exposed utility where it crosses the newly installed utility and where it enters and exits the trench. Any exposed connections, valves, bends, and rises/falls shall have points taken as well.

Survey data – Control points established for a project are preferred to be at locations easily identifiable from aerial imagery. Examples include corners were

asphalt and concrete intersect, distinct corners of pedways and sidewalks, the center of circular utility manhole covers, etc. A few examples are circled in yellow in the image below. A project should contain a minimum of three control points per Civil Site Utilities As-Built sheet that are visible from aerial imagery and mapped on the As-Built. If that is not possible then points are to be collected for features visible from aerial imagery, using the same technology (GPS or total station survey) and coordinates supplied to NAU. Control points and points visible from aerial imagery will be documented with photographs (see photographic documentation section) and written descriptions and used for GIS georeferencing purposes.

A list of coordinate values will be provided for control points and all other utility points collected as well as a comment/note of what the point is of (ex. 8” waterline bend) as well as include projection and datum information, specifically scale factor, datum, and spheroid/ellipsoid information. Preferably, the data is delivered in the following spatial reference system.

The LDPm System is defined by the following conditions:

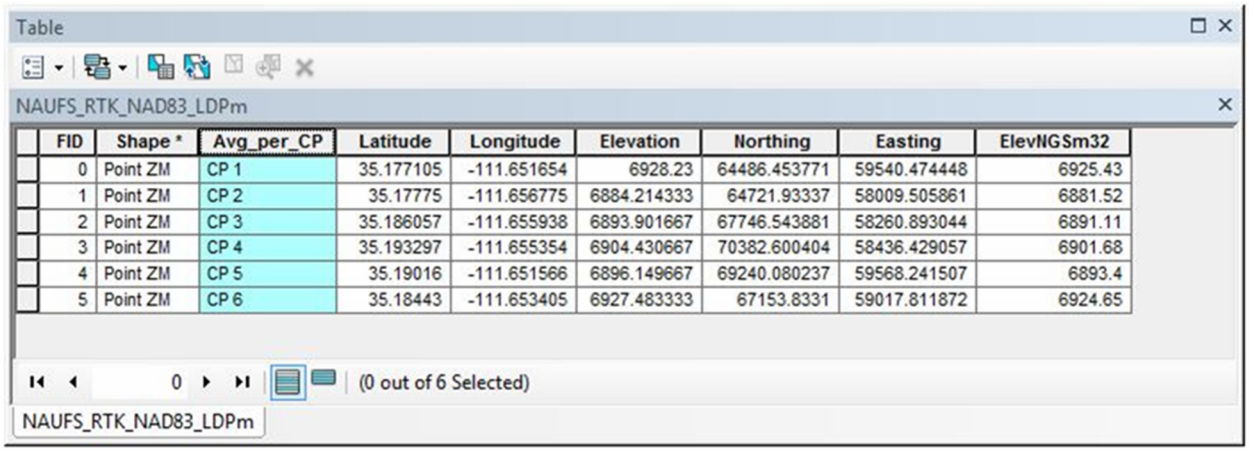
Arizona LDP (Meters)

Section Number | Title

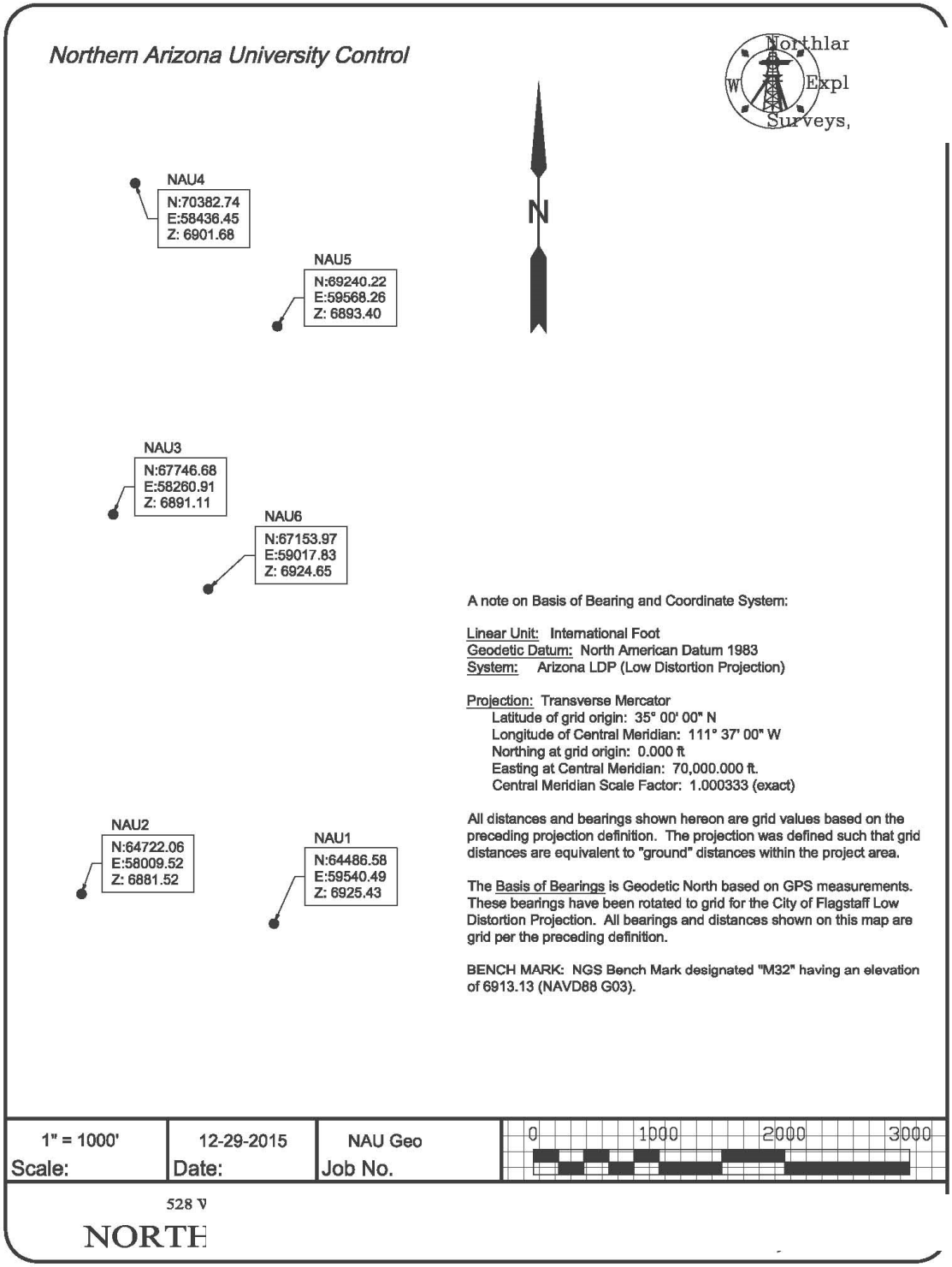
Authority: Custom

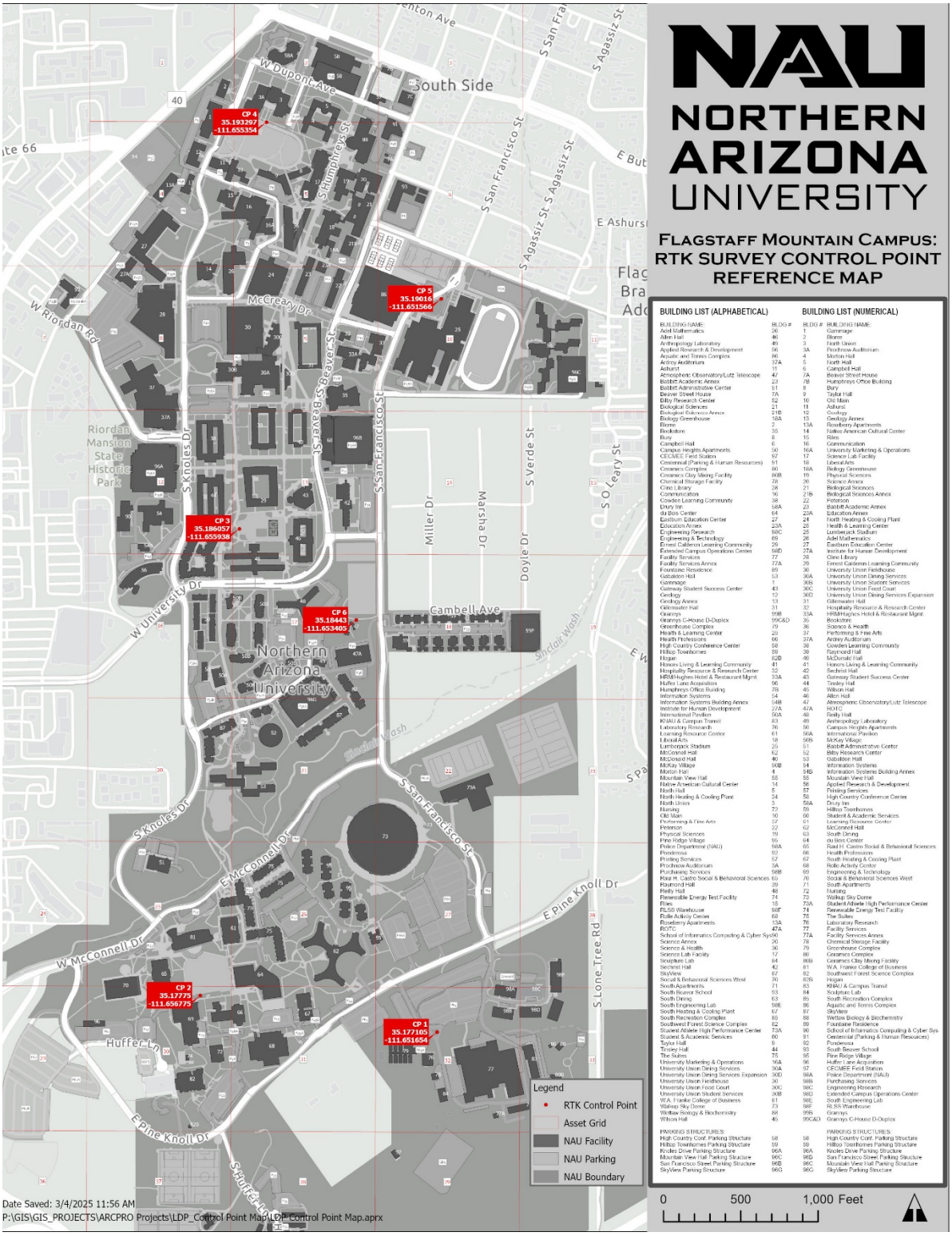
Projection: Transverse_Mercator
False_Easting: 21336.0
False_Northing: 0.0
Central_Meridian: -111.616667
Scale_Factor: 1.000333
Latitude_Of_Origin: 35.0
Linear Unit: Meter (1.0)
Where the basis of bearing is Geodetic North based on GPS measurements. These bearings have been rotated to grid for the City of Flagstaff LDP.
BENCHMARK: NGS Bench Mark designated 'M32' having an elevation of 6913.13 (NAVD88 G03)
(see corresponding map below)

The Lat/Long/elevation control point coordinates (converted to feet) are as follows:



FID	Shape *	Avg_per_CP	Latitude	Longitude	Elevation	Northing	Easting	ElevNGSm32
0	Point ZM	CP 1	35.177105	-111.651654	6928.23	64486.453771	59540.474448	6925.43
1	Point ZM	CP 2	35.17775	-111.656775	6884.214333	64721.93337	58009.505861	6881.52
2	Point ZM	CP 3	35.186057	-111.655938	6893.901667	67746.543881	58260.893044	6891.11
3	Point ZM	CP 4	35.193297	-111.655354	6904.430667	70382.600404	58436.429057	6901.68
4	Point ZM	CP 5	35.19016	-111.651566	6896.149667	69240.080237	59568.241507	6893.4
5	Point ZM	CP 6	35.18443	-111.653405	6927.483333	67153.8331	59017.811872	6924.65


Northern Arizona University Control
Northlar
W Expl
Surveys,
N
NAU4
N:70382.74
E:58436.45
Z: 6901.68
NAU5
N:69240.22
E:59568.26
Z: 6893.40
NAU3
N:67746.68
E:58260.91
Z: 6891.11
NAU6
N:67153.97
E:59017.83
Z: 6924.65
NAU2
N:64722.06
E:58009.52
Z: 6881.52
NAU1
N:64486.58
E:59540.49
Z: 6925.43
A note on Basis of Bearing and Coordinate System:
Linear Unit: International Foot
Geodetic Datum: North American Datum 1983
System: Arizona LDP (Low Distortion Projection)
Projection: Transverse Mercator
Latitude of grid origin: 35° 00' 00" N
Longitude of Central Meridian: 111° 37' 00" W
Northing at grid origin: 0.000 ft
Easting at Central Meridian: 70,000.000 ft.
Central Meridian Scale Factor: 1.000333 (exact)
All distances and bearings shown hereon are grid values based on the preceding projection definition. The projection was defined such that grid distances are equivalent to "ground" distances within the project area.
The Basis of Bearings is Geodetic North based on GPS measurements. These bearings have been rotated to grid for the City of Flagstaff Low Distortion Projection. All bearings and distances shown on this map are grid per the preceding definition.
BENCH MARK: NGS Bench Mark designated "M32" having an elevation of 6913.13 (NAVD88 G03).
1" = 1000'
Scale:
12-29-2015
Date:
NAU Geo
Job No.
0
1000
2000
3000
528 V
NORTH



BUILDING LIST (ALPHABETICAL)

BUILDING NAME:	BLDG #
Adel Mathematics	26
Allen Hall	46
Anthropology Laboratory	49
Applied Research & Development	56
Aquatic and Tennis Complex	90
Ardrey Auditorium	37A
Ashurst	11
Atmospheric Observatory/Lutz Telescope	47
Babbitt Academic Annex	23
Babbitt Administrative Center	61
Beaver Street House	7A
Bilby Research Center	62
Biological Sciences	21
Biological Sciences Annex	21B
Biology Greenhouse	18A
Blome	2
Bookstore	35
Bury	8
Campbell Hall	6
Campus Heights Apartments	50
CEFMEE Field Station	97
Centennial (Parking & Human Resources)	91
Ceramics Complex	80
Ceramics Clay Mixing Facility	80B
Chemical Storage Facility	78
Cline Library	28
Communication	16
Cowden Learning Community	38
Drury Inn	58A
du Bois Center	64
Eastburn Education Center	27
Education Annex	25A
Engineering Research	98C
Engineering & Technology	69
Ernest Calderon Learning Community	25
Extended Campus Operations Center	98D
Facility Services	77
Facility Services Annex	77A
Fountaine Residence	89
Gabaldon Hall	53
Gammage	1
Gateway Student Success Center	43
Geology	12
Geology Annex	13
Gillenwater Hall	31
Giannys	99B
Giannys C-House D-Duplex	99C&D
Greenhouse Complex	79
Health & Learning Center	28
Health Professions	66
High Country Conference Center	58
Hilltop Townhomes	88
Hogan	82B
Honors Living & Learning Community	41
Hospitality Research & Research Center	32
HRM/Hughes Hotel & Restaurant Mgmt	33A
Huffer Lane Acquisition	96
Humphreys Office Building	7B
Information Systems	54
Information Systems Building Annex	54B
Institute for Human Development	27A
International Pavilion	50A
KNAU & Campus Transit	83
Laboratory Research	76
Learning Resource Center	61
Liberal Arts	18
Lumberjack Stadium	29
McConnell Hall	62
McLeod Hall	40
McKay Village	90B
Morton Hall	4
Mountain View Hall	55
Native American Cultural Center	14
North Hall	5
North Heating & Cooling Plant	24
North Union	3
Nursing	72
Old Main	10
Performing & Fine Arts	37
Peterson	22
Physical Sciences	19
Pine Ridge Village	95
Police Department (NAU)	98A
Ponderosa	92
Printing Services	67
Prochnow Auditorium	3A
Purchasing Services	98B
Raul H. Castro Social & Behavioral Sciences	69
Raymond Hall	39
Reilly Hall	48
Renewable Energy Test Facility	74
Ribes	95
RLSS Warehouse	98F
Rolfe Activity Center	68
Roseberry Apartments	13A
ROTC	47A
School of Informatics Computing & Cyber Sys	90
Science Annex	20
Science & Health	30
Science Lab Facility	17
Sculpture Lab	64
Sechrist Hall	42
SkyView	97
Social & Behavioral Sciences West	70
South Apartments	71
South Beaver School	93
South Dining	63
South Engineering Lab	98E
South Heating & Cooling Plant	67
South Recreation Complex	85
Southwest Forest Science Complex	82
Student Athlete High Performance Center	73A
Student & Academic Services	60
Taylor Hall	9
Tinsley Hall	44
The Suites	75
University Marketing & Operations	16A
University Union Dining Services	30A
University Union Dining Services Expansion	30D
University Union Fieldhouse	30
University Union Food Court	30C
University Union Student Services	30B
W.A. Franke College of Business	81
Walsh Sky Dome	73
Wettaw Biology & Biochemistry	86
Wilson Hall	45
PARKING STRUCTURES:	
High Country Conf. Parking Structure	58
Hilltop Townhomes Parking Structure	88
Knoles Drive Parking Structure	96A
Mountain View Hall Parking Structure	96C
San Francisco Street Parking Structure	96B
SkyView Parking Structure	96G

BUILDING LIST (NUMERICAL)

BLDG #	BUILDING NAME:
1	Gammage
2	Blome
3	North Union
3A	Prochnow Auditorium
4	Morton Hall
5	North Hall
6	Campbell Hall
7A	Beaver Street House
7B	Humphreys Office Building
8	Bury
9	Taylor Hall
10	Old Main
11	Ashurst
12	Geology
13	Geology Annex
13A	Roseberry Apartments
14	Native American Cultural Center
15	Ribes
16	Communication
16A	University Marketing & Operations
17	Science Lab Facility
18	Liberal Arts
18A	Biology Greenhouse
19	Physical Sciences
20	Science Annex
21	Biological Sciences
21B	Biological Sciences Annex
22	Peterson
23	Babbitt Academic Annex
25A	Education Annex
26	Adel Mathematics
27	Eastburn Education Center
27A	Institute for Human Development
28	Cline Library
29	Ernest Calderon Learning Community
30	University Union Fieldhouse
30A	University Union Dining Services
30B	University Union Student Services
30C	University Union Food Court
30D	University Union Dining Services Expansion
31	Gillenwater Hall
32	Hospitality Resource & Research Center
33A	HRM/Hughes Hotel & Restaurant Mgmt
35	Bookstore
36	Science & Health
37	Performing & Fine Arts
37A	Ardrey Auditorium
38	Cowden Learning Community
39	Raymond Hall
40	McDonald Hall
41	Honors Living & Learning Community
42	Sechrist Hall
43	Gateway Student Success Center
44	Tinsley Hall
45	Wilson Hall
46	Allen Hall
47	Atmospheric Observatory/Lutz Telescope
47A	ROTC
48	Reilly Hall
49	Anthropology Laboratory
50	Campus Heights Apartments
50A	International Pavilion
50B	McKay Village
51	Babbitt Administrative Center
52	Bilby Research Center
53	Gabaldon Hall
54	Information Systems
54B	Information Systems Building Annex
55	Mountain View Hall
56	Applied Research & Development
57	Printing Services
58	High Country Conference Center
58A	Drury Inn
59	Hilltop Townhomes
60	Student & Academic Services
61	Learning Resource Center
62	McConnell Hall
63	South Dining
64	du Bois Center
65	Raul H. Castro Social & Behavioral Sciences
66	Health Professions
67	South Heating & Cooling Plant
68	Rolfe Activity Center
69	Engineering & Technology
70	Social & Behavioral Sciences West
71	South Apartments
72	Nursing
73	Walsh Sky Dome
73A	Student Athlete High Performance Center
74	Renewable Energy Test Facility
75	The Suites
76	Laboratory Research
77	Facility Services
77A	Facility Services Annex
78	Chemical Storage Facility
79	Greenhouse Complex
80	Ceramics Complex
80B	Ceramics Clay Mixing Facility
81	W.A. Franke College of Business
82	Southwest Forest Science Complex
82B	Hogan
83	KNAU & Campus Transit
84	Sculpture Lab
85	South Recreation Complex
86	Aquatic and Tennis Complex
87	SkyView
88	Wettaw Biology & Biochemistry
89	Fountaine Residence
90	School of Informatics Computing & Cyber Sys
91	Centennial (Parking & Human Resources)
92	Ponderosa
93	South Beaver School
95	Pine Ridge Village
96	Huffer Lane Acquisition
97	CEFMEE Field Station
98A	Police Department (NAU)
98B	Purchasing Services
98C	Engineering Research
98D	Extended Campus Operations Center
98E	South Engineering Lab
98F	RLSS Warehouse
98G	Giannys
99C&D	Giannys C-House D-Duplex
PARKING STRUCTURES:	
58	High Country Conf. Parking Structure
88	Hilltop Townhomes Parking Structure
96A	Knoles Drive Parking Structure
96B	San Francisco Street Parking Structure
96C	Mountain View Hall Parking Structure
96G	SkyView Parking Structure

Projection:

NAD_1983_StatePlane_Arizona_Central_FIPS_0202_Feet
Projection: Transverse_Mercator
False_Easting: 699998.600000
False_Northing: 0.000000
Central_Meridian: -111.916667
Scale_Factor: 0.999900
Latitude_Of_Origin: 31.000000
Linear Unit: Foot_US (0.304801)

Geographic Coordinate System:

GCS_North_American_1983
Angular Unit: Degree (0.017453292519943299)
Prime Meridian: Greenwich (0.000000000000000000)
Datum: D_North_American_1983
Spheroid: GRS_1980
Semimajor Axis: 6378137.000000000000000000
Semiminor Axis: 6356752.314140356100000000
Inverse Flattening: 298.257222101000020000

Drawings

Projects will have a minimum of three control points per Civil Site Utilities As-Built sheet that are visible on aerial imagery. Other utility GPS/survey data is to be included in the Record Drawings including information from comments/notes.

Layers to be included are:

1. Electric on layer ELEC (red).
2. Telephone on layer TELE (orange).
3. Gas on layer GAS (yellow).
4. Water on layer H2O (blue).
5. Storm/sewer on layer STRM (green).
6. Fire lines and hydrant locations on layer FIRE (blue).
7. Reclaimed water (purple).
8. Survey lines/ Easement (pink)
9. Steam
10. Hot Water
11. Chilled Water

Section Number | Title

Other helpful features include:

Buildings on layer BLDG (green) – not to be used for GIS georeferencing.
Sidewalks on layer WALK (white).
Miscellaneous structures on layer MSTR (blue).
Curb and gutter on layer C&G (cyan).
Vegetation (including plants, trees, shrubs and *all* landscaping) on layer VEG (green).
Parking on layer PARK (yellow).

Alternatives to this need approval from Utility Services.

01 32 26 Construction Progress Reporting

The Contractor shall maintain a written daily log in accordance with the Construction Agreement.

01 32 33 Photographic Documentation

Photos are required on projects as determined by Owner, submitted electronically with pay application, and representative of the work for which the pay application is for. Photographs shall be a minimum of 5 megapixels. A description of photos required will be discussed at the preconstruction meeting. The photo's file name shall be labeled with first the location of the photo, direction of view and then description. Exterior locations must provide the location with GPS coordinates.

01 32 43 Procurement Tracking

Included in the Contractor's critical path schedule, the Contractor shall provide procurement durations for all major project components (equipment and material) to be purchased (regardless if purchased by Owner or Contractor).

Expediting reports/schedule corrections shall be provided by the Contractor to the Owner in the event that scheduled deliveries, of a significant nature, do not arrive as planned and the Contractor shall make all reasonable effort to expedite deliveries in accordance with the original schedule.

Time submitted by the Contractor on the basis of delayed material or equipment deliveries, shall be accompanied by documentation from the vendor/supplier indicating the date order was placed, usual time required for delivery and the date of scheduled delivery.

Section Number	Title
01 33 00	**Submittal Procedures** Provide complete submittals. Diagrams shall show installed component model numbers; block diagrams do not constitute an acceptable schematic. There shall be a separate submittal for each of the first-4 digits of the CSI divisions, as needed. For example, a separate submittal is needed for Division 26 05 as opposed to a submittal for Division 26 09.
01 33 13	Certificates Provide certificates as required by Contract Documents.
01 33 16	Design Data
01 33 19	Field Test Reporting Copies of Field Test Reports will be turned over monthly along with the Pay Application.
01 33 23	Shop Drawings, Product Data, and Samples The Submittal Procedure shall be per the requirements of the Construction Agreement.
01 33 29	Sustainable Design Reporting
01 33 29.06	Reused Product Form *N/A*
01 35 00	**Special Procedures**
01 35 13	Special Project Procedures *N/A*
01 35 13.26	Special Project Procedures for Clean Rooms *N/A*
01 35 13.43	Special Project Procedures for Contaminated Sites *N/A*
01 35 23	Owner Safety Requirements The Contractor's responsibility for project safety is according to OSHA/ADOSH regulations, the EHS Contractor Safety Program (found at https://in.nau.edu/environmental-health-and-safety/occupational-safety/), and the Construction Agreement, which requires submitting a written safety plan to Owner and DP. This safety plan shall be based on contractor performed job hazard assessment (JHA) of the project or work site. Safety Plans shall include the name

and contact information of the contractor/vendor safety officer, emergency contact information, information on hazards likely to be encountered on the work site, work site PPE requirements, and ~~any~~ safety training requirements, training logs or proof of certification, and Job Hazard Analyses (JHA's) for the planned activities which list the task/job steps, anticipated hazards, hazard controls, and required PPE. Contractor shall use their own JHA form and submit to Contractor. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with Contractor's Work.

The Contractor shall designate an employee as Safety Officer at the Project Site whose duties shall include prevention of accidents and monitoring/enforcement of the Contractor's safety program.

The Contractor's Safety Officer shall attend the preconstruction meeting.

The Contractor's Safety Officer will be responsible for continued monitoring of the job site to maintain safe working conditions in strict compliance with applicable State of Arizona Occupational Safety and Health Standards for the Construction Industry (29 CFR Part 1926), including Housekeeping (Section 1926.25, ADOSH, 29 CFR Part 1926).

The Contractor and all subcontractors shall clear away all debris which poses an unsafe condition as required in Section 1926.25 on a daily basis.

Failure of the Contractor to promptly correct unsafe conditions, subsequent to written or other documented notification by the Owner, shall constitute violation of the standards indicated herein. The Owner reserves the right, in the event of such violation, to correct unsafe conditions through the most expedient means available. Any costs incurred by the Owner for such corrective work shall be reimbursed by the Contractor, via deductive Change Order.

Additional or specific information regarding Contractor Roles and Responsibilities for safety can be found in the EHS Contractor Safety Program manual (https://in.nau.edu/environmental-health-and-safety/occupational-safety/). This information includes campus safety program information and expectations but may not be comprehensive. It is the responsibility of the Contractor to take adequate steps to ensure safety at the work site.

All design professionals and contractors as well as their subconsultants and subcontractors shall be aware of the *NAU Safe* app, which is Owner's official safety app. The app features notifications and alerts, tools for responding to an emergency, tips for staying safe on campus, and other enhanced features. All

Section Number | Title

external personnel working on campus are encouraged to download the app in order to receive important emergency notifications regarding events occurring on campus that may impact safety. Information regarding the app and how to download it can be found on Owner's website at https://in.nau.edu/its/nausafe/.

01 35 26 Governmental Safety Requirements

All employees of the Contractor or subcontractors shall have adequate safety training for their respective facets of the work as specifically required by document #2254, Training Requirements and OSHA Standards and Training Guidelines (USDA, OSHA 2015).

01 35 29 Health, Safety, and Emergency Response Procedures

Contractor will receive the FS28 – Project Specific Emergency Contacts form from the Owner Project Manager at the project kickoff meeting. Information on how to proceed during an emergency will be provided at that meeting.

01 35 29.13 Health, Safety, and Emergency Response Procedures for Contaminated Sites

This information can be obtained from the Owner's Office of Environmental Health & Safety. https://in.nau.edu/environmental-health-and-safety/

01 35 43 Environmental Procedures

The Owner shall have first right of refusal on all materials and equipment which are removed as part of the Project construction process to include materials both above and below the existing ground surface.

Contractor shall notify the Owner prior to disposing of such materials and equipment. Owner will notify the Contractor promptly if possession is to be taken by the Owner.

Materials not claimed by the Owner within three working days of notification of impending disposal shall be removed from the Project site by the Contractor and disposed of appropriately.

Hazardous Materials Procedures

Any hazardous construction materials must be removed and disposed of in compliance with all applicable regulatory standards. If hazard abatement is required, these activities must be completed prior to the commencement of other activities that would disturb the materials in question or result in hazard to workers or building occupants. If previously undiscovered materials, which are known/suspected to be hazardous are encountered, the Contractor is responsible for stopping work and contacting the Owner (Office of Environmental Health &

Safety [EHS] and the Project Manager) to determine the appropriate action before proceeding. Owner may have regulatory obligations for shipping and tracking of hazardous waste streams. The Contractor is responsible for coordinating with the Owner before disposal of any removed hazardous construction materials.

The Contractor shall inform Owner (Office of Environmental Health & Safety (EH&S) and the Project Manager) of any hazardous chemicals they will be using on campus. The Contractor shall comply with the requirements specified in OSHA's Hazard Communication program (29 CFR 1910.1200). The Contractor shall assume responsibility for the safe and legal disposal of all chemicals used on the job site. If any hazardous waste is generated on site as a result of a project, please contact Owner (EHS) for determination of whether the waste must be disposed of in accordance with EPA regulations.

To maintain compliance with all applicable state and Federal EPA and OSHA regulations, Owner's policy requires that a site-specific hazard inspection be completed to determine the need for abatement before any work involving the disturbance of pre-existing building components is conducted. This inspection may be requested by Owner via the online Worksite Hazard Inspection (FS13) Request Form, which is available at https://in.nau.edu/environmental-health-and-safety/forms/. This form must be signed by Contractor prior to commencing work. Any other required asbestos information and guidance may be requested directly by contacting EH&S at https://in.nau.edu/environmental-health-and-safety/contact-form/. Inspections may involve additional sampling of previously untested materials, and may facilitate the need for NESHAP notified abatement work, so an appropriate amount of lead time must be allotted in the project schedule.

To satisfy its obligations under OSHA, Owner will issue a written notification of the presence of asbestos and other hazards in the work area and building in which work is being conducted; and specific abatement requirements, which may be required for the project. The Contractor is responsible for the health and safety of its own employees and for meeting OSHA requirements for communication of hazard, training, and PPE. Worker compliance with all applicable regulations shall be enforced by the Contractor.

Lead Abatement

This information can be obtained from the Owner (EHS).

Mercury Disposal

This Information can be obtained from the Owner (EH&S)

PCB Disposal

This information can be obtained from the Owner (EH&S)

Asbestos Abatement

NAU has completed asbestos surveys for the majority of buildings currently present on the Flagstaff Campus and remote campuses. Survey results are housed in the NAU Environmental Health and Safety office and are available for review or notification purposes.

All asbestos-containing materials (ACM) which are scheduled for disturbance are to be removed, containerized, and disposed of in accordance with all applicable Federal, State, and Local regulations. This work must be performed by NAU or by a licensed asbestos abatement contractor before any other work which may impact the materials in question. Work must be scheduled and performed in a manner which minimizes the chance of contamination of non-asbestos materials. The asbestos removal work must comply with the NESHAP (40 CFR 61, subpart M), AHERA (40 CFR 763, subpart E), and OSHA Asbestos construction standard (29 CFR 1926.1101) and general industry standard (29 CFR 1910.1001), whichever may apply. NAU specifically requires that floor tile be removed inside a standard class II containment area (e.g. Critical barriers, shower decon, negative pressure, splash guards when applicable). ACBM roofing materials be removed by certified asbestos workers in a regulated work are using appropriate engineering and work controls. Regulatory exemptions for these materials do not meet NAU campus standards. Category I and II Non-Friable materials that are located on the exterior of the building, may be removed within a regulated area that meets the applicable OSHA requirements. If the exterior non-friable materials are to be rendered into Regulated Asbestos Containing Material (RACM) or if RACM to be removed is located on the exterior of the building, the removal will be conducted within a containment under negative pressure with all the OSHA requirements.

By Default, abatement activities are the responsibility of Owner and may not be subcontracted as part of the larger construction project without prior authorization from the Owner's Environmental Health and Safety Office.

When Owner performed abatement is necessary, the Owner's Project Manager will work in cooperation with EHS to develop specifications, collect bids, and contract/complete any necessary abatement independently from the larger construction contract and, unless otherwise authorized by EHS, abatement shall

be completed prior to commencement of any other construction activities at the work site.

In cases where abatement is performed by the Contractor, or by a subcontractor retained by the Contractor, the Contractor or abatement subcontractor must meet the minimum requirements for qualifications and insurance for abatement contractors under the Arizona State purchasing system. The Contractor shall work with the Owner or an Owner retained representative (Consultant) to thoroughly inspect the work area, develop abatement scope and schedule, collect bids from Owner-approved abatement vendors, and execute abatement consistent with the regulations and requirements identified in this standard. In the event that deficiencies, additional hazards, or inappropriate work practices are noted, the Owner or Owner representative may exercise stop work authority as necessary to facilitate corrective actions.

Oversight for abatement services shall be conducted by Owner or by an approved third-party oversight contractor. No additional demolition or renovation activities may proceed in the selected abatement area until the work has been cleared by the oversight contractor and/or Owner. The oversight contractor or Owner will have the authority to stop work immediately if abatement or demolition procedures are found to be inadequate to control the release of asbestos fibers, or if asbestos is being disturbed in an uncontrolled or unsafe manner.

Owner will issue a written or verbal authorization to proceed with non-asbestos demolition/renovation activities following achievement of acceptable clearance of the asbestos abatement. Prior to authorization to proceed, the oversight contractor or Owner (EH&S) must complete a visual inspection and/or analytical sampling of the area to document completeness of the work. If contamination is found following abatement, the abatement contractor will be required to perform additional cleaning, at no additional cost to Owner, until acceptable levels are achieved. No other non-asbestos work may commence until all necessary abatement has been completed and authorization to proceed has been furnished by the Owner (EH&S).

It is the responsibility of the construction or demolition contractor to furnish an accurate work schedule to the Owner in order to allow for timely abatement and good coordination between other trades/subcontractors. The construction/demolition contractor may be held accountable for additional fees incurred by the Owner due to improper scheduling or communication on the part of the Contractor.

Following completion of all abatement activities, the abatement/oversight contractor shall provide copies of closeout documents including the date, location, and scope of work; negative exposure assessment; and air sampling data, daily logs, and waste shipment records. Copies of all closeout documents shall be furnished to both the Owner's Project Manager and Owner's Material Safety office.

The Contractor shall comply with the National Emission Standard for Hazardous Air Pollutants (NESHAP), 40 CFR 61, subpart M, enforced by the Arizona Department of Environmental Quality, regulating the removal and disposal of asbestos-containing materials.

The abatement contractor will be required to notify the State of Arizona Department of Environmental Quality NESHAP office 10 business days before removal of threshold amounts of friable asbestos or RACM as specified in 40 CFR 61.145. The Contractor shall send a copy of this notice to the Owner's Asbestos Program Manager. A NESHAP notification is also required 10 days prior to commencement of demolition of any building on Owner campus even if no asbestos abatement is required. Filing of the Demolition NESHAP notification is the responsibility of the demolition or construction contractor.

During and following completion of the renovation, all newly installed building materials shall be analyzed for asbestos and a report containing the analytical results shall be furnished to the Owner's Material Safety Office to maintain complete records of NAU buildings in the future. Testing shall conform to the guidelines set forth in the EPA AHERA regulation. This testing shall be conducted by an AHERA certified building inspector and if requested by Owner, shall be conducted by the renovation/construction contractor. This is an inspection sign off item in the Owner's FS #15 form and final sign off will not be furnished without completion of the inspection and review of the resulting report by the Owner's Material Safety office.

<u>Blasting Policy</u>

Blasting is not a preferred process on campus. Any use of explosives must be approved in writing by NAU Fire Marshal and must conform to The City of Flagstaff policies and procedures. The City of Flagstaff maintains jurisdiction for all blasting.

Prior to any blasting, the Contractor shall submit to Owner appropriate employee certification for use of explosives.

Section Number	Title
	No explosives will be stored on the campus overnight or on weekends. No quantity of explosives will be brought to the campus beyond that which will be used on the day blasting operations are to be performed.
01 35 43.13	Environmental Procedures for Hazardous Materials *N/A*
01 35 43.16	Environmental Procedures for Toxic Materials *N/A*
01 35 46	Indoor Air Quality Procedures *N/A*
01 35 53	Security Procedures Contractor is responsible for securing access to all construction areas to prevent damage or theft. This may include but is not limited to securing site fencing, temporary construction and building entrances. Work within tunnels must be in accordance with 01 41 19 Rules. Refer to Construction Agreement for any additional security requirements.
01 35 63	Sustainability Certification Project Requirements *N/A*
01 35 66	Sustainability Certification Project Procedures Owner's Project Manager is to be listed as the NAU administrator for the UGBC LEED website login.
01 35 91	Historic Treatment Procedures N/A

****END OF SECTION****

Section Number | Title

01 40 00 QUALITY REQUIREMENTS

01 41 00 Regulatory Requirements

Any work performed on or within the boundaries of the Northern Arizona University campus shall be subject to special inspections, periodic inspections, Code compliance inspections, and pre-occupancy and/or final inspections by the following agencies as applicable:

- State Fire Marshal's Office
- Arizona Corporation Commission
- State Boiler Inspector
- State Risk Management Division
- City of Flagstaff, including Dark Sky ordinance
- Coconino County
- State Elevator Inspector
- NAU Facility Services
- National Emissions Standards for Hazardous Air Pollutants (NESHAP)
- Arizona Department of Environmental Quality

It is the responsibility of the Contractor to provide a complete copy of the construction plans, specifications and other pertinent documents as necessary for review and approval by the necessary agencies.

No construction shall commence until the Contractor receives from NAU Fire Marshal and NAU Building Official the approved stamped copy of the construction plans, permit, and other documents provided.

01 41 13 Codes and Standards

All design and construction work shall be done in such a manner that the completion of the project is in compliance with the following codes and standards the Owner has adopted as Code. When reference is made to "this Code" it shall mean all the codes listed below. In the event there is a conflict between any of these codes and standards, the most restrictive code shall apply.
The department of Engineering and Inspections of Northern Arizona University has marked and designated the *International Building Code 2021, including the listed codes and standards below,* excluding appendix chapters of the I codes are hereby adopted as the building codes of Northern Arizona University in the state of Arizona

- International Building Code 2021 (IBC)
- International Residential code 2021

- International Existing Building Code 2021(IEBC)
- International Energy Conservation Code 2021
- International Plumbing Code 2021(IPC)
- International Mechanical Code 2021 (IMC)
- National Electrical Code 2020 (NEC) (NFPA 70)
- International Fuel Gas Code 2021 (IFGC)
- International Fire Code 2021 (IFC)
- National Fire Alarm Code2022(NFPA 72)
- Installation of Sprinkler Systems 2022(NFPA 13)
- NAU Fire Code 2025
- Arizona State Fire Code
- 2010 ADA Standards for Accessible Design as approved by the Department of Justice on July 26, 2010 (published in the Federal Register on September 15, 2010) and any more recent related Federal and State requirements with their related standards as they may apply.
- ICC/ANSI, A117.1 – 2017, Accessible and Usable Buildings and Facilities.
    - FYI: Please be advised that where there is a conflict between any applicable accessibility requirements the most restrictive shall apply (e.g., 2021 IBC, 2010 ADA, 2017 ICC/ANSI A117.1, other NAU, State & Federal requirements, etc.).
- 2022 American Society of Mechanical Engineers (ASME) A17.1, Safety Codes for Elevators and Escalators (unless otherwise required)
    - AZ Elevator Act (Title 23, Chapter 2, Article 12)
    - Latest ADOSH Arizona Elevator Rules
- AZ Executive Order 2008-29 (FYI: Reaffirms Executive Order 2005-05. Requires all new state-funded buildings to meet the Silver LEED standard, at a minimum.)
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 55 2023
- ASHRAE 362024
- ASHRAE 62.1 2019
- ASHRAE 90.1 – 2022
- ASHRAE 189.1 – 2023
- ASHRAE 202 2024
- Arizona Revised Statutes (ARS)
- IECC 2021
- Occupational Safety and Health Administration Regulations
- NAU Material Safety Policies (e.g., Program Manuals such as Asbestos, Lead, PCB, etc.) (Most recent edition unless otherwise required) http://nau.edu/Research/Compliance/Environmental-Health-and-Safety/

Section Number | Title

- IAQ Guidelines for Occupied Buildings Under Construction (Most recent edition unless otherwise required)
- ACGIH Industrial Ventilation Manual of Recommended Practices (Most recent edition unless otherwise required)
- ANSI/AIHA Z9.5 Laboratory Ventilation2022
- NAU Design Guidelines and Technical Standards 2025

Compliance shall conform to the requirements of the latest editions of all State regulations and the various codes which have been adopted by the University at the time of selection of the Design Professional (or at time of bid if the University does not designate a Design Professional), unless otherwise required by Federal or State regulation (such as ADA code compliance which is required at time of bid).

Contractor will be held to have examined and to have become familiar with these regulations in all ways they apply to the project.

If a conflict is found between any Code requirement and information given in written or graphic specifications, Contractor will abide by the more stringent of the two. Such conflict shall be reported in writing to the DP and to Owner (NAU Fire Marshal, Building Official, and PM).

The issuance of approved plans, specifications, and computations shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of the above-listed codes, the NAU Fire Prevention Manual or the NAU Design Guidelines and Technical Standards.

The issuance of approved plans, specifications, and other data shall not prevent Owner from thereafter requiring the correction of errors in said plans, specifications and other data, nor shall issuance of such approved plans, specifications, or other data preclude the prevention of building operations being carried on thereunder when in violation of the above-listed codes.

01 41 16 Laws

By signing a contract with Owner or as a subcontractor to a general contractor that has a contract with Owner, the Contractor agrees to follow Owner's Blue Stake procedure under ARS 40-360.22.

It is the responsibility of the Contractor to make all utility staking requests. To request utility staking for any project the Contractor must submit an E-Stake request through the Arizona811 Center (http://www.arizona811.com/e-stake/)

Section Number | Title

and email Owner, per Blue Stake request form and process**.** All requests are given a log number. It is the Contractor's responsibility to note that number for future reference.

For the complete Blue Stake Procedure, Contractor shall refer to https://in.nau.edu/facility-services/dp-contract/.

DO NOT DIG UNTIL BLUE STAKING HAS BEEN CLEARED! ALL KNOWN UTILITIES MUST BE POTHOLED!

If the excavation phase is completed more than a month prior to substantial completion, Contractor shall remove the blue stake marks outside of the fenced area in a manner that does not damage finished surfaces. All projects will remove blue stake marks at substantial completion in a manner that does not damage finished surfaces. Note that the longer that the paint is on the ground the harder it is to remove.

01 41 19 Rules

The tunnels on campus are generally considered a non-permit required confined space. However, conditions may change without Owner knowledge. Prior to entry, contractors must supply their own atmospheric tester/monitor, complete an NAU Confined Space Entry Checklist, and submit this checklist to their safety officer and the Owner's project manager. If through utilization of the checklist the area is to be considered a confined space, then the contractor is responsible for their confined space safety program. This must be submitted to the Owner's project manager for documentation. Owner's confined space program is located here: https://in.nau.edu/wp-content/uploads/sites/226/2020/03/Confined-Space-Entry-Program.pdf.

No one may enter the tunnel system alone. Anyone entering the tunnel system must make contact with Owner (PM and appropriate plant operator) to provide the section of tunnel being accessed, time of entry, purpose of work and approximate time frame. Contact must be made with the appropriate Owner (plant operator) when leaving the tunnels as well.

The entry checklist can be found at: https://in.nau.edu/wp-content/uploads/sites/226/2020/03/NAUentrychecklist.pdf

01 41 23 Fees

If a Contractor requires a re-inspection because the Contractor is unprepared for the initial inspection, a fee will be assessed. The fee will be charged at the

Section Number | Title

inspector's chargeout rate per hour spent, and no less than $200. This will be at the Contractor's expense.

01 41 26 Permit Requirements

NAU permit requirements and applications can be found at: https://in.nau.edu/facility-services/dp-contract/

01 43 00 Quality Assurance

01 43 23 Installer Qualifications

Installers shall be qualified and experienced in work of similar type and scope.

- Mechanical/Chiller Technician: Installers for the new air-cooled chillers must be factory-trained and certified by the equipment manufacturer (e.g., Trane, York, or Daikin) to ensure warranty compliance.
- Controls Integrator: The contractor must have at least five years of experience integrating new HVAC components into the existing Schneider Electric/EcoStruxure Building Management System (BMS) used at NAU.
- Certified Welder: All structural welding for the new mechanical platforms must be performed by AWS D1.1 certified welders.

01 43 26 Testing and Inspecting Agency Qualifications

This section is to include project specific information which will be provided by the DP for the purposes of NAU's ARQ inspection selections.

01 43 29 Code-Required Special Inspector Qualifications

This section is to include project-specific information which will be provided by the DP for the purposes of NAU's ARQ inspection selections.

01 45 00 Quality Control

01 45 23 Testing and Inspecting Services

Please refer to https://in.nau.edu/facility-services/dp-contract/ for the complete detail of inspection procedures.

Re-inspection of uncompleted work shall be at the Contractor's expense. See 01 41 23.

Section Number | Title

All Work must be inspected and accepted by Owner. Any work required to be inspected which is covered prior to inspection, must be uncovered by Contractor at Contractor's expense.

Reinforcing steel or structural framework of any part of any building or structure shall not be covered or concealed without first obtaining approval of the DP or Structural Engineer.

Foundation Inspection: To be made after excavations for footings are complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection.

Concrete Slab or Under-Floor Inspection: To be made after all in-slab or under-floor building service equipment, conduit, piping accessories and other ancillary equipment items are in place, but before any concrete is placed or floor sheathing installed, including the sub-floor.

Frame and Rough-In Mechanical, Plumbing and Electrical Inspection: To be made after the roof, all framing, fire blocking and bracing are in place and all pipes, chimneys and vents are complete and the rough electrical, plumbing, and heating, pipes and ducts, and fire sprinkler piping are approved.

Lath and/or Gypsum Board Inspection: To be made after all lathing and gypsum board, interior and exterior, is in place but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.

Substantial Completion Inspection: Prior to issuance of the Substantial Completion Certificate, all required in progress inspections listed in form FS#15 shall be passed. The Contractor must schedule a walkthrough with each trade inspector individually to sign off on the substantial completion lines of the FS#15 and provide a punch list.

Final Completion Inspection: Prior to Final Payment the Contractor must schedule an additional walk with each trade inspector ensure that all punch work is completed and inspected, and all required inspections listed in form FS#15 shall be passed.

01 45 26 Plant Inspection Procedures
Materials must be inspected by Owner (Landscape Architect) prior to install.

01 45 33 Code-Required Special Inspections and Procedures

- Structural Steel: Periodic inspection of high-strength bolting and continuous inspection of all structural welding for the new mechanical platforms.

- Concrete: Periodic inspection of anchors and bolts cast in concrete for equipment pads.

- Mechanical Systems: Hydrostatic testing of all new chilled water piping at 150% of the working pressure for a minimum of 4 hours.

****END OF SECTION****

Section Number	Title

01 50 00 TEMPORARY FACILITIES AND CONTROLS

01 51 00 Temporary Utilities

Temporary construction utility connections are to be approved by Owner (Utility Services department) and shall be metered.

01 51 13 Temporary Electricity

Provide temporary electrical power as required for construction.
Contractor responsible.

01 51 16 Temporary Fire Protection

Provide temporary fire protection per code. Contractor responsible.

01 51 23 Temporary Heating, Cooling, and Ventilating

Provide temporary systems as needed for construction and material requirements. Contractor responsible.

01 51 26 Temporary Lighting

Provide temporary lighting for safe working conditions. Contractor responsible.

01 51 29 Temporary Natural-Gas

Temporary natural gas is not allowed. Propane may be used for temporary heating.

01 51 33 Temporary Telecommunications

Temporary telephone service is available through Owner. Contractor is responsible for all connection, maintenance, and service fees.

01 51 36 Temporary Water

Temporary water connections must have a back-flow prevention device with meter, obtained from Owner (Plumbing department) and installed by the Contractor.

01 52 00 Construction Facilities

The Contractor shall provide a staging plan/site logistic plan at the preconstruction meeting. The staging plan shall clearly identify the following items:

- Construction Trailer
- Material Staging
- Wash down areas (concrete, mud, etc.)
- Dumpsters
- Traffic Control including signals and barricades

Section Number | Title

- Signage
- Site Fencing including gate locations and height of the fence
- Site Access for contractors, material delivery and waste haul off
- Sanitary Facilities
- Temporary Utilities
- Temporary Parking
- SWPPP measures
- ADA accessible routes
- Pedestrian/bikes routes
- Vehicle routes
- Emergency Access
- Tree and Plant Protection area

Any additional provision, instruction, or arrangement approved by the Owner, Contractor, and DP must be clearly documented and reflected on the staging or site demolition plan.

01 52 13 Field Offices and Sheds

Location of field office must be approved by Owner. All utilities to the field office must be metered. Area must be restored to its original condition when field office is removed, including demolition of utilities back to the source.

01 52 19 Sanitary Facilities

Contractors shall not use Owner's sanitary facilities. Contractors are responsible for providing and maintaining adequate temporary sanitation facilities and indicate location(s) on the site logistics plan.

01 55 00 Vehicular Access and Parking

01 55 13 Temporary Access Roads

Optimum truck routes and access roads, including fire department access, to the Project site shall be identified at the pre-construction conference and noted in the site logistics plan.

01 55 19 Temporary Parking Areas

All persons driving or parking on the NAU campus are subject to NAU parking regulations. Owner's parking policies are available at https://in.nau.edu/university-transit-services/ .

All vehicles parking within campus boundaries must display permits. Vehicles without permits will be ticketed by the NAU Police Department or Parking

Section Number | Title

Services. Vehicles parked within the fenced staging / storage area identified on the Construction Documents do require parking permits. The Contractor will be required to make a written request to the Owner (Project Manager) at the preconstruction meeting for parking permits for all vehicles to be parked within the campus boundaries. NAU Parking Services will attempt to meet requests for specific parking areas; however, due to availability, alternative parking areas may be assigned. Storage / Staging areas will be requested in writing to the Owner (Project Manager) prior to bidding. They are not guaranteed to be approved where requested, but Owner will attempt to make the best accommodations possible.

01 55 26 Traffic Control

All traffic control shall be coordinated with the Owner's Project Manager, and shall be approved by NAU Parking Services, NAU Shuttle Services, NAU Police Department, NAU Fire Marshal, NAU Office of Environmental Health & Safety and City of Flagstaff Fire Department.

All proposed traffic control plans or modifications shall be submitted to the Owner's Project Manager five (5) working days prior to the proposed implementation date of the change and receive approval, as stated above.

01 55 29 Staging Areas

The Contractor shall submit a site logistics plan at the preconstruction meeting. Storage / Staging Areas must be maintained and returned to the condition they were in prior to occupation by the Contractor. The Contractor shall patch, repair or replace any and all damaged areas upon completion of the work. The area must receive final inspection and approval by the Owner prior to final payment.

01 56 00 Temporary Barriers and Enclosures

01 56 16 Temporary Dust Barriers

Dust control is the Contractor's responsibility at no additional cost to the Owner. The Contractor shall address complaints regarding dust control within four (4) hours. Air, water, surface, and subgrade conditions shall be protected from pollution by the Contractor. Such protection requirements as detailed in all State and Federal regulations shall apply. Arizona State DEQ, OSHA, and NAU Office of Environmental Health & Safety may inspect for compliance without notice.

01 56 19 Temporary Noise Barriers

Provide temporary noise control measures as required to minimize disruption to adjacent areas.

Section Number | Title

01 56 26 Temporary Fencing

Project Site Fencing

Contractor shall erect and maintain in good condition a six-foot high chain link fence of standard construction surrounding the Project site and enclosing the area of work and materials staging. Location of the fence shall be approved by the Owner prior to erection. Written approval is also required from the Director or Assistant Director for University Transit Services (Parking) prior to Contractor pounding or boring holes into the asphalt for erection of Project site fencing, where site fencing is located in a parking lot. Fence gates shall remain locked when unattended to discourage access by unauthorized persons.

This applies to large construction projects and small projects with multiple locations.

Staging Area Fencing

A commercial grade chain-link fence around the entire perimeter of the staging area will be required.

The fence may be ground-set or tee-supported, but must remain stable in high or gust wind conditions and scaling by pedestrians. The Contractor shall coordinate all fence pole locations that are to be pounded into the ground with Owner's Landscape and Outdoor Services and Blue Stake to avoid shallow utilities and irrigation. Written approval is also required from the Director or Assistant Director for University Transit Services (Parking) prior to Contractor pounding or boring holes into the asphalt for erection of staging area fencing located on a parking lot The Contractor is responsible for all repairs required to return the area to original condition after fencing is removed, including, but not limited to, sod, asphalt and concrete repair.

Post holes in asphalt will be repaired using Fastpatch DPR Pourable Asphalt Repair. Using a hot or cold patch for the post holes is not allowed.

An 8' wide, two section chain-link access gate shall be required in the fence and the Facility Services' Project Manager and Construction Manager (as applicable) shall be given a key(s) to the gate lock by the Contractor for emergency access.

Fencing shall be placed immediately after or during site preparation and remain in place for the entire duration of construction.

Section Number | Title

The staging plan shall note that the Contractor is to maintain the fence in a neat and orderly appearance.

01 56 39 Temporary Tree and Plant Protection

Part 1 – General

A. This section includes work in connection with protection of existing trees, lawn and other plants during construction, and repair and replacement necessitated as a result of construction operations.

B. Refer to Part 3 – Execution for scenarios where protection will be required.

C. Related sections:
   1. 32 84 00 Irrigation
   2. 32 91 13 Soil Preparation
   3. 32 92 00 Turf and Grasses
   4. 32 93 00 Planting
   5. 32 94 00 Planting Accessories and Mulch
   6. 32 96 00 Transplanting

D. Submittals: Prior to start of construction, the Design Professional or Contractor (if no Design Professional) shall document trees and plants to remain, including type, condition, approximate size, any structural deficiencies, and potential hazard trees. Landscaping & Outdoor Services and Campus Landscape Architect shall approve.

E. Prior to construction, Contractor to flag all trees and plants to remain or to be removed for review and approval by Owner. Use white plastic ribbon for those to remain, and orange for those to be removed.

F. Contractor qualifications: Submit qualifications of installer to perform work to Owner for approval prior to work for firm to perform all branch pruning, plant removal, root pruning, and fertilizing required by this section. Preferred installer qualifications to be certified arborist or minimum five-year's experience of similar experience.

G. Prohibited removals: Campus trees that have unique value include those part of NAU's Arboretum (Wommack Tree Walk, Littleman Tree Walk, J. Norm Grim Arboretum, and School of Forestry Tree Walk: https://in.nau.edu/greenhouse/nau-arboretum-tree-walks/), or trees

designated as donor or memorial trees, and shall be prohibited from removal. Exceptions may be granted if determined necessary by the Facilities Services Associate Vice President or the Vice President for Capital Planning & Campus Operations.

Part 2 – Products

A. Mulch for temporary protection shall be coarse ground, free from tree and woody brush, sourced from a local supplier. Minimum range of fine particles to be 3/8" inch or less and maximum size of individual pieces shall be approximately 1 to 1-1/2" in diameter with a maximum length of four to eight inches. Submit one gallon sample for approval to Campus Landscape Architect and LOS.

B. Plastic mesh fence: heavy-duty green or orange, as approved by Owner, plastic mesh fencing fabric 48" wide. Owner may request additional posts, post depth, or fabric attachments if fencing sags, leans or otherwise does not present a significant barrier to access. Provide a three-foot-wide gate for each fenced area.

C. Tree and plant protection signage: provide 8.5 x 11-inch corrugated plastic signs with white background and black text in arial font with two-inch-high letters, attached to tree protection fencing every 50 feet. Signage to read, "TREE AND PLANT PROTECTION AREA – PLEASE KEEP OUT."

D. Ground protection for vehicle and work protection shall be heavy duty, sufficient for vehicle loading over tree roots. Submit product data for Owner approval prior to placement.

Part 3 – Execution

A. To minimize disruption and protect existing tree roots, the guidelines below shall be followed:
   1. Locate poles, conduit, boxes 10' min. from tree trunk for large mature trees such as ponderosa pine or maple.
   2. Locate poles, conduit, boxes 6' min. from tree trunk for smaller mature trees such as ornamental crabapple.
   3. Never cut roots within 2' of tree trunk. Cutting of just one buttress root within 2' of tree reduces stability strength by 25%, making tree a liability

even if it survives.

4. Ideal tree protection is the entire drip line (outer edge of tree canopy). Majority of roots (80%) are in the top 2’ of soil. Where no limit of tree and plant protection is defined on the drawings, limit shall be drip line of each tree or group of trees.
5. Prior to excavation into existing soil within two feet of the limit of tree and protection area or trees to remain, root prune existing trees with vertical cuts to depth of 24 inches below existing grade. Remove all torn root ends on tree side of excavation using clean cuts and backfill immediately with existing soil.

B. Contractor shall not engage in construction activity within the tree and plant protection area without approval of Campus Landscape Architect and Landscaping & Outdoor Services, including: operating and storing equipment, supplies or materials; temporary facilities including trailers or portable toilets; vehicular or foot traffic use of area to traverse for access to other areas or for breaks.
   1. Notify Owner in writing of any conditions or conflicts that may impact successful tree and plant protections.
   2. In the event that construction activity is unavoidable within tree and plant protection area, submit plan for Owner approval to include: reason for and description of activity, time period, and remedial actions to reduce impact.

C. Prior to any construction activity at the site including utility work, grading, material storage, or installation of temporary construction facilities, install tree and plant protection fencing, signage, and mulch. Existing trees, lawn, and other plants designated to remain shall be protected with temporary fencing.
   1. Where foot traffic or storage of lightweight materials is anticipated to be unavoidable within tree and plant protection area, install five inches of mulch. Lightweight materials are packaged materials that can be physically moved by hand into the location. No bulk materials such as excavated material, soil, or aggregate shall ever be stored within tree and plant protection areas.
   2. Where light vehicle traffic is unavoidable provide eight inches of mulch.
   3. Areas where heavy vehicle traffic is unavoidable provide 8-12 inches of mulch and a layer of ground protection over the mulch. Geogrids may also be required below mulch.
   4. Owner shall approve appropriate level of protection.

D. Protect tree and plant protection area at all times from soil compaction, and from damage or contamination to trunks, bark, branches, leaves and roots from construction materials or operations. Notify Owner of any damage,

compaction or contamination and take corrective action using methods as approved by Owner.

E. Tree Removal: Refer to NAU Tree Bank for replacement of trees planned for removal. Only trees indicated by drawings as requiring removal, or those determined to be incapable of restoration to normal growth as a result of damage from construction operations, shall be removed, in a manner that will not damage adjacent plants or structures.
   1. Protect adjacent paving, soil, trees and other plants to remain from damage during all tree removal operations. Protection to include root systems, trunk, limbs, and crown, and soil from compaction.
   2. Remove stumps and grind trunk bases and large buttress roots to depth of largest buttress root or 18 inches minimum below existing grade. Remove all wood until there is less than 20 percent visible from stump hole. Backfill with native soil.
   3. Existing trees to be removed are categorized and replaced using the method below:
      a. <u>Single or Multi-Stem Deciduous Trees, and Ponderosa Pines:</u>
         Removal of a tree 6” DBH or greater but less than 15” DBH requires one (1) new 2” caliper deciduous tree or one (1) new 6’ ht. evergreen tree.
      b. Removal of a tree 15” DBH or greater but less than 24” DBH requires two (2) new 2” caliper deciduous trees, two (2) new evergreen trees at 6’ height, or one (1) evergreen tree at 10’ height.
      c. Removal of a tree 24” DBH or greater requires three (3) new 2” caliper deciduous trees, three (3) new evergreen trees at 6’ height, or two (2) evergreen trees at 10’ height.
      d. <u>Evergreen Trees (Excluding Ponderosa Pines):</u>
         Removal of a tree less than 10 feet in height requires one (1) new 6’ height tree.
      e. Removal of a tree greater than 10 feet but less than 20 feet in height requires two (2) new trees at 6’ height, or one (1) tree at 10’ height.
      f. Removal of a tree 20 ft in height or greater requires three (3) new trees at 6’ height, or two (2) trees at 10’ height.
   4. If an exception is granted for removal of a prohibited tree per Part 1. Item G this Section, values will be assessed at 1.5 times their DBH where deciduous or ponderosa pine, or 1.5 times their height where evergreen. Mitigation fees are calculated based on DBH x 1.5 less the total DBH of replacement trees.
   5. Exceptions for mitigation will be made where:
      a. Removal is considered beneficial to the health of the campus tree

canopy such as in instances of overcrowding or dense ponderosa pine tree stands;

b. Tree is an unhealthy condition and cannot be reasonably treated for survival;
c. Tree species is classified as a noxious weed by the Arizona Department of Agriculture, such as Siberian Elm or Russian Olive: https://agriculture.az.gov/pestspest-control/agriculture-pests/noxious-weeds;
d. Tree is deemed to pose a hazard to buildings or pedestrians due to leaning trunks, weak branching or structural instability;
e. Tree is not of significant size (DBH is less than six inches);
f. Tree is able to be salvaged and transplanted in accordance with Section 32 96 00 Transplanting; or
g. Tree is dead (less than 25% live limbs).

F. Plant maintenance: Contractor may be responsible for ensuring adequate water, insect and disease control, and weed removal is provided during entire construction period. Responsibility for project maintenance to be determined by Owner on case-by-case basis.
1. Contractor shall coordinate with LOS to adjust irrigation system, if available, and apply additional water as required using hoses or water tanks to all plants to be preserved.
2. Provide hand removal of weedy species in and around the fenced tree and plant protection areas at least once per month during growing season, including final weeding at end of construction period.
3. Monitor all plants to remain for disease and insect infestations during entire construction period, and provide control required as approved by Owner.

G. At end of construction period or when requested by Owner, remove all fencing, mulch, and ground protection. Make all repairs to grades, ruts, and other damage.

H. Repair and Replacement of Existing Trees, Shrubs, Lawn and Native Grasses
1. Repair all plant material and landscape areas, including native grass and forest areas, damaged by construction in a manner acceptable to Owner. Make repairs promptly after damage occurs to prevent progressive deterioration, at no additional expense to Owner.
2. Remove and replace dead and damaged plants as a result of construction which are determined by the Owner to be incapable of restoration to normal growth patterns. Damaged trees, shrubs, lawns or native grass

areas shall be removed and replaced and treated as required to conform with Division 32 specifications for fresh stock, at Contractor's expense.

3. Replace existing damaged and dead shrubs, lawns or native grass areas with similar species of equal size or the largest size plants reasonably available. Plant, maintain, and warranty as specified under Division 32 of the specifications. Restore planting areas back to preconstruction conditions including mulch or gravel.
4. Plants that are damaged shall be considered as requiring replacement in the event the damage affects more than 25% of the crown, trunk, or root protection area, or the tree is damaged in a manner that the tree could develop into a potential hazard. Tree assessment may be determined by Owner or Owner's consultant to assess health or condition.
5. Replacement of trees will be achieved by replanting with species similar to those removed, with preference for native materials or as otherwise approved by Campus Landscape Architect. Tree replacements require two (2) year warranty per Division 32.
    a. Location of replacement trees are evaluated on a case-by-case basis by Campus Landscape Architect. Where it is not possible or desirable to plant the replacement tree at the same location, trees may be installed in another campus location with suitable conditions.
    b. Campus Landscape Architect may approve installation of non-similar species at alternate locations to enhance other campus areas.
    c. In instances where project limitations such as schedule or seasonal timing preclude replacement plantings, payment is to be made from the construction project budget to the Tree Bank account. Costs are based on recent campus construction projects, and are adjusted annually for inflation (based on the Replacement Cost Basis as outlined in the Guide for Plant Appraisal prepared by the Council of Tree and Landscape Appraisers (CTLA) 10^{th} edition, which includes tree purchase, delivery, installation and establishment/warranty). In some instances, mitigation fees may also be calculated based on DBH less the total DBH of replacement trees. Refer to Tree Bank for current fee schedule.
6. Any remedial work on damaged existing plants shall be completed by the Contractor at no cost to the Owner. Remedial work can include but is not limited to soil compaction remediation, pruning, insect and disease control, compensatory watering, and mulching. Work may extend up to two years following Substantial Completion Acceptance to allow for multiple applications or seasonal timing.

Section Number	Title
01 58 00	**Project Identification**
01 58 13	Temporary Project Signage

Free-standing or hanging signs for Contractors, Sub-contractors or suppliers are not allowed on University property including individual advertising signs, banners, plaques or credits on buildings or premises, except the name of the Contractor on their trailer. Site safety signage in accordance with OSHA standards is allowed but must be approved by the NAU Project Manager. Safety signage shall be provided by Contractor at all jobsite entrances, to include NAU project name, name of Contractor, superintendent's name and contact information, and OSHA safety requirements. All signage to have final approval by Facility Services Planning, Design and Construction (FS-PDC).

Exterior NAU signage for active construction, including site wraps, jobsite signage, and construction , parking lot road or sidewalk closure signs, shall be provided and managed by FS-PDC and printed through the University's Printing Services.

01 58 16 Temporary Interior Signage

Signs for temporary construction barricades shall include University project name, name of Contractor, superintendent's name and contact information, and duration dates for closures or barricades.

Two weeks minimum advance notice shall be provided for temporary closures of student spaces.

****END OF SECTION****

Section Number	Title
01 60 00	**PRODUCT REQUIREMENTS**
01 61 00	**Common Product Requirements**
01 61 13	Software Licensing Requirements
01 66 00	**Product Storage and Handling Requirements** Refer to Agreement for information regarding on-site and off-site storage.

****END OF SECTION****

Section Number | Title

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

01 73 00 Execution

01 73 29 Cutting and Patching

Cutting and patching of asphalt and concrete may necessitate removal of embedded utility survey markers. The Contractor is required to field verify marker locations prior to bidding and include replacement of markers where necessary. Refer to Division 33 for installation standards. Verification of marker location requires sign-off on the FS#15 prior to substantial completion.

01 74 00 Cleaning and Waste Management

01 74 13 Progress Cleaning

The Contractor shall maintain all work and staging areas in a clean and orderly condition to enhance the safety and appearance of the jobsite. Accumulations of refuse will not be permitted except as specifically approved in writing by the Owner.

Contractor is responsible for removal of Blue Stake markings and returning the site to its original condition.

01 74 16 Site Maintenance

01 74 19 Construction Waste Management and Disposal

The Contractor will identify waste diversion opportunities and track waste and recycling figures for each of their respective projects. Waste and waste diversion totals should be tracked on a monthly basis and entered into the project-specific spreadsheet FS#49.

The Contractor will provide proper and adequate trash containers at no additional cost to the Owner. These containers will be emptied at regular intervals so that trash will not be allowed to overflow and/or collect around the dump area.

The placing of trash or debris in any Owner trash container by the Contractor or any subcontractor is expressly forbidden. Contractor shall be responsible for costs incurred by the Owner for the removal of trash placed in Owner trash containers.

01 74 23 Final Cleaning

Provide final cleaning of the work area prior to Owner occupancy. Final cleaning shall mean cleaning each surface or unit of work to conditions expected in a new building and high-level maintenance program. Comply with manufacturer's

instructions for cleaning operations. Cleaning shall include but not be limited to all of the following as applicable:

- Clean transparent/reflective surfaces to a polished, streak free condition including all mirrors, windows and door glass. Remove all paint, putty, labels or other vision obscuring materials. Replace any broken or damaged surfaces.
- Remove marks, stains, fingerprints, other soil and dirt from painted, decorated or stained work.
- Clean polish and/or wax woodwork as preferred by Owner.
- Clean light fixtures and lamps so as to function at full efficiency. Remove dirt, dust, fingerprints, excess lubrication, drywall, paint etc. and all non-permanent labels.
- Wipe clean all mechanical and electrical equipment; remove excess lubrication and other substances.
- Clean exposed interior and exterior surface finishes to a condition free of dirt, dust, stains, films or other noticeable distracting substance.
- Clean exterior and interior metal surfaces, including doors and windows, of oil, stains, dust, dirt, paint and the like.
- Clean and polish all hard floors, remove dirt, material or water stains, scratches etc.; clean and vacuum all carpeted areas.
- Clean plumbing fixtures to polished, sanitary condition free of stains including those resulting from water exposure.
- Landscaping and irrigation: irrigation systems and equipment to be operational with sufficient soil moisture without overwatering or soggy conditions; prune plants as required under Division 32; reset any plants that have settled or are leaning; tree guy wires to be taut; all landscape areas and planting beds to be free of weeds and any plants that do not appear on planting plan; remove all trash and debris from site boundaries to have neat and tidy appearance; clean all debris from surface water drains and paved surfaces.
- Except as otherwise indicated or requested by Owner, remove all temporary protection devices and facilities which were installed during the course of the work.

Make building ready for occupancy in all respects. Protect cleaned areas until final inspection and acceptance.

All existing improvements inside or outside the property which have been disturbed, damaged or destroyed by the Work under the Contract shall be restored to the condition in which they originally were, including all storage and staging areas. If concrete work was undertaken as part of the project, all debris or excess materials shall be removed from site and the area left in a clean and tidy

state. Final inspection of storage / staging areas used during construction is required prior to final payment.

If the Contractor fails to clean up during, or at the completion of the Work, or fails to enforce such clean up by subcontractors, the Owner, subsequent to advising the Contractor in writing, may after five (5) working days proceed to perform clean-up of areas which pose a threat to life/safety or are excessively unsightly. The cost of cleaning provided by the Owner under this condition shall be borne by the Contractor, via deductive Change Order.

01 75 00 Starting and Adjusting

01 75 13 Checkout Procedures

Coordinate system startup and checkout with applicable trades and manufacturers.

01 75 16 Startup Procedures

Signoff from the Owner (Utility Services department) on the FS #15 is required before any utility is energized. Refer to Division 33 for individual utility requirements.

The Preliminary Balance Report shall have been submitted by the Contractor to the Owner prior to, and as a requirement of, Substantial Completion.

The Final Balance Report shall have been submitted by the Contractor to the Owner prior to, and as a requirement of, Final Completion.

Systems start-up, commissioning, and balancing shall be 100% complete prior to, and as a requirement of, Final Completion.

Any additional information to be provided by the Design Professional.

01 77 00 Closeout Procedures

01 77 13 Preliminary Closeout Reviews

The Contractor shall request the Owner to schedule a closeout meeting to be scheduled 30 days prior to substantial completion.

01 77 16 Final Closeout Review

Section Number | Title

The Contractor will schedule a meeting with the Owner and DP when the all the document packages are ready for the individual substantial completion, final completion and final payment phases.

01 77 19 Closeout Requirements

For all closeout requirements, please refer to the Construction Agreement located at https://in.nau.edu/facility-services/dp-contract/

All contracts are listed under "Contracts". Please refer to the appropriate contract's closeout requirements specific to the project you are contracted for.

01 78 00 Closeout Submittals

01 78 23 Operation and Maintenance Data

01 78 23.13 Operation Data

Upon completion of the installation of all work specified in Construction Documents, and prior to Final Completion, Contractor shall furnish to the DP for review; one (1) complete bound copy and one (1) electronic copy of operating and maintenance instructions and parts lists for all material and equipment, including electrical and control items, being supplied. Upon receipt of review, the Contractor shall submit three (3) complete bound corrected copies and one (1) electronic corrected copy of the operating and maintenance instructions and parts list for all material and equipment in divisions 2-48. **Operation and maintenance manuals for <u>all</u> specified equipment and systems shall be provided as part of the contractor's base bid.**

Assemble Operation and Maintenance (O&M) Manuals in hard-back 3-ring loose leaf binders. Manuals will be organized by division will all warranties in a separate section at the back of the manual. Suitably label and index all material contained therein for ready reference.

Operating instructions shall include complete operating sequence, control diagrams, description of method for operating machinery, machine serial numbers, factory order numbers, parts lists, instruction books, suppliers' phone numbers and addresses and individual equipment guarantee. Parts lists shall be complete in every respect, showing all parts and part numbers for ready reference.

O&M materials related to any of the following building components (as applicable for each project) are to be provided by the Contractor to the project manager to then be submitted to the Office of Regulatory Compliance:

- boilers

Section Number | Title

- emergency generators
- acid neutralization tanks
- grease interceptors
- sand/oil separators
- cooling towers
- chillers (documenting refrigerant type used)
- pre/post construction stormwater controls/NOI's
- emergency showers
- bulk chemical storage locations
- fume hoods/bio-safety cabinets
- location of sanitary sewer drains

01 78 23.16 Maintenance Data

Close-out submittals shall include a completed "Maintenance Check List" (FS#88) indicating all maintenance and frequency required for warranty purposes.

01 78 29 Final Site Survey

The contractor is to keep a copy of as-builts onsite for review during the project. At the completion of underground utilities and final site work, the Contractor shall provide an as-built drawing of all work completed. The contractor is responsible for locating all new and/or replaced utilities until substantial completion is reached and the as-builts have been submitted to, reviewed, and accepted by NAU. Natural Gas is turned over when it is energized so as-builts must be available for that system prior to being energized. The final site work drawing shall be provided after all site work is complete. The as-built/CAD record drawings shall adhere to the following:

- All buried and concealed items must be located by survey as indicated above or other NAU GIS accepted format. This includes, but is not limited to tie-in locations, pipe alignments, change in direction, valves, manholes, utility crossings, and depth of utility.
- The site survey shall also include site as built grades which have been surveyed and verified by a licensed surveyor.
- The as-builts must be certified by a licensed surveyor who is currently registered in the State of Arizona certifying the drawing and GPS coordinates are accurate. Refer to Division 01 32 23.
- As-built CAD drawings to include irrigation system and landscaping.

01 78 36 Warranties

Provide warranties and guarantees as specified in individual sections of the Contract Documents. Submit documentation at project closeout.

Section Number | Title

The Contractor's warranty shall commence on the date of Substantial Completion and remain in effect for two years. Prior to Final Completion the Contractor shall schedule a 1 year and 2-year warranty walkthrough with the Owner.

All other warranties shall commence at Substantial Completion unless otherwise specified by manufacturer. These warranties are to remain in effect per the Construction Documents, including as specified throughout these Design Guidelines and Technical Standards.

The Contractor shall provide 24-hour response to all critical building systems, i.e., loss of heating, cooling and control systems. If applicable, the Contractor shall provide at Substantial Completion, service agreements between service companies and the Owner for all critical areas. The service agreement shall include 24-hour phone numbers and contact persons' names the Owner may use in case of emergency. The emergency service agreement shall remain in effect for the two-year warranty period. The Contractor shall provide a contact person's name and phone number for Contractor's bonding company for use if the Owner experiences problems during the warranty.

All other, noncritical warranty items will be corrected within five (5) working days; unless the Contractor notifies the Owner in writing that a delay will be experienced due to shipping of materials. A shipping date must be provided to advise the Owner of the approximate date of warranty repair. All warranty work must commence as soon as reasonably possible and be diligently prosecuted to completion.

01 78 39 Project Record Documents

For all project record documentation procedures, please reference the Construction Agreement located at https://in.nau.edu/facility-services/dp-contract/

Refer to Owner's form FS #76 at https://in.nau.edu/facility-services/dp-contract/ for example of As-Builts required.

01 78 43 Spare Parts

Provide spare parts as specified in individual sections.

01 78 46 Extra Stock Materials

Refer to Owner's form FS #76 at: https://in.nau.edu/facility-services/forms-index/.

Section Number	Title
01 78 53	Sustainable Design Closeout Documentation *N/A*

01 79 00 Demonstration and Training

As directed by Owner, the Contractor may be required to develop, coordinate, and provide startup, operation and maintenance training on installed systems and equipment. Project-specific needs will be outlined during project implementation. The contractor is responsible for clarifying the scope of the training required with Owner. Generally, the Commissioning Agent and Design Professional shall conduct systems overview, design intent, and design criteria training as part of the contractor developed training. The contractor and vendors shall perform all other portions of trainings. Vendor trainings shall be from a trained and qualified factory representative. Prior to scheduling the trainings, the contractor shall develop the training lesson plan and submit to the university for approval that includes:

1. Proposed dates, start times and finish times, and locations
2. Outline of the information to be presented.
3. Names and qualifications of the presenters.
4. List of texts and other materials required to support training.

Appropriate contractor or vendor shall instruct the Owner's designated representative(s) on the safe and proper operation, maintenance, diagnosis, and repair of each piece of specific equipment. Submitted operation and maintenance information shall be used during training. Sessions shall include as a minimum:

1. Conceptual overview of how the equipment works.
2. Names, addresses, numbers etc. of sources for information, tools, spare parts, etc. for the equipment.
3. Details of the warranty or guarantee.
4. Intended sequences of operation in all modes of operation.
5. Sources of utility support.
6. Routine operator tasks involving monitoring and operation covering all modes of operation and mode switching as applicable.
7. Relevant health and safety practices/concerns.

Along with the in-person training, the Contractor shall supply written instructions and manufacturers equipment maintenance guidelines that will be used as handouts for trainings and have the Systems Operations and Maintenance Manuals available at the training session.

The training shall be video recorded by the contractor or designated representative with at least 720P format, on a tripod, and moved at times to clearly see components that are being presented on. The recording shall be provided to Owner in either MP4 or MKV file format.

The components include, but are not limited to:

Irrigation system and programing (diagram required)
Door closer tune-up
6 pin cylinder set-up
Automatic door openers
ADA push buttons.
Folding partition walls.
Fire sprinkler system.
Fire Alarm system and Dialer
Fire alarm annunciator panel
Mag Lock at doors
Air Handler Units
VFD's
VAV Boxes
Chilled Beams
Makeup air units
Heat exchangers and pumps
Exhaust Fan
Fan Coil Units
Expansion tank
Glycol make-up
Terminal heating and cooling equipment
Air curtain
Radiant floor systems
Snow melt systems
Building management systems
Sequence of operation
Block programming
Graphic system operation and modification
Switchboard, MCC and panelboards
Generator
UPS
Transformers
Lighting Control Systems
Security System
A/V systems

Section Number | Title

Data/Com Connectivity
Elevator operation and maintenance
Air-Cooled Chiller
Chilled Water Pumps
BMS Interface
Refrigerant Monitoring System

Refer to Owner's form FS #76 at: https://in.nau.edu/facility-services/dp-contract/.

****END OF SECTION****

01 80 00 PERFORMANCE REQUIREMENTS

Intentionally left blank.

01 81 00 Facility Performance Requirements

01 81 13 Sustainable Design Requirements

The Owner's Project Manager will be designated as an alternate project administrator for all sustainable design programs.

****END OF SECTION****

Section Number	Title

01 90 00 LIFE CYCLE ACTIVITIES

Intentionally left blank.

01 91 00 Commissioning

01 91 13 General Commissioning Requirements

Commissioning Agent is typically hired directly by Owner. Commissioning Agent shall adhere to ASHRAE Standards and Guidelines.

All commissioning documents such as pre-functional checklists, TAB, and commissioning reports shall be submitted on PMWeb as submittals for review and approval by Utility Services in addition to the Commissioning agent when required.

The Checklist and the Functional Testing will be Activities in the Construction Schedule.

01 92 00 Facility Operation

01 92 13 Facility Operation Procedures

Provide operation procedures and training for installed systems.

01 93 00 Facility Maintenance

01 93 13 Facility Maintenance Procedures

Provide maintenance procedures and manuals for installed systems.

****END OF SECTION****

SECTION 01 10 00

SUMMARY

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Specification and drawing conventions.

1.02 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.02 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.03 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use form provided in Project Manual.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project, from ICC–ES.
      j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
      k. Cost information, including a proposal of change, if any, in the Contract Sum.
      l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.04 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.05 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.06 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      d. Requested substitution has received necessary approvals of authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. RFIs.
   4. Digital project management procedures.
   5. Project meetings.

1.02 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.03 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in 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 ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

1.04 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project–specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade–specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   f. Indicate required installation sequences.
   g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
   1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire–protection, fire–alarm, and electrical Work. Show locations of visible ceiling–mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
   2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
   3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire–protection, fire–alarm, and electrical equipment.
   4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
   5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
   6. Mechanical and Plumbing Work: Show the following:
      a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
      b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
      c. Fire–rated enclosures around ductwork.
   7. Electrical Work: Show the following:
      a. Runs of vertical and horizontal conduit 1–1/4 inches in diameter and larger.
      b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire–alarm locations.
      c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor–control center locations.
      d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   8. Fire–Protection System: Show the following:
      a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
   9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
   10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
   1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.

2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format: Retain one of two subparagraphs below.
      a. Same digital data software program, version, and operating system as original Drawings.
   2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
   3. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
      a. Perform three–dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.

1.05 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
   2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Owner name.
   3. Owner's Project number.
   4. Name of Architect.
   5. Architect's Project number.
   6. Date.
   7. Name of Contractor.
   8. RFI number, numbered sequentially.
   9. RFI subject.
   10. Specification Section number and title and related paragraphs, as appropriate.
   11. Drawing number and detail references, as appropriate.
   12. Field dimensions and conditions, as appropriate.
   13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   14. Contractor's signature.
   15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
      a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software–generated form with substantially the same content as indicated above, acceptable to Architect.
   1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow three days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
   1. The following Contractor–generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number, including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.
   8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.06 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.
   1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
   2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
   3. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
      a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.

B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
   1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
   3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.07 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Responsibilities and personnel assignments.
   b. Tentative construction schedule.
   c. Critical work sequencing and long lead items.
   d. Designation of key personnel and their duties.
   e. Lines of communications.
   f. Procedures for processing field decisions and Change Orders.
   g. Procedures for RFIs.
   h. Procedures for testing and inspecting.
   i. Procedures for processing Applications for Payment.
   j. Distribution of the Contract Documents.
   k. Submittal procedures.
   l. Preparation of Record Documents.
   m. Use of the premises and existing building.
   n. Work restrictions.
   o. Working hours.
   p. Owner's occupancy requirements.
   q. Responsibility for temporary facilities and controls.
   r. Procedures for moisture and mold control.
   s. Procedures for disruptions and shutdowns.
   t. Construction waste management and recycling.
   u. Parking availability.
   v. Office, work, and storage areas.
   w. Equipment deliveries and priorities.
   x. First aid.
   y. Security.
   z. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
1. Attendees: 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 Architect , and Owner's Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following: a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility requirements.
   k. Time schedules.

l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web–based Project software site data files.
d. Submittal of written warranties.
e. Requirements for completing sustainable design documentation.
f. Requirements for preparing operations and maintenance data.
g. Requirements for delivery of material samples, attic stock, and spare parts.
h. Requirements for demonstration and training.
i. Preparation of Contractor's punch list.
j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
k. Submittal procedures.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how

construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Status of sustainable design documentation.
6) Deliveries.
7) Off–site fabrication.
8) Access.
9) Site use.
10) Temporary facilities and controls.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Status of RFIs.
16) Status of Proposal Requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.
3. Delegated design procedural requirements.

1.02 DEFINITIONS

A. Construction Submittals: Written and graphic information and physical samples prepared for the purpose of demonstrating the Contractor's compliance with the Contract Documents.
1. Action Submittals: Require Architect's responsive action. Action Submittals are those construction submittals indicated in individual Specification Sections as "Action Submittals."
2. Informational Submittals: Do not require Architect's responsive action. Informational Submittals may be rejected for not complying with requirements and returned to the Contractor. Informational Submittals are those construction submittals indicated in individual Specification Sections as "Informational Submittals."
3. Construction submittals not identified as "Action Submittals" or "Informational Submittals" shall comply with the requirements for "Action Submittals."

1.03 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
a. Scheduled date for first submittal.
b. Specification Section number and title.
c. Submittal Category: Action; informational.
d. Name of subcontractor.
e. Description of the Work covered.
f. Scheduled date for Architect's final release or approval.
g. Scheduled dates for purchasing.
h. Scheduled date of fabrication.
i. Scheduled dates for installation.
j. Activity or event number.

1.04 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
1. Project name.
2. Date.
3. Name of Architect.

4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.05 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
      a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination. a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Resubmittal Review: Allow seven days for review of each resubmittal.
   3. Informational Submittals: If no response is received after the number of days indicated, the Contractor shall consider the submittal acceptable as submitted.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.06 CONSTRUCTION SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
   2. Do not include Safety Data Sheets (SDSs) as Product Data. Submit SDSs only where specifically requested.
   3. Mark each copy of each submittal to show which products and options are applicable.
   4. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   5. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams that show factory–installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   6. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project–specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Paper Sheet Size: Except for templates, patterns, and similar full–size Drawings, submit Shop Drawings in PDF on sheets at least 8–1/2 by 11 inches, but no larger than 30 by 42 inches.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
   1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
   2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
      a. Project name and submittal number.
      b. Generic description of Sample.
      c. Product name and name of manufacturer.

d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality–control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit Insert number full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one submittal set with options selected.
6. Samples for Verification: Submit full–size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:
   1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
   2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
   3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
a. Name of evaluation organization.
b. Date of evaluation.
c. Time period when report is in effect.
d. Product and manufacturers' names.
e. Description of product.
f. Test procedures and results.
g. Limitations of use.

1.07 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.08 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
   1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.09 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
   1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

B. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 – GENERAL 1.01

SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality–assurance and quality–control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality–assurance and quality–control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality–assurance and quality–control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.02 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality–Control Tests and Inspections: Tests and inspections that are performed on–site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub–subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
   1. Use of trade–specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
   1. Mockups are used for one or more of the following:
      a. Verify selections made under Sample submittals.
      b. Demonstrate aesthetic effects.
      c. Demonstrate the qualities of products and workmanship.
      d. Demonstrate successful installation of interfaces between components and systems.
      e. Perform preconstruction testing to determine system performance.
   2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
   3. In–Place Mockups: Mockups constructed on–site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality–Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality–Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality–Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality–control services do not include contract administration activities performed by Architect.

1.03 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.04 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is 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, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.05 ACTION SUBMITTALS

A. Mockup Shop Drawings:
   1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
   2. Indicate manufacturer and model number of individual components.
   3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.06 INFORMATIONAL SUBMITTALS

A. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.

9. Unique characteristics of each quality–control service.

B. Reports: Prepare and submit certified written reports and documents as specified.

C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.07 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections.
Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample–taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory–Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory–authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory–authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.08 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in–service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory–authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in–service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in–service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
   1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory–Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor's Responsibilities:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site–assembled test assemblies and mockups, using installers who will perform same tasks for Project.
      e. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality–assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and
      state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups of size indicated.
   2. Build mockups in location indicated or, if not indicated, as directed by Architect.
   3. Notify Architect days in advance of dates and times when mockups will be constructed.
   4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
   5. Demonstrate the proposed range of aesthetic effects and workmanship.
   6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
      a. Allow seven days for initial review and each re–review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

1.09 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality–control activities, whether specified or not, to verify and document that the Work complies with requirements.
   1. Unless otherwise indicated, provide quality–control services specified and those required by authorities having jurisdiction. Perform quality–control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Engage a qualified testing agency to perform quality–control services.
   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
   4. Where quality–control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality–control service.
   5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality–control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the locations from which test samples will be taken and in which in–situ tests are conducted.
   3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality–control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform duties of Contractor.

D. Manufacturer's Field Services: Where indicated, engage a factory–authorized service representative to inspect field–assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

F. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality–control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality–assurance and qualitycontrol services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality–control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
1. Schedule Contents: Include tests, inspections, and quality–control services, including Contractor– and Owner–retained services, commissioning activities, and other Project–required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality–control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality–control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample–taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality–control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality–control services.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 – GENERAL

1.01 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.02 INDUSTRY 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.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
   1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should 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, obtain copies directly from publication source.

1.03 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
   1. IAPMO – International Association of Plumbing and Mechanical Officials; www.iapmo.org.
   2. ICC – International Code Council; www.iccsafe.org.
   3. ICC–ES – ICC Evaluation Service, LLC; www.icc–es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list.
   Information is subject to change and is up to date as of the date of the Contract Documents.
   1. CPSC – U.S. Consumer Product Safety Commission; www.cpsc.gov.
   2. DOC – U.S. Department of Commerce; www.commerce.gov.
   3. DOE – U.S. Department of Energy; www.energy.gov.
   4. DOJ – U.S. Department of Justice; www.ojp.usdoj.gov
   5. EPA – United States Environmental Protection Agency; www.epa.gov.
   6. LBNL – Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
   7. NIST – National Institute of Standards and Technology; www.nist.gov.
   8. OSHA – Occupational Safety & Health Administration; www.osha.gov.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. CFR – Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
   2. USAB – United States Access Board; www.access–board.gov.
   3. USATBCB – U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.
   3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in–service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

C. Basis–of–Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis–of–design product," including make or model number or other designation. Published attributes and characteristics of basis–of–design product establish salient characteristics of products.
   1. Evaluating Comparable Products: In addition to the basis–of–design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in–service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis–of–design product also establish salient characteristics of products for purposes of evaluating comparable products.

D. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

E. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
   1. Identification of basis–of–design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
   2. Data indicating compliance with the requirements specified in "Comparable Products" Article.

F. Basis–of–Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."

G. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

1.02 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service– or power–operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.
   3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.03 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long–term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:
   1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
   2. Store products to allow for inspection and measurement of quantity or counting of units.
   3. Store materials in a manner that will not endanger Project structure.
   4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
   5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather–protection requirements for storage.
   7. Protect stored products from damage and liquids from freezing.
   8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.05 PRODUCT WARRANTIES

A. Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents.
   1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project–specific information and properly executed.
   2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 – PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
      a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by Architect, whose determination is final.

B. Product Selection Procedures:
   1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
   2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
   3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated. a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
   4. Non–Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
      a. Non–limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
      b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
   5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated. a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non–Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
    a. Non–limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis–of–Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
    1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
    1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
    2. Detailed comparison of significant qualities of proposed product with those of the named basis–ofdesign product. Significant product qualities include attributes such as type, function, in–service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
    3. Evidence that proposed product provides specified warranty.
    4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
    5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    1. Architect's Approval of Submittal: Marked with approval notation from Architect's action stamp. See Section 01 33 00 "Submittal Procedures."
    2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Single–Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering.
   3. Installation.
   4. Cutting and patching.
   5. Starting and adjusting.
   6. Protection of installed construction.
   7. Correction of the Work.

1.02 DEFINITIONS

A. Cutting: Removal of in–place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certified Surveys: Submit two copies signed by land surveyor.

C. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.

1.04 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.05 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land–surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load–carrying capacity or increase deflection.
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following: a. Primary operational systems and equipment.
      b. Fire separation assemblies.
      c. Air or smoke barriers.
      d. Fire–suppression systems.
      e. Plumbing piping systems.

f. Mechanical systems piping and ducts.
g. Control systems.
h. Communication systems.
i. Fire–detection and –alarm systems.
j. Conveying systems.
k. Electrical wiring systems.
l. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load–carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
   Other construction elements include but are not limited to the following: a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain–wall construction.
   d. Sprayed fire–resistive material.
   e. Equipment supports.
   f. Piping, ductwork, vessels, and equipment.
   g. Noise– and vibration–control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on–site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water–service piping; underground electrical services; and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance.
   Record observations.
   1. Examine roughing–in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.04 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field–engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.05 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb, and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items onsite and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.06 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in–place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in–place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 10 00 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in–place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond–core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: 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. a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in–place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in–place ceilings as necessary to provide an even–plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.08 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.09 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to likenew condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final Completion procedures.
   3. List of incomplete items.
   4. Submittal of Project warranties.
   5. Final cleaning.

1.02 DEFINITIONS

A. List of Incomplete Items: Contractor–prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.04 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest–control inspection.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.06 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list").

B. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Advise Owner of pending insurance changeover requirements.
   2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   3. Complete startup and testing of systems and equipment.
   4. Perform preventive maintenance on equipment used prior to Substantial Completion.
   5. Advise Owner of changeover in utility services.
   6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
   7. Complete final cleaning requirements.
   8. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

C. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of five days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.07 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   3. Submit pest–control final inspection report.
   4. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
   5. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   6. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
      a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
   7. Submit testing, adjusting, and balancing records.

A. Procedures Prior to Final Completion: Complete the following a minimum of five days prior to requesting inspection for determining Final Completion.
   1. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   2. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of five days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.08 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
   2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.

d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:
   a. PDF Electronic File: Architect will return annotated file.

1.09 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item.
Provide bookmarked table of contents at beginning of document.
   1. Submit on digital media acceptable to Architect.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by 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.

PART 3 – EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste–removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are not planted, mulched, or paved to a smooth, even–textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. 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.
      f. Remove debris and surface dust from limited–access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      g. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
      h. Vacuum and mop concrete.
      i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.

j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision–obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency. q. Clean strainers.
r. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste–disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

3.02 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Systems and equipment operation manuals.
   3. Systems and equipment maintenance manuals.
   4. Product maintenance manuals.

1.02 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.03 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Final Completion. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual prior to issuance of Certificate for Final Completion.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.04 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.05 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system.
Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross–reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross–referenced to Specification Section number in Project Manual.

D. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract
Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.06 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
1. Engage a factory–authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.

5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break–in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.07 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
1. Engage a factory–authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross–reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.

2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross–referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

I. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

1.08 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross–reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
1. Record Drawings.
2. Record specifications.
3. Miscellaneous record submittals.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. Number of Copies: Submit copies of Record Drawings as follows:
a. Initial Submittal:
1) Submit PDF electronic files of Record Drawings.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
b. Final Submittal:
1) Submit PDF electronic files of Record Drawings and one one full–size and one half–size sets of file prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record–keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

1.03 RECORD DRAWINGS

A. Record Drawings: Maintain one set of marked–up paper or electronic copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked–up record prints.
a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross–reference record prints to corresponding photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.

i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked–up record prints.
4. Mark important additional information that was either shown schematically or omitted from original Drawings.
5. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification.
Include identification in each digital data file.
4. Identification: As follows:
a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Contractor.

1.04 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
3. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.05 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.06 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.02 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer–produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance–based test.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: A factory–authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.04 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.05 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility. c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Systems and equipment operation manuals.
c. Systems and equipment maintenance manuals.
d. Product maintenance manuals.
e. Project Record Documents.
f. Identification systems.
g. Warranties and bonds.
h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break–in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

1.06 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23

"Operation and Maintenance Data." B. Set up instructional equipment at instruction location.

1.07 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed–on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on–site in the completed and fully operational facility using the actual equipment in–place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance–based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. General requirements for coordinating and scheduling commissioning activities.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of commissioning process test equipment, instrumentation, and tools.
5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
6. Commissioning tests and commissioning test demonstration.
7. Adjusting, verifying, and documenting identified systems and assemblies.

1.02 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

B. Basis–of–Design Document: A document prepared by Architect that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.

C. Commissioning Authority: An entity engaged by Owner to evaluate Commissioning–Process Work.

D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation of commissioning requirements.

E. Commissioning: A quality–focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities.

F. Construction–Phase Commissioning–Process Completion: The stage of completion and acceptance of commissioning process when resolution of deficient conditions and issues discovered during commissioning process and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date construction–phase commissioning–process completion is achieved.
1. Commissioning process is complete when the Work specified of this Section and related Sections has been completed and accepted, including, but not limited to, the following: a. Completion of tests and acceptance of test results.
   b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
   c. Completion and acceptance of submittals and reports.

G. Owner's Project Requirements: A document that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. This document is prepared either by the Owner or for the Owner by the Architect or Commissioning Authority.

H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect–designated witness authorized to authenticate test demonstration data and to sign completed test data forms.

I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as–built" systems, assemblies, subsystems, equipment, and components.

J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4. 1.03 COMMISSIONING TEAM

A. Members Appointed by Contractor(s):
1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning process.
2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning process.
3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning process.
4. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by Owner:
1. Commissioning Authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning process.
2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning process.
3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning process.

1.04 INFORMATIONAL SUBMITTALS

A. Comply with requirements in Section 01 33 00 "Submittal Procedures" for submittal procedure general requirements for commissioning process.

B. Commissioning Plan Information:
1. List of Contractor–appointed commissioning team members to include specific personnel and subcontractors performing the various commissioning requirements.
2. Schedule of commissioning activities, integrated with the Construction Schedule.
3. Contractor personnel and subcontractors participating in each test.
4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning Coordinator Letter of Authority: Within 10 days after approval of Commissioning Coordinator qualifications, submit a letter of authority for Commissioning Coordinator, signed by a principal of Contractor's firm. Letter shall authorize Commissioning Coordinator to do the following:
1. Make inspections required for commissioning process.
2. Coordinate, schedule, and manage commissioning process of Contractor, subcontractors, and suppliers.
3. Obtain documentation required for commissioning process from Contractor, subcontractors, and suppliers.
4. Report issues, delayed resolution of issues, schedule conflicts, and lack of cooperation or expertise on the part of members of the commissioning team.

D. Commissioning Coordinator Qualification Data: For entity coordinating Contractor's commissioning activities to demonstrate their capabilities and experience.
1. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

E. List test instrumentation, equipment, and monitoring devices. Include the following information:
1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
2. Brief description of intended use.

3. Calibration record showing the following:
    a. Calibration agency, including name and contact information.
    b. Last date of calibration.
    c. Range of values for which calibration is valid.
    d. Certification of accuracy.
    e. Certification for calibration equipment traceable to NIST.
    f. Due date of the next calibration.

F. Test Reports:
1. Pre–Startup Report: Prior to startup of equipment or a system, submit signed, completed construction checklists.
2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
3. Commissioning Issue Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit printout of log of alarms that occurred since the last log was printed.

G. Construction Checklists:
1. Material checks.
2. Installation checks.
3. Startup procedures, where required.

1.05 CLOSEOUT SUBMITTALS

A. Commissioning Report: At Construction–Phase Commissioning Completion, include the following:
1. Pre–startup reports.
2. Approved test procedures.
3. Test data forms, completed and signed.
4. Progress reports.
5. Commissioning issue report log.
6. Commissioning issue reports showing resolution of issues.
7. Correspondence or other documents related to resolution of issues.
8. Other reports required by commissioning process.
9. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction–Phase Commissioning Completion.
10. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction–Phase Commissioning Process Completion.

C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Commissioning Coordinator Qualifications:
1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least three projects of similar scope and complexity.
2. Certification of commissioning–process expertise. The following certifications are acceptable. Owner reserves the right to accept or reject certifications as evidence of qualification.
    a. Certified Commissioning Authority, by AABC Commissioning Group (ACG).
    b. Commissioning–Process Management Professional, by American Society of Heating, Refrigerating and Air–Conditioning Engineers.
    c. Certified Commissioning Professional, by Building Commissioning Association.

d. Accredited Commissioning–Process Authority Professional, by University of Wisconsin.
e. Accredited Commissioning–Process Manager, by University of Wisconsin.
f. Accredited Green Commissioning–Process Provider, by University of Wisconsin.

B. Calibration Agency Qualifications: Certified by The American Association for Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

PART 2 – PRODUCTS

2.01 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Test equipment and instrumentation required to perform the commissioning process shall remain the property of Contractor unless otherwise indicated.

B. Test equipment and instrumentation required to perform commissioning process shall comply with the following criteria:
1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
2. Calibrated and certified.
a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but not less than within six months of initial use on Project. Calibration tags shall be permanently affixed.
b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.
3. Maintain test equipment and instrumentation.
4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.02 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate, or perform work on its equipment.
1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.
2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

2.03 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:
1. Bind report in three–ring binders.
2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
3. Electronic Data: Portable document format (PDF); a single file with outline–organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:
1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:
a. Test specification.
b. Pre–startup reports.
c. Approved test procedures.
d. Test data forms, completed and signed.

e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 – EXECUTION

3.01 PREPARATION

A. Review preliminary construction checklists and preliminary test procedures and data forms.

3.02 CONSTRUCTION CHECKLISTS

A. Construction checklists cannot modify or conflict with the Contract Documents.

B. Create construction checklists based on actual systems and equipment to be included in Project.

C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment if applicable.
   1. Service connection requirements, including configuration, size, location, and other pertinent characteristics.
   2. Included optional features.
   3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness, and lack of damage.
   4. Installation Checks:
      a. Location according to Drawings and approved Shop Drawings.
      b. Configuration.
      c. Compliance with manufacturers' written installation instructions.
      d. Attachment to structure.
      e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall–protection regulations and safe work practices.
      f. Utility connections are of the correct characteristics, as applicable.
      g. Correct labeling and identification.
      h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.

D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, at minimum.

E. Performance Tests:
   1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation–resistance tests, and water–penetration tests.
   2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.
   3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
   4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
   5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.

F. Deferred Construction Checklists: Obtain Owner approval of proposed deferral of construction checklists, including proposed schedule of completion of each deferred construction checklist, before submitting request for Certificate of Construction–

Phase Commissioning Process Completion. When approved, deferred construction checklists may be completed after date of Construction–Phase Commissioning Completion. Include the following in a request for Certificate of Construction–Phase Commissioning Process Completion:

1. Identify deferred construction checklists by number and title.
2. Provide a target schedule for completion of deferred construction checklists.
3. Written approval of proposed deferred construction checklists, including approved schedule of completion of each deferred construction checklist.

G. Delayed Construction Checklists: Obtain Owner approval of proposed delayed construction checklists, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction–Phase Commissioning Process Completion. When approved, delayed construction checklists may be completed after date of Construction–Phase Commissioning Completion. Include the following in a request for Certificate of Construction–Phase Commissioning Process Completion:

1. Identify delayed construction checklist by construction checklist number and title.
2. Provide a target schedule for completion of delayed construction checklists.
3. Written approval of proposed delayed construction checklists, including approved schedule of completion of each delayed construction checklist.

3.03 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning process with the Construction Schedule.

B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.

1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.
   a. General Inspection: Level II.
   b. Special Inspection: Level S–3.
   c. Acceptance Quality Limit (AQL) of 1.5.
2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.

D. Report test data and commissioning issue resolutions.

E. Schedule personnel to participate in and perform Commissioning–Process Work.

F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.
2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.04 COMMISSIONING COORDINATOR RESPONSIBILITIES

A. Management and Coordination: Manage, schedule, and coordinate commissioning process, including, but not limited to, the following:

1. Coordinate with subcontractors on their commissioning responsibilities and activities.
2. Obtain, assemble, and submit commissioning documentation.
3. Attend periodic on–site commissioning meetings.

4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the Construction Schedule. Update Construction Schedule at specified intervals.
5. Review and comment on preliminary test procedures and data forms.
6. Report inconsistencies and issues in system operations.
7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
8. Direct and coordinate test demonstrations.
9. Coordinate witnessing of test demonstrations by Owner's witness.
10. Coordinate and manage training. Be present during training sessions to direct video recording, present training, and direct the training presentations of others.
11. Prepare and submit specified commissioning reports.
12. Track commissioning issues until resolution and retesting is successfully completed.
13. Retain original records of Commissioning–Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.
14. Assemble and submit commissioning report.

3.05 COMMISSIONING TESTING

A. Quality Control: Construction checklists, including tests, are quality–control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality–control process.

B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published Commissioning Schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning process.

C. Construction Checklists:
   1. Complete construction checklists as Work is completed.
   2. Distribute construction checklists to installing contractors before they start work.
   3. Installers:
      a. Verify installation using approved construction checklists as Work proceeds.
      b. Complete and sign construction checklists weekly for work performed during the preceding week.
   4. Provide Commissioning Authority access to construction checklists.

D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.

E. Pre–Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre–startup report for each system.

F. Test Procedures and Test Data Forms:
   1. Test procedures shall define the step–by–step procedures to be used to execute tests and test demonstrations.
   2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
   3. Completed test data forms are the official records of the test results.
   4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
   5. Review preliminary test procedures and test data forms, and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:
      a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
      b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.

6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.

G. Performance of Tests:
1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
2. Perform and complete each step of the approved test procedures in the order listed.
3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:
1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be 100 percent unless otherwise indicated in the individual test specification.
2. Notify Owner's witness at least three days in advance of each test demonstration.
3. Perform and complete each step of the approved test procedures in the order listed.
4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.
6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.
    a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed–on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.
7. False load test requirements are specified in related sections.
    a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady–state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Architect's written approval.

I. Deferred Tests:
1. Deferred Test List: Identify, in the request for Certificate of Construction–Phase Commissioning Process Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction–Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction–Phase Commissioning Process Completion as follows: a. Identify deferred tests by number and title.
    b. Provide a target schedule for completion of deferred tests.
2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Architect and Commissioning Authority at least three working days (minimum) in advance of tests.
3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

J. Delayed Tests:
   1. Delayed Test List: Identify, in the request for Certificate of Construction–Phase Commissioning Process Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction–Phase Commissioning Process Completion. Include the following in the request for Certificate of Construction–Phase Commissioning Process Completion: a. Identify delayed tests by test number and title.
      b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.
   2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Architect and Commissioning Authority at least three working days (minimum) in advance of tests.
   3. Where delayed tests are approved, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

K. Commissioning Compliance Issues:
   1. Test results that are not within the range of acceptable results are commissioning compliance issues.
   2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
   3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
   4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:
      a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
      b. Submit commissioning compliance issue report form within 24 hours of the test.
      c. Determine the cause of the failure.
      d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.
   5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.
      a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return–air

damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.

b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.

c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.

d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.

6. Diagnose and correct failed test demonstrations as follows:

a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.

b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.

c. Record the results of each step of the diagnostic procedure.

d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.

e. Determine and record corrective measures.

f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.

7. Retest:

a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.

b. For each repeated test demonstration, submit a new test data form, marked "Retest." 8. Do not correct commissioning compliance issues during test demonstrations.

a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than five minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

3.06 SEQUENCING

A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:

1. Construction Checklists:

a. Material checks.

b. Installation checks.

c. Startup, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.

d. Performance Tests:

1) Static tests, as appropriate.

2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.

3) Equipment and assembly performance tests.

4) System performance tests.

5) Intersystem performance tests.

2. Commissioning tests.

B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.

C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.

D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.07 SCHEDULING

A. Commence commissioning process as early in the construction period as possible.

B. Commissioning Schedule: Integrate commissioning activities into Construction Schedule.
1. Include detailed commissioning activities in monthly updated Construction Schedule and shortinterval schedule submittals.
2. Schedule the start date and duration for the following commissioning activities: a. Submittals.
b. Preliminary operation and maintenance manual submittals.
c. Installation checks.
d. Startup, where required.
e. Performance tests.
f. Performance test demonstrations.
g. Commissioning tests.
h. Commissioning test demonstrations.
3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
4. Determine milestones and prerequisites for commissioning process. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical–path–method construction schedule and short–interval schedule submittals.

C. Two–Week Look–Ahead Commissioning Schedule:
1. Two weeks prior to the beginning of tests, submit a detailed two–week look–ahead schedule. Thereafter, submit updated two–week look–ahead schedules weekly for the duration of commissioning process.
2. Two–week look–ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
3. Use two–week look–ahead schedules to notify and coordinate participation of Owner's witnesses. D. Owner's

Witness Coordination: Coordinate Owner's witness participation.

3.08 COMMISSIONING REPORTS

A. Test Reports:
1. Pre–startup reports include observations of the conditions of installation, organized into the following sections:
a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.

2. Test data reports include the following:
    a. "As–tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
    b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
    c. Signatures of individuals performing and witnessing tests.
    d. Data trend logs accumulated overnight from the previous day of testing.
3. Commissioning Compliance Issue Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:
    a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
    b. Action distribution list.
    c. Report date.
    d. Test number and description.
    e. Equipment identification and location.
    f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
    g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
    h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
    i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
    j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
    k. Schedule for retesting.
4. Weekly progress reports include information for tests conducted since the preceding report and the following:
    a. Completed data forms.
    b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
    c. Activities scheduled but not conducted per schedule.
    d. Commissioning compliance issue report log.
    e. Schedule changes for remaining Commissioning–Process Work, if any.
5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.
    a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
    b. Attach to the data form printed trend log data collected during the test or test demonstration.
    c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.
6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."
    a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.09 CERTIFICATE OF CONSTRUCTION–PHASE COMMISSIONING PROCESS COMPLETION

A. When Contractor considers that construction–phase commissioning process, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Architect

a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning process.

B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction–phase commissioning process or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction–Phase Commissioning Process Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction–Phase
Commissioning Process Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction–phase commissioning process completion.

C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning process. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and
Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.

D. When construction–phase commissioning process or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction–Phase Commissioning Process Completion that shall establish the date of completion of construction–phase commissioning process. Certificate of
Construction–Phase Commissioning Process Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Removal and salvage of existing items for delivery to Owner and removal of existing items for reinstallation.

1.02 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of off–site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner as indicated.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage; prepare for reuse; and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed.

1.03 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.04 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on–site operations are uninterrupted.
2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

1.05 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.06 FIELD CONDITIONS

A. Owner will not occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Historic Areas: Demolition and hauling equipment and other materials to be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more. F. On–site sale of removed items or materials is not permitted.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 – EXECUTION 3.01

EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
   1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.02 PREPARATION

A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location and reinstalled in their original locations after selective demolition operations are complete.

3.03 UTILITY SERVICES AND BUILDING SYSTEMS

A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.
   1. Maintain fire–protection facilities in service during selective demolition operations.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated utilities when requested by Contractor.
   2. If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
   3. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.
      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
      c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.
   4. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.
      a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
      b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
   5. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:
      a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
      b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

3.04 SALVAGE/REINSTALL

A. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

B. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.05 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flamecutting operations. Maintain portable fire–suppression devices during flame–cutting operations.
   5. Maintain fire watch during and for at least two hours after flame–cutting operations.
   6. Maintain adequate ventilation when using cutting torches.
   7. Remove decayed, vermin–infested, or otherwise dangerous or unsuitable materials and promptly dispose of off–site.
   8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct selective demolition and debris–removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
   2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental–protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.06 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power–driven saw, and then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using powerdriven saw, and then remove masonry between saw cuts.

C. Concrete Slabs–on–Grade: Saw–cut perimeter of area to be demolished, and then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent–based adhesive strippers.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
   1. See Section 07 31 13 "Asphalt Shingles" for new roofing requirements.
   2. Remove existing roof membrane, flashings, copings, and roof accessories.
   3. Remove existing roofing system down to substrate.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA–approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on–site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent. B. Burning: Do not burn demolished materials.

3.08 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. Structural steel.
2. Grout.

1.02 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural–steel components.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Mill test reports for structural steel, including chemical and physical properties.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC–Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC–Certified Erector, Category CSE.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

D. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 – PRODUCTS

2.01 STRUCTURAL–STEEL MATERIALS

A. HSS–Shapes: As indicated in General Structural Notes on Drawings.

B. Channels, Angles, and Shapes: As indicated in General Structural Notes on Drawings.

C. Plate and Bar: As indicated in General Structural Notes on Drawings.

D. Cold–Formed Hollow Structural Sections: As indicated in General Structural Notes on Drawings.

E. Steel Pipe: As indicated in General Structural Notes on Drawings.

F. Welding Electrodes: As indicated in General Structural Notes on Drawings.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. High–Strength Bolts, Nuts, and Washers: As indicated in General Structural Notes on Drawings.

B. Shear Connectors: As indicated in General Structural Notes on Drawings.

C. Anchor Rods: As indicated in General Structural Notes on Drawings.

2.03 PRIMER

A. Primer: Fabricator's standard lead– and chromate–free, nonasphaltic, rust–inhibiting primer complying with MPI#79 and compatible with topcoat.

2.04 GROUT

A. Nonmetallic, Shrinkage–Resistant Grout: ASTM C 1107/C 1107M, factory–packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30–minute working time.

2.05 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed–stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

2.06 SHOP CONNECTIONS

A. High–Strength Bolts: Shop install high–strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.07 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces of high–strength bolted, slip–critical connections.
   4. Surfaces to receive sprayed fire–resistive materials (applied fireproofing).
   5. Galvanized surfaces.
   6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC–SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete– and masonry–bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates: Clean concrete– and masonry–bearing surfaces of bond–reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage–resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.03 FIELD CONNECTIONS

A. High–Strength Bolts: Install high–strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built–up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

END OF SECTION

SECTION 05 52 13

PIPE AND TUBE RAILINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. New steel railings.
2. Reinstallation of existing railings.

1.02 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

B. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated design professional engineer.

B. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
1. AWS D1.1/D1.1M, "Structural Welding Code – Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.

Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1–1/2–inch clearance from inside face of handrail to finished wall surface.

2.03 STEEL RAILINGS

A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

B. Plates, Shapes, and Bars: ASTM A36/A36M.

2.04 FASTENERS

A. Fastener Materials:

1. Ungalvanized–Steel Railing Components: Plated steel fasteners complying with ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
2. Hot–Dip Galvanized Railing Components: Type 304 stainless steel or hot–dip zinc–coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

2.05 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast iron center of handrail 2–1/4 inches from wall.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High–zinc–dust–content paint, complying with SSPC–Paint 20 and compatible with paints specified to be used over it.

E. Shop Primers: Provide primers that comply with Section 09 91 23 "Interior Painting."

2.06 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.
1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.
1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
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 flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.

I. Form changes in direction as follows: By bending to smallest radius that will not result in distortion of railing member.

J. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

L. Provide wall returns at ends of wall–mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

2.07 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot–dip galvanize steel railings, including hardware, after fabrication.
   2. Comply with ASTM A123/A123M for hot–dip galvanized railings and hardware.
   3. Do not quench or apply post–galvanizing treatments that might interfere with paint adhesion.
   4. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

   For galvanized railings, provide hot–dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparation for Shop Priming: Prepare uncoated ferrous–metal surfaces to comply with SSPC–SP 6/NACE No. 3.

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC–PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
   1. Do not apply primer to galvanized surfaces.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.
   1. Fit exposed connections together to form tight, hairline joints.
   2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
   3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
   4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Adjust railings before anchoring to ensure matching alignment at abutting joints.

C. Fastening to In–Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in–place construction.

3.02 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
   1. Existing Railings: Where existing railings are welded to new or existing railings, remove paint down to metal surface from welding area to a distance not less than 2 inches from the weld location.

3.03 ANCHORING POSTS

A. Anchor posts to metal surfaces as follows:
   1. For steel railings, weld posts to embedded metal supporting surfaces.

3.04 ATTACHING RAILINGS

A. Attach handrails to walls with wall brackets. Provide brackets with 1–1/2–inch clearance from inside face of handrail and finished wall surface.
   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
   2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled–in expansion shields and hanger or lag bolts.
   2. For steel–framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

3.05 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPCPA 1 for touching up shop–painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0–mil dry film thickness.

3.06 CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.07 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Penetration firestopping systems in fire–resistance–rated walls and horizontal assemblies.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestopping manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestopping systems in EJs.

C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fireprotection engineer as an engineering judgment or equivalent fire–resistance–rated assembly developed in accordance with current International Firestop Council (IFC) guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Entity that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL and found to comply with UL's "UL Solutions Qualified Firestop Contractor Program."

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping systems when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping system materials in accordance with manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced–air circulation.

1.07 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be accessed and installed in accordance with specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core–drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 – PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain penetration firestopping systems for each type of opening indicated from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Fire–Test–Response Characteristics:
1. A qualified testing agency, acceptable to authorities having jurisdiction, will perform penetration firestopping system tests.
2. Test in accordance with testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
   a. Penetration firestopping systems installed with products bearing the classification marking of a qualified testing agency.
      1) UL in its online directory "Product iQ."
      2) Intertek Group in its "Directory of Building Products."
      3) FM Approvals in its "Approval Guide."

B. Provide components for each penetration firestopping system that, upon curing, do not re–emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction. C. Provide components for each penetration firestopping system that do not contain ethylene glycol.

D. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.

E. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.

2.03 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire–resistance rating of construction penetrated. Penetration firestopping systems must be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire–Resistance–Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
1. F–Rating: Not less than the fire–resistance rating of the wall penetrated.
2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
1. F–Rating: At least one hour, but not less than the fire–resistance rating of the floor penetrated.

2. T–Rating: At least one hour, but not less than the fire–resistance rating of the floor. The following floor penetrations do not require a T–rating: a. Those within the cavity of a wall.
   b. Floor, tub, or shower drains within a concealed space.
   c. 4–inch or smaller metal conduit penetrating directly into metal–enclosed electrical switchgear.

D. Exposed Penetration Firestopping Systems: Flame–spread and smoke–developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84 or UL 723.

2.04 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated, including but not limited to:
   1. Permanent forming/damming/backing materials.
   2. Substrate primers.
   3. Collars.
   4. Steel sleeves.

2.05 FILL MATERIALS

A. Latex Sealants: Single–component latex formulations that do not re–emulsify after cure during exposure to moisture.

B. Firestopping Devices: Factory–assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Intumescent Putties: Nonhardening, water–resistant, intumescent putties containing no solvents or inorganic fibers.

D. Intumescent Wrap Strips: Single–component intumescent elastomeric strips for use around combustible penetrants.

E. Silicone Foams: Multicomponent, silicone–based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

F. Silicone Sealants: Single–component, silicone–based, neutral–curing elastomeric sealants.

G. Fire–Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.

H. Fire–Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air–leakage ratings.
   1. Fire–rated cable pathway devices are the preferred product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add–ons, and changes will occur. Such devices must be:
      a. Capable of retrofit around existing cables.
      b. Designed so that two or more devices can be ganged together.
      c. Maintenance–free so no action is required to activate the smoke– and fire–sealing mechanism.
   2. Where fire–rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided with re–enterable products specifically designed for retrofit, such as retrofit devices for cable bundles, firestopping putty, plugs, or pillows.

I. Retrofit Device for Cable Bundles: Factory–made, intumescent, collar–like device for firestopping existing over–filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.

J. Wall–Opening Protective Materials: Intumescent, non–curing putty pads or self–adhesive inserts for protection of electrical switch and receptacle boxes.

K. Fire–Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestopping gasket for use around rectangular steel HVAC ducts without fire dampers.

L. Firestopping Plugs: Flexible, re–enterable, intumescent, foam–rubber plug for use in blank round openings and cable sleeves.

M. Fire–Rated Cable Grommet: Molded two–piece grommet made of plenum–grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch in diameter.

2.06 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work. B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings in accordance with manufacturer's written instructions and with the following requirements:
   1. Remove foreign materials from substrate surfaces that could interfere with adhesion of penetration firestopping materials.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form–release agents from concrete.

B. Prime substrates in accordance with penetration firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.03 INSTALLATION

A. General: Install penetration firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross–sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire–resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE BARRIER – PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375–inch strokes.
   1. Locate in accessible concealed floor, floor–ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self–adhering–type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning – Penetration Firestopping – Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Owner will engage a qualified inspection agency to conduct and report on inspections in accordance with ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Polyurea joint sealants.
4. Mildew–resistant joint sealants.
5. Butyl joint sealants.
6. Latex joint sealants.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2–inch–wide joints formed between two 6–inch–long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint–Sealant Schedule: Include the following information:
1. Joint–sealant application, joint location, and designation.
2. Joint–sealant manufacturer and product name.
3. Joint–sealant formulation.
4. Joint–sealant color.

1.03 INFORMATIONAL SUBMITTALS A. Sample warranties.

1.04 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.06 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint–sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint–sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 – PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.02 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by jointsealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single–component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic–use, neutral–curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: a. GE Construction Sealants; Momentive Performance Materials Inc.
      b. Pecora Corporation.
      c. Sika Corporation – Building Components.
      d. The Dow Chemical Company.
      e. Tremco Incorporated.

2.04 URETHANE JOINT SEALANTS

A. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic– and nontraffic–use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: a. Bostik; Arkema.
      b. LymTal International, Inc.
      c. Master Builders Solutions, brand of MBCC Group, a Sika company.
      d. Pecora Corporation.
      e. Sherwin–Williams Company (The).
      f. Tremco Incorporated.

2.05 POLYUREA JOINT SEALANTS

A. Fast Cure Polyurea: Multicomponent, pourable, for traffic use, with minimum Shore A Hardness of 65 when tested in accordance with ASTM D2240.
   1. Basis–of–Design Product: Provide Hi–Tech Systems; PE65 Polyurea Joint Filler or approved comparable product.

2.06 MILDEW–RESISTANT JOINT SEALANTS

A. Mildew–Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew–resistant, single–component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic–use, acid–curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: a. GE Construction Sealants; Momentive Performance Materials Inc.
      b. Pecora Corporation.
      c. PPG Paints; PPG Industries, Inc.
      d. Sika Corporation – Building Components.
      e. The Dow Chemical Company.
      f. Tremco Incorporated.

2.07 BUTYL JOINT SEALANTS

A. Butyl–Rubber–Based Joint Sealants: ASTM C1311.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: a. Bostik; Arkema
      b. Everkem Diversified Products, Inc.
      c. GSSI Sealants
      d. Pecora Corporation
      e. Sika Corporation – Building Components

2.08 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: a. Everkem Diversified Products, Inc.
      b. Pecora Corporation.
      c. PPG Paints; PPG Industries, Inc.
      d. Sherwin–Williams Company (The).
      e. Tremco Incorporated.

2.09 JOINT–SEALANT BACKING

A. Sealant Backing Material: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed–cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond–Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint–filler materials or joint surfaces at back of joint. Provide self–adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint–sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint–sealant–substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work. B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint–sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil–free compressed air. Porous joint substrates include the following: a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
   3. Remove laitance and form–release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following: a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint–sealant manufacturer or as indicated by preconstruction joint–sealant–substrate tests or prior experience. Apply primer to comply with jointsealant manufacturer's written instructions. Confine primers to areas of joint–sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint–sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross–sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond–breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross–sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT–SEALANT SCHEDULE

A. Joint–Sealant Application (JS–1): Exterior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation and contraction joints in cast–in–place concrete slabs.
      b. Other joints as indicated on Drawings.
   2. Joint Sealant: Urethane, M, P, 25, T, NT.

B. Joint–Sealant Application (JS–2): Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints in masonry.
      b. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
      c. Control and expansion joints in ceilings and other overhead surfaces.
      d. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.

C. Joint–Sealant Application (JS–3): Interior joints in horizontal traffic surfaces.
   1. Joint Location: Polished concrete surfaces.
   2. Joint Sealant: Polyurea.

D. Joint–Sealant Application (JS–4): Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
   1. Joint Locations:
      a. Control joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Acrylic latex.

E. Joint–Sealant Application (JS–5): Mildew–resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.

F. Joint–Sealant Application (JS–6): Concealed mastics.
   1. Joint Locations:
      a. Aluminum thresholds.
      b. Sill plates.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Butyl–rubber based.

END OF SECTION

SECTION 09 91 23

INTERIOR PAINTING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Primers.
   2. Water–based finish coatings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include preparation requirements and application instructions.
   2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross–reference paint systems specified in this Section. Include color designations.

1.03 MOCKUPS

A. Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well–ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.05 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 – PRODUCTS

2.01 PAINT PRODUCTS

A. Basis–of–Design Products: Provide products indicated or approved comparable products from one of the following:
   1. Benjamin Moore & Co.
   2. Dunn–Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company).
   3. Pittsburgh Paints Co.

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

C. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated. D. Colors: As indicated in finish schedule on Drawings.

2.02 PRIMERS

A. Alkali–Resistant, Water–Based Primer: Water–based primer.
   1. Basis–of–Design Product: Sherwin–Williams Company (The); Loxon Concrete and Masonry PrimerSealer.

B. Interior, Institutional Low–Odor/VOC Primer Sealer: Water–based primer sealer with low–odor characteristics and a VOC of less than 10 grams per liter.
   1. Basis–of–Design Product: Sherwin–Williams Company (The); ProMar 200 Zero VOC Interior Latex Primer.

C. Water–Based Rust–Inhibitive Primer: Corrosion–resistant, water–based–emulsion primer.
   1. Basis–of–Design Product: Sherwin–Williams Company (The); Pro Industrial Pro–Cryl Universal Primer.

2.03 WATER–BASED FINISH COATS

A. Interior, Latex, Institutional Low Odor/VOC, Flat: White or colored latex paint with low–odor characteristics and a VOC of less than 10 grams per liter.
   1. Basis–of–Design Product: Sherwin–Williams Company (The); ProMar 200 HP Zero VOC Interior Latex Flat.
   2. Gloss and Sheen Level: Maximum gloss of 5 units at 60 degrees and maximum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523.

B. Interior, Latex, Institutional Low Odor/VOC, Eggshell: White or colored latex paint with low–odor characteristics and a VOC of less than 10 grams per liter.
   1. Basis–of–Design Product: Sherwin–Williams Company (The); ProMar 200 HP Zero VOC Interior Latex Eg–Shel.
   2. Gloss and Sheen Level: Gloss of 10 to 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523.

C. Interior, Latex, High–Performance Architectural Coating, Low Sheen: High–performance architectural latex coating.
   1. Basis–of–Design Product: Sherwin–Williams Company (The); Emerald Interior Acrylic Latex Satin.
   2. Gloss and Sheen Level: Maximum gloss of 10 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Gypsum Board: 12 percent.
   2. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface–applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface–applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC–SP 3.

E. Shop–Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC–PA 1 for touching up shop–primed surfaces.

3.03 INSTALLATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire–Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in occupied spaces:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      h. Other items as directed by Architect.
   2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

A. Dry–Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry–film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry–film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry–film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
   1. Do not clean equipment with free–draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
   2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
   3. Allow empty paint cans to dry before disposal.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:
   1. High–Performance Architectural Latex System:
      a. Prime Coat: Water–based rust–inhibitive primer.
      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Topcoat: Interior, latex, high–performance architectural coating, low sheen.

B. Gypsum Board Substrates:
   1. Institutional Low–Odor/VOC Latex System:
      a. Prime Coat: Interior, institutional low–odor/VOC primer sealer.
      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Interior, latex, institutional low odor/VOC.
         1) Ceilings: Flat.
         2) Walls: Eggshell.

C. Plaster Substrates:
   1. Institutional Low–Odor/VOC Latex System:
      a. Prime Coat: Alkali–resistant, water–based primer.
      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Interior, latex, institutional low odor/VOC, eggshell.

END OF SECTION

TABLE OF CONTENTS

DIVISION	*SECTION*	*TITLE*	*PAGES THRU*
23		HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)	
	23 05 00	Basic HVAC Requirements	23 05 00 - 30
	23 05 05	HVAC Demolition for Remodeling	23 05 05 - 04
	23 05 13	Motors	23 05 13 - 05
	23 05 16	HVAC Expansion Compensation	23 05 16 - 04
	23 05 29	HVAC Supports and Anchors	23 05 29 - 14
	23 05 53	HVAC Identification	23 05 53 - 06
	23 05 93	Testing, Adjusting and Balancing	23 05 93 - 20
	23 07 13	Ductwork Insulation	23 07 13 - 06
	23 07 19	HVAC Piping Insulation	23 07 19 - 16
	23 21 00	Hydronic Piping	23 21 00 - 25
	23 31 00	Ductwork	23 31 00 - 32
	23 33 00	Ductwork Accessories	23 33 00 - 11
	23 34 16	Centrifugal Fans	23 34 16 - 02
	23 37 00	Air Inlets and Outlets	23 37 00 - 08
	23 73 13	Indoor Modular Air Handling Units	23 73 13 - 06
26		ELECTRICAL	
	26 05 00	Basic Electrical Requirements	26 05 00 - 33
	26 05 03	Through Penetration Firestopping	26 05 03 - 07
	26 05 05	Electrical Demolition for Remodeling	26 05 05 - 04
	26 05 13	Wire And Cable	26 05 13 - 07
	26 05 26	Grounding and Bonding	26 05 26 - 07
	26 05 27	Supporting Devices	26 05 27 - 04
	26 05 33	Conduit and Boxes	26 05 33 - 19
	26 05 53	Electrical Identification	26 05 53 - 12
	26 27 26	Wiring Devices	26 27 26 - 12
	26 28 13	Fuses	26 28 13 - 02
	26 28 16	Disconnect Switches	26 28 16 - 03

END TABLE OF CONTENTS 00 00 00

SECTION 23 05 00 - BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 23 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make his portion of the Mechanical Work a finished and working system.

1.3 OWNER FURNISHED PRODUCTS

A. The Owner will supply manufacturer's installation data for Owner-purchased equipment for this project.

B. This Contractor shall make all mechanical system connections shown on the drawings **or** as required for fully functional units.

C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

1.4 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours will be required.

B. Schedule overtime for the following work:

C. Itemize all work and list associated hours and pay scale for each item.

1.5 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:

    a. Plumbing Contractor.
    b. Heating Contractor.
    c. Air Conditioning and Ventilating Contractor.
    d. Temperature Control Contractor.
    e. Fire Protection Contractor.
    f. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.

3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.

4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.

5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.

    a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.

2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete

electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.

3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.

4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Code of Regulation Title 24, Article E725.

5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:

    a. Light fixtures.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical busduct.
    d. Sheet metal.
    e. Electrical cable trays, including access space.
    f. Sprinkler piping and other piping.
    g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:

    a. Boiler Feed Pumps.
    b. Burners.
    c. Chillers.
    d. Computer Room Air Conditioning Units.
    e. Condensate Return Stations.
    f. Condensing Units.
    g. Makeup Air Units.
    h. Electric Humidifiers.
    i. Gas Trains.
    j. Package Air Handling Units.
    k. Packaged Rooftop Units.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.

3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.

4. Temperature Control Contractor's Responsibility:

    a. Wiring of all devices needed to make the Temperature Control System functional.

b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor Contractor.

c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.

2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor Contractor when so noted on the Electrical Drawings.

3. Provides motor control and temperature control wiring, where so noted on the drawings.

4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.

5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.

6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.6 QUALITY ASSURANCE

A. Contractor’s Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the

Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.

2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of Arizona Codes, Laws, Ordinances and other regulations having jurisdiction.

2. Conform to all published standards of Northern Arizona University.

3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.

4. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.

5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.

6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.

7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.

2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.

3. Pay all charges for permits or licenses.

4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.

5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.

7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.

3. Scaling of the drawings is not sufficient or accurate for determining these locations.

4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.

6. If an item is either on the drawings or in the specifications, it shall be included in this contract.

7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.

8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.

    b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing AutoCAD MEP Revit.

2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.

3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.

4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.

5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.

6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.

7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.7 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
23 05 00	Owner Training Agenda
23 05 13	Motors
23 05 16	Expansion Compensation
23 05 29	Hangers and Supports
23 05 48	Vibration Isolation Equipment
23 05 53	HVAC Identification
23 05 93	Testing, Adjusting, and Balancing
23 07 13	Duct Insulation
23 07 19	HVAC Pipe Insulation
23 21 00	Hydronic Piping Systems and Valves
23 21 23	HVAC Pumps
23 31 00	Ductwork
23 37 00	Grilles, Registers, and Diffusers
23 37 00	Louvers

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

   a. Date
   b. Project title and number
   c. Contractor's name and address
   d. Division of work (e.g., plumbing, heating, ventilating, etc.)
   e. Description of items submitted and relevant specification number
   f. Notations of deviations from the contract documents
   g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

   a. Date
   b. Project title and number
   c. Architect/Engineer
   d. Contractor and subcontractors' names and addresses
   e. Supplier and manufacturer's names and addresses
   f. Division of work (e.g., plumbing, heating, ventilating, etc.)
   g. Description of item submitted (using project nomenclature) and relevant specification number
   h. Notations of deviations from the contract documents
   i. Other pertinent data
   j. Provide space for Contractor's review stamps

3. Composition:

   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.

   b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).

   c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor's Approval Stamp:

   a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.

   b. Unstamped submittals will be rejected.

   c. The Contractor's review shall include, but not be limited to, verification of the following:

      1) Only approved manufacturers are used.
      2) Addenda items have been incorporated.
      3) Catalog numbers and options match those specified.
      4) Performance data matches that specified.
      5) Electrical characteristics and loads match those specified.
      6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
      7) Dimensions and service clearances are suitable for the intended location.
      8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
      9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

   d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.

   e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**

6. Submittal Identification and Markings:

   a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.

   b. The Contractor shall clearly indicate the size, finish, material, etc.

   c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.

   d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.

8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.

9. Reproduction of contract documents alone is not acceptable for submittals.

10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.

11. Submittals not required by the contract documents may be returned without review.

12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.

13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.

14. Contractor’s responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer’s approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

   a. Submittal file name: 23 XX XX.description.YYYYMMDD
   b. Transmittal file name: 23 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

D. Paper Copy Submittal Procedures:

1. Paper copies are acceptable where electronic copies are not provided.

2. The Contractor shall submit ten (10) paper copies of each shop drawing.

3. Each set shall be bound in a three-ring binder or presentation binder. Copies that are loose or in pocket folders are not acceptable.

1.8 EQUIPMENT SUPPLIERS' INSPECTION

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that

the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Base Mounted Pumps
2. Water Chillers

B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner’s Operation and Maintenance Manuals.

1.9 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.

C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability (“Network Capability”). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.11 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.13 PROJECT COMMISSIONING

A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 23 08 00, and provide all services as described in the Commissioning Plan.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.

2. The Contractor shall do all excavating, filling, backfilling and compacting associated with his/her work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.

2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.

3. Trim bottom and sides of excavations to grades required for foundations.

4. Protect excavations against frost and freezing.

5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.

6. Perform all trenching in a manner to prevent cave-ins and risk to workers.

7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.

8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.

2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.

2. Provide all necessary sand and/or CA6 for backfilling.

3. Dispose of the excess excavated earth as directed.

4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials and stones greater than 4 inches in diameter. Water shall not be permitted to rise in unbackfilled trenches. No material shall be used for backfilling that contains frozen earth, debris, or earth with a high void content.

5. Backfill all trenches and excavations immediately after installing pipes or removal of forms, unless other protection is provided.

6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

7. Lay all piping on a compacted bed of CA6 at least 3 inches deep. Backfill around pipes with CA6, 6 inch layers, and compact each layer.

8. Use sand or CA6 for backfill up to grade for all piping under slabs or paved areas. All other piping shall have sand or CA6 backfill to 6 inches above the top of the pipe.

9. Place all backfill above the sand/CA6 in uniform layers not exceeding 6 inches deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.

10. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T-99 or ASTM D-698 test.

F. Surface Restoration:

1. Where trenches are cut through graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.

2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

a. Pipe insulation is installed and fully sealed.
b. Pipe and duct wall penetrations are sealed.
c. Pipe identification and valve tags are installed.
d. Main, branch and flexible ducts are installed.
e. Diffusers, registers and grilles are installed and connected to ductwork.
f. Terminal air box reheat coil piping or wiring is complete.
g. Terminal air box control wiring is complete and all control boxes are closed.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.

3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. IDPH Final Occupancy Checklist for Request of Inspection:

1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.

C. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.

2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.

3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

D. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.

2. Record documents including marked-up or reproducible drawings and specifications.

3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.

4. Inspection by State Boiler Inspector.

5. Start-up reports on all equipment requiring a factory installation inspection or start-up.

6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.

2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be

rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

   a. O&M file name: O&M.div23.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title “Operation and Maintenance Instructions”, title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.

7. All text shall be searchable.

8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.

2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.

3. Copies of all final approved shop drawings and submittals. Include Architect’s/Engineer’s shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.

4. Refer to Section 23 09 00 for additional requirements for Temperature Control submittals.

5. Copy of final approved test and balance reports.

6. Copies of all factory inspections and/or equipment startup reports.

7. Copies of warranties.

8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

9. Dimensional drawings of equipment.

10. Capacities and utility consumption of equipment.

11. Detailed parts lists with lists of suppliers.

12. Operating procedures for each system.

13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.

14. Repair procedures for major components.

15. List of lubricants in all equipment and recommended frequency of lubrication.

16. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The instructions shall include:

1. Explanation of all system flow diagrams.
2. Explanation of all air handling systems.
3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
4. Maintenance of equipment.
5. Smoke control systems.
6. Stairwell pressurization systems.
7. Start-up procedures for all major equipment.
8. Explanation of seasonal system changes.
9. Description of emergency system operation.

E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.

F. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.

2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.

D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.

E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of mechanical drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the mechanical systems.

B. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

C. Refer to Section 23 09 00 for additional requirements for Temperature Control documents.

D. Before completion of the project, a set of reproducible mechanical drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.

E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

F. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

G. Paint all outdoor exposed natural gas propane piping the color selected by Owner or Architect/Engineer.

H. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.

2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.

3.10 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.11 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner’s designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner’s designated representative will result in removal and reinstallation of the equipment at the Contractor’s expense.

3.12 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

    a. Minimizing the amount of dust generated.
    b. Reducing solvent fumes and VOC emissions.
    c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
    d. Protect stored on-site and installed absorptive materials from moisture damage.

2. Request that the Owner designate an IAQ representative.

3. Review and receive approval from the Owner’s IAQ representative for all IAQ-related construction activities and negative pressure containment plans.

4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.

5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner’s IAQ representative during unoccupied periods.

6. Request copies of and follow all of the Owner’s IAQ and infection control policies.

7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.

8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.

9. In addition to the criteria above, provide measures as recommended in the SMACNA “IAQ Guidelines for Occupied Buildings Under Construction”.

10. If permanently installed air handlers are used to serve both construction and occupied areas, all return grilles throughout construction areas shall be sealed to prevent air from construction areas being supplied to occupied areas.

11. If permanently installed air handlers are used during construction to serve only construction areas and do not supply air to adjacent occupied areas, MERV 8 filtration media shall be used to protect each return air grille or opening. The intent of this will be to prevent construction dust and debris from entering any return or supply air ductwork in the facility. All filtration media shall be replaced immediately prior to occupancy.

3.13 MAINTAINING CLEAN DUCTWORK THROUGHOUT CONSTRUCTION

A. Throughout the duration of construction, all ductwork shall be capped or sealed with sheet metal caps, polyethylene film, or other airtight protective to keep dust, dirt, and construction debris out of ducts. Similar means shall be used to seal air-side connections of HVAC equipment to include, but not limited to, air handling units, fans, terminal air boxes, fan coil units, cabinet heaters, blower coils, and the like.

B. When air terminal devices are installed, contractors shall seal all supply, return, and exhaust grilles with polyethylene film or other airtight protective to keep dust, dirt, and construction debris out of ducts.

C. Should HVAC equipment be started during construction, Contractor shall remove airtight protectives and shall install one-inch thick MERV 8 filter media over all return and exhaust grilles to prevent dust, dirt, and construction debris from entering ductwork. Filter media shall cover the entire grille face and shall be secured such that air cannot bypass filter media.

D. Should filter media become laden with dust and dirt, Contractor shall replace filter media with new media to prevent damage to air distribution system and equipment.

E. The following steps shall be taken during testing, adjusting, and balancing of each air system:

1. All construction activities in all spaces served by the air system shall stop.

2. All airtight protectives and temporary filter media shall be removed from all portions of the air system.

3. Testing, adjusting, and balancing work shall not commence until all construction activity is stopped and all airtight protectives and temporary filter media is removed.

4. Once testing, adjusting, and balancing work is complete for the air system, airtight protectives or temporary filter media shall be installed over all ductwork openings

and air terminals on the air system prior to resuming construction activities in any spaces served by the air system.

F. The Owner shall agree the building is sufficiently clean prior to the removal of any filtration media and airtight protectives from air terminal devices.

END OF SECTION 23 05 00

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All fans shall be operating and balanced.
4. All pumps, boilers and chillers operating and balanced.
5. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
6. All temperature control systems operating, programmed and calibrated.
7. Pipe insulation complete, pipes labeled and valves tagged.
8. Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 23 05 05 - HVAC DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.
B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. THE DRAWINGS ARE INTENDED TO INDICATE THE GENERAL SCOPE OF WORK AND DO NOT SHOW EVERY PIPE, DUCT, OR PIECE OF EQUIPMENT THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY CONDITIONS PRIOR TO SUBMITTING A BID.

B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.

C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.

D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.

E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.

F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.

G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

C. Existing Heating System: Maintain existing system in service until new system is complete and ready for service. Drain system only to make switchovers and connections. Obtain permission from the Owner at least 48 hours before partially or completely

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing mechanical work under provisions of Division 2 and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned ducts and piping to source of supply and/or main lines.

D. Remove exposed abandoned pipes and ducts, including abandoned pipes and ducts above accessible ceilings. Cut ducts flush with walls and floors, cap duct that remains, and patch surfaces. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.

E. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work.

G. Maintain access to existing mechanical installations which remain. Modify installation or provide access panels as appropriate.

H. Remove unused sections of supply and return air ductwork back to mains. Patch opening with sheet metal and seal airtight. Patch existing insulation to match existing. Where existing ductwork is to be capped and reused, locate the end cap within 6” of the last branch. End caps shall be 3” pressure class and seal class “A”.

I. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CUTTING AND PATCHING

A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 23 05 29 for additional requirements.

B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.

C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.

D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.

E. Floor slab is post-tensioned. All penetrations shall be x-rayed prior to cutting and/or drilling to avoid any tension cables or utilities encased in floor construction.

F. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes x-ray or similar non-destructive means.

G. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Clean all systems adjacent to project which are affected by the dust and debris caused by this construction.

C. MECHANICAL ITEMS REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL DISPOSE OF MATERIAL THE OWNER DOES NOT WANT TO REUSE OR RETAIN FOR MAINTENANCE PURPOSES.

3.6 SPECIAL REQUIREMENTS

A. Install temporary filter media over outside air intakes which are within 100 feet of the limits of construction or as noted on the drawings. This Contractor shall complete any cleaning required for existing systems which are affected by construction dust and debris.

B. Review locations of all new penetrations in existing floor slabs or walls. Determine construction type and review for possible interferences. Bring all concerns to the attention of the Architect/Engineer before proceeding.

C. Connection to Existing Glycol Systems:

1. Where existing piping system is maintained and only “hot taps” or existing valves are used as connection points, flush and clean the components in advance of connecting to the existing system.

    a. Provide additional glycol solution to be added to the system due to the increased volume associated with the new work and provide new solution for the portion of the added system.

    b. Use existing glycol feeder to add to the system.

2. Where existing piping system is reused in parts, existing system in its entirety shall be drained.

    a. Prior to starting work, provide an analysis of the existing glycol solution and make a report to the Owner/Engineer. The report shall include the level of glycol concentration as well as a statement regarding the overall condition of the solution about cleanliness of the solution.

        1) If the existing concentration is below the design level, the Contactor shall coordinate with the Owner to provide the additional quantity of glycol as added scope to the project.

        2) If the overall condition of glycol solution is poor and not worthy of being placed back into the system, the Contactor shall

coordinate with the Owner to provide the additional quantity of glycol as added scope to the project.

b. Provide means to store the existing glycol solution drained from the system for the duration of the work. Glycol may be stored on site or removed and brought back to the site when the system is ready to be refilled.

c. Once the new work is attached to the system and installation has been completed, pressure test the system in its entirety as a complete system. Anticipate leaks will occur in the existing piping system.

1) Repair all leaks.

2) Coordinate with Owner at the time of the pressure test and aid Owner in identification of leaks that they will repair.

d. Upon completion of an acceptable pressure test, flush the system in its entirety. Provide enough chemicals and flow to clean and flush the system as a whole.

e. In addition to the stored glycol solution, provide additional glycol solution to be added to the system due to the increased volume associated with the new work. Provide new solution for the portion of the added system. Use existing glycol feeder to add to the system.

END OF SECTION 23 05 05

SECTION 23 05 13 - MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single Phase and Three Phase Electric Motors.

1.2 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
E. ANSI/NEMA MG 1 - Motors and Generators.
F. ANSI/NFPA 70 - National Electrical Code.
G. Energy Independence and Security Act of 2007.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00. Include nominal efficiency and power factor for all premium efficiency motors. Efficiencies must meet or exceed the nominal energy efficiency levels presented below.

B. Submit shop drawings for all three phase motors.

C. Submit motor data with equipment when motor is installed by the manufacturer at the factory.

D. Submit shaft grounding device for all motors as required.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer’s recommendations for equipment and motor.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of commercial and industrial motors and accessories, with a minimum of three years documented manufacturing experience.

PART 2 - PRODUCTS

2.1 MOTORS - GENERAL CONSTRUCTION AND REQUIREMENTS

A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. Design motors for continuous operation in 40ºC environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Explosion-Proof Motors: UL listed and labeled for the hazard classification shown on the drawing, with over-temperature protection.

D. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.

E. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

F. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.

G. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.

H. Each contractor shall set all motors furnished by him.

I. All motors shall have a minimum service factor of 1.15.

J. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.

K. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.

L. Aluminum end housings are not permitted on motors 15 HP or larger.

M. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Motors over 40 HP shall have dual screw adjusters. Slide bases shall conform to NEMA standards.

N. Motors for fans and pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in

accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of varying motor speed.

2.2 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

A. All motors, unless exempted by EPAct legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

	Full-Load Efficiencies %					
	Open Drip-Proof			Totally Enclosed Fan Cooled		
HP	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10.0	91.7	91.7	89.5	91.0	91.7	90.2
15.0	91.7	93.0	90.2	91.7	92.4	91.0
20.0	92.4	93.0	91.0	91.7	93.0	91.0
25.0	93.0	93.6	91.7	93.0	93.6	91.7
30.0	93.6	94.1	91.7	93.0	93.6	91.7
40.0	94.1	94.1	92.4	94.1	94.1	92.4
50.0	94.1	94.5	93.0	94.1	94.5	93.0
60.0	94.5	95.0	93.6	94.5	95.0	93.6
75.0	94.5	95.0	93.6	94.5	95.4	93.6
100.0	95.0	95.4	93.6	95.0	95.4	94.1
125.0	95.0	95.4	94.1	95.0	95.4	95.0
150.0	95.4	95.8	94.1	95.8	95.8	95.0
200.0	95.4	95.8	95.0	95.8	96.2	95.4
250.0	95.4	95.8	95.0	95.8	96.2	95.8
300.0	95.4	95.8	95.4	95.8	96.2	95.8
350.0	95.4	95.8	95.4	95.8	96.2	95.8
400.0	95.8	95.8	95.8	95.8	96.2	95.8
450.0	96.2	96.2	95.8	95.8	96.2	95.8
500.0	96.2	96.2	95.8	95.8	96.2	95.8

B. Motor nameplate shall be noted with the above ratings.

2.3 MOTORS ON VARIABLE FREQUENCY DRIVES

A. All motors driven by VFDs shall be premium efficiency type.

B. Motors shall be designed for use with VFDs in variable torque applications with 1.15 service factor. Motors shall not be equipped with auxiliary blowers.

C. Motors driven by VFDs shall have Class F or H insulation and be designated by the motor manufacturer to be suitable for inverter duty service in accordance with NEMA MG 1 Section IV, “Performance Standards Applying to All Machines,” Part 31 “Definite-Purpose Inverter-Fed Polyphase Motors.

D. All 480-volt motors controlled by VFDs shall be equipped with an alternate discharge path, such as a shaft grounding ring or grounding brush, to divert adverse shaft currents from the motor bearings on the drive end of the motor shaft. Motor shafts 2” and larger require shaft grounding on the drive end and the non-drive end. This Contractor shall ensure (via field observation and measurement) that the shaft is effectively grounded upon startup.

1. Providing grounding rings internal to the motor housing is an acceptable solution, provided the motor is affixed with a label clearly indicating the presence of a grounding assembly. The grounding ring shall be listed for 40,000 hours of motor service and shall be accessible via the drive endplate.

2.4 MOTOR DRIVEN EQUIPMENT

A. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.

B. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

2.5 SHEAVES

A. All sheaves shall conform to NEMA Standard MG1-14.42, which lists minimum diameters and maximum overhangs. Locate motors to minimize overhang.

B. When replacing sheaves, use sheaves of at least the originally supplied sizes.

C. Contractor responsible for motor shall also be responsible for replacement sheaves. Coordinate with testing and balancing of the equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer’s recommendations. Align shafts to manufacturer’s requirements or within 0.002 inch per inch diameter of coupling hub.

C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer’s instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer’s recommendations.

Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

END OF SECTION 23 05 13

SECTION 23 05 16 - HVAC EXPANSION COMPENSATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Expansion Joints and Compensators.
B. Pipe Loops, Offsets, and Swing Joints.

1.2 REFERENCES

A. Conform to Standards of Expansion Joint Manufacturer's Association.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00.

B. Expansion joint shop drawings shall include maximum motion.

1.4 DESIGN CRITERIA

A. Unless noted otherwise, base expansion calculations on 50ºF installation temperature to 210ºF for heating water and steam condensate, plus 30% safety factor. Contact Architect/Engineer for steam temperatures.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Type EJ-1:

1. Multiple plies of 300 series stainless steel bellows.

2. Rated for 150 psi working pressure at 250ºF and 100psi at 400ºF.

3. Cycle life shall be at least 1,000 full range (compression and extension) cycles at rated stroke and 6,000 cycles at 1/2 rated stroke.

4. Axial motion shall be as scheduled on the drawings, but not less than 2" (compression plus extension).

5. Provide stainless steel inner liner for all steam expansion joints.

6. Provide removable metal insulation shroud around the bellows.

7. Joints 2" or smaller in copper piping systems shall have all copper, brass or bronze construction with stainless steel bellows and union ends or sweat ends with unions added. Acceptable Manufacturers: American BOA Type KH, Hyspan Type 8509, Flexonics Model HB, Metraflex Model HPMF, or Keflex Series 7QT.

8. Joints 2" or smaller in ferrous piping systems shall have steel bodies with union ends or male threaded ends with unions added. Acceptable Manufacturers: American BOA Type B, Hyspan Type 8503, Flexonics Model H, Metraflex Model HP, or Keflex Series 7Q-MPT.

9. Joints 2-1/2" or larger shall have 150 lb. forged steel flanges. Acceptable Manufacturers: American BOA Model 3150FS or 3150FL, Hyspan Model 1501, RM Model X-Flex-150 Multiply, Keflex Series 311-1215, or Metraflex Model MNLC.

B. Type EJ-2:

1. Multiple plies of 300 series stainless steel bellows.

2. Rated for 300 psi working pressure at 800ºF.

3. Cycle life shall be at least 1,000 full range (compression and extension) cycles at rated stroke and 6,000 cycles at 1/2 rated stroke.

4. Axial motion shall be as scheduled on the drawings, but not less than 2" (compression and extension).

5. Joints shall have 300 lb. flanges on each end.

6. Provide stainless steel inner liner.

7. Provide removable metal insulation shroud around the bellows.

8. Acceptable Manufacturers: American BOA Type FS3300, Flexonics, RM Model X-Flex-300 Multiply, or Hyspan Model 1501.

C. Type EJ-3:

1. Offset hinged or gimbal mounted, self-equalizing expansion joints with stainless steel carriers.

2. Suitable for vacuum to 300 psig.

3. Acceptable Manufacturers: Barco Manufacturing or Metraflex Model MC.

D. Type EJ-4:

1. Assembly consisting of two flexible connectors, two stainless steel flexible connectors, two 90º elbows, and a 180º return pipe. Unit shall be in the form of a pipe loop.

2. Connectors shall have corrugated stainless hose bodies with stainless steel braided casings.

3. Connectors shall be rated for 150 psi working pressure at 70ºF and 100 psi at 800ºF.

4. Sizes 2" and smaller shall have steel threaded connections.

5. Sizes 2-1/2" and larger shall have 150 lb. steel flanges.

6. Connectors shall be suitable for 1/2" permanent misalignment.

7. Acceptable Manufacturer: Metraflex Type ML.

E. Alignment Guides:

1. Bolted semi-steel spider.

2. Bolted guiding cylinder with supporting legs welded to pipe support.

3. Sized to allow insulation to pass through the outer cylinder.

4. Acceptable Manufacturers: American BOA, Hyspan, Flexonics, Keflex, or Metraflex.

F. Concrete Thrust Blocks - Rods and Clamps:

1. Bends, offsets, tees, crosses, and dead ends, including flange and spigot pieces, shall be suitably rodded or clamped and blocked with concrete thrust blocks.

2. Rods shall be all thread type, galvanized steel conforming to ANSI B1.1, Class 2A FIT, USS National Coarse Thread, tensile strength 55/77 ksi, yield strength 36 ksi minimum.

3. Rods and clamps shall receive one field coat of asphaltum after installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Accomplish structural work and provide equipment required to control expansion and contraction of piping; including loops, offsets, swing joints, and expansion joints where required.

B. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so all movement occurs along axis of pipe only.

C. Each mechanical expansion joint shall have one anchor on each side and two alignment guides on each side of it. Guides shall be located within 4 and 14 pipe diameters of the mechanical expansion joint or as recommended by the joint manufacturer.

D. Preset all expansion joints to allow for expected expansion from installation temperature to operating temperature.

END OF SECTION 23 05 16

SECTION 23 05 29 - HVAC SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.
B. Equipment Bases and Supports.
C. Sleeves and Seals.
D. Flashing and Sealing of Equipment and Pipe Stacks.
E. Cutting of Openings.
F. Escutcheon Plates and Trim.

1.2 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.
B. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
C. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
D. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
E. MSS SP-127 – Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 23 05 00. Include plastic pipe manufacturers' support spacing requirements.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

A. Hanger rods for single rod hangers shall conform to the following:

Pipe Size	Hanger Rod Diameter	
	Column #1	Column #2
2" and smaller	3/8"	3/8"
2-1/2" through 3-5/8"	1/2"	1/2"
4" and 5"	5/8"	1/2"
6"	3/4"	5/8"
8" through 12"	7/8"	3/4"
14"	1"	7/8"
16" and 18"	1"	N/A
20" and 24"	1-1/4"	N/A

Column #1: Steel pipe.
Column #2: Copper, plastic and fiberglass reinforced pipe.

B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.

C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

2.2 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).

2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

a. Insulation Couplings:

1) Insulation Coupling: Molded thermoplastic, -65ºF to 275ºF, sizes up to 4-1/8” OD, and receive insulation thickness up to 1”. Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.

2) Horizontal Strut Mounted Insulated Pipe:

a) Acceptable Manufacturers: Klo-Shure or equal.

3) Vertical:

a) Acceptable Manufacturers: Klo-Shure Titan or equal.

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

Acceptable Products:
Cooper/B-Line - Fig B3373 Series
Erico - 510 Series
Nibco/Tolco - Fig. 82

2. Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.

Acceptable Products: Mason RBA, RCA, or BR.

3. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.

4. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts

C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.

2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp within their temperature limits of -65°F to +275°F.

3. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.

4. Ferrous hot piping 2-1/2 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

Acceptable Products:

Anvil -	Fig. 160, 161, 162, 163, 164, 165
Cooper/B-Line -	Fig. 3160, 3161, 3162, 3163, 3164, 3165
Erico -	Model 630, 631, 632, 633, 634, 635
Nibco/Tolco -	Fig. 260-1, 261-1 1/2, 262-2, 263-2 1/2, 264-3, 265-4

5. As an alternative to separate pipe insulation insert and saddle, properly sized integral rigid insulation sections may be used.

Acceptable Products:

Cooper/B-Line -	Fig. B3380 through B3384
Pipe Shields -	A1000, A2000
Erico -	Model 124, 127

6. Unless otherwise indicated, hangers shall be as follows:

   a. Clevis Type:
      Service: Bare Metal Pipe
      Rigid Plastic Pipe
      Insulated Cold Pipe
      Insulated Hot Pipe - 3 inches & Smaller

Acceptable Products:	Bare Steel, Plastic or Insulated Pipe	Bare Copper Pipe
Anvil	Fig. 260	
Cooper/B-Line	Fig. 3100	Fig. B3100C
Erico	Model 400	
Nibco/Tolco	Fig. 1	Fig. 81PVC

   b. Roller Type:
      Service: Insulated Hot Pipe - 4 inches and Larger

Acceptable Products:	4" through 6"	8" and Above
Anvil	Fig. 181, 271	Fig. 171, 271
Cooper/B-Line	Fig. 3110, 3117	Fig. 3114, 3117
Erico	Model 610	Model 605
Nibco/Tolco	Fig. 324, 327	Fig. 322, 327

   c. Continuous Channel with Clevis Type:
      Service: Plastic Tubing
      Flexible Hose
      Soft Copper Tubing

      Acceptable Products:
      Cooper/B-Line - Fig. B3106, with Fig. B3106V
      Erico - Model 104, with Model 104V
      Nibco/Tolco - Fig. 1V

   d. Adjustable Swivel Ring Type:
      Service: Bare Metal Pipe - 4 inches and Smaller

Acceptable Products:	Bare Steel Pipe	Bare Copper Pipe
Anvil	Fig. 69	
Cooper/B-Line	Fig. B3170NF	Fig. B3170CTC
Erico	Model FCN	102A0 Series
Nibco/Tolco	Fig. 200	Fig. 203

7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4” in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer’s installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

   a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

   b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

8. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

a. Clamp Type:
Service: Bare Metal Pipe
Rigid Plastic Pipe
Insulated Cold Pipe
Insulated Hot Pipe - 3 inches and smaller

1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.

2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.

Acceptable Products:	Bare Steel, Plastic or Insulated Pipe	Bare Copper Pipe
Unistrut	Fig. P1100 or P2500	
Cooper/B-Line	Fig. B2000 or B2400	Fig. BVT
Nibco/Tolco	Fig. A-14 or 2STR	

b. Roller Type:
Service: Insulated Hot Pipe - 4 inches and larger.

Acceptable Products:	4" through 6"	8" and Above
Unistrut	Fig. P2474	Fig. P2474-1
Cooper/B-Line	Fig. B218	Fig. B219
Nibco/Tolco	Fig. ROL-12	Fig. ROL-13

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps

1) C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists):

Acceptable Products:	
Anvil	Fig. 92
Cooper/B-Line	Fig. B3033/B3034
Erico	Model 300
Nibco/Tolco	68

2) Scissor Type Beam Clamps (For use with bar-joists and wide flange):

Acceptable Products:	
Anvil	Fig. 228, 292
Cooper/B-Line	Fig. B3054
Erico	Model 360
Nibco/Tolco	Fig. 329

b. Concrete

1) Concrete Inserts, Single Rod Galvanized:

Acceptable Products:	
Anvil	Fig. 282
Cooper/B-Line	Fig. B3014
Erico	Model 355
Nibco/Tolco	Fig. 310

2) Concrete Inserts, Continuous Strip Galvanized:

Acceptable Products:	
Unistrut Corp	P3200 Series
Cooper/B-Line	Fig. B22-J
Erico	CONCT

3) Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.

4) Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

c. Steel Structure Welding:

1) Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.

2.3 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.

2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

1. Refer to Section 23 05 50 for additional requirements for concrete bases in seismic applications.

2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base).

3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a “dirt-trap”.

4. Concrete materials and workmanship required for the Contractor's work shall be provided by him. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6”x6”, W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.

5. Equipment requiring bases is as follows:

   a. Air Compressor
   b. Air Handling Unit
   c. Boiler
   d. Boiler Feed Pump/Tank
   e. Chemical Feed Equipment
   f. Chiller
   g. Expansion Tank
   h. Condensate Return Station
   i. Day Tank
   j. Fans
   k. Furnace
   l. Steam Generator (Humidifier)
   m. Heat Exchanger
   n. Pump
   o. Tank

C. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.

2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

D. Grout:

1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.

2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.

3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.4 OPENINGS IN FLOORS, WALLS AND CEILINGS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.5 ROOF PENETRATIONS

A. Seal pipes with surface temperature below 150ºF penetrating single-ply roofs with conical stepped pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots. Material shall match roofing membrane.

B. Break insulation only at the clamp for pipes between 60ºF and 150ºF. Seal outdoor insulation edges watertight.

2.6 SLEEVES AND LINTELS

A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor’s work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.

D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.

E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer’s design.

F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.

G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.

I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

J. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.

2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120ºF, sleeves may be thermoplastic with integral water seal and textured surface.

3. Sleeves shall be at least 2 pipe sizes larger than the pipes.

4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.

5. Sealing element shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40ºF to 250ºF
T	High/Low Temperature	Silicone	-67ºF to 400ºF
T	Fire Seals (1 hour)	Silicone	-67ºF to 400ºF
FS	Fire Seals (3 hours)	Silicone	-67ºF to 400ºF
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

6. Acceptable Manufacturers: Thunderline Corporation "Link-Seals", O-Z/Gedney Company, Calpico, Inc., Innerlynx, or Metraflex Company (cold service only).

2.7 ESCUTCHEON PLATES AND TRIM

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.8 PIPE PENETRATIONS

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.9 PIPE ANCHORS

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.10 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 HVAC SUPPORTS AND ANCHORS

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.

2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.

3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with sheet metal contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Install roof pipe supports to resist wind movement per manufacturer’s recommendations. Method of securing base to roof shall be compatible with roofing materials.

2. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.

3. Set all concrete inserts in place before pouring concrete.

4. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.

5. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.

6. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.

2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.

3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.

4. Piping shall not introduce strains or distortion to connected equipment.

5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.

6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.

7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.

8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3’ spacing between loads.

2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

a. The hanger is attached within 6” from a web/chord joint.

b. Additional L2x2x1/4 web reinforcement is installed per manufacturer’s requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.

4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2’-0” on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2’-0” spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

	Pipe Material	Maximum Spacing
1.	Steel and Fiberglass (Std. Weight or Heavier – Liquid Service):	
	1-1/4" & under	7'-0"
	1-1/2"	9'-0"
	2"	10'-0"
	2-1/2"	11'-0"
	3"	12'-0"
	4" & larger	12'-0"
2.	Steel (Std. Weight or Heavier – Vapor Service):	
	1-1/4" and under	9'-0"
	1-1/2"	12'-0"
	2" & larger	12'-0"
3.	Hard Drawn Copper & Brass (Liquid Service):	
	3/4" and under	5'-0"
	1"	6'-0"
	1-1/4"	7'-0"
	1-1/2"	8'-0"
	2"	8'-0"
	2-1/2"	9'-0"
	3"	10'-0"
	4"	12'-0"
	6"	12'-0"
4.	Hard Drawn Copper & Brass (Vapor Service):	
	3/4" & under	7'-0"
	1"	8'-0"
	1-1/4"	9'-0"
	1-1/2"	10'-0"
	2"	11'-0"
	2-1/2" & larger	12'-0"

5. Flexible Plastic Pipe, Flexible Hose, and Soft Copper Tubing:

   a. Continuous channel with hangers maximum 8’-0” OC.

6. Rigid Plastic Pipe:

   a. Hangers shall be spaced based on the piping system manufacturers’ instructions or, if no system instructions are available, space hangers at 4’-0” maximum centers.

7. Installation of hangers shall conform to MSS SP-58, 69, and 89.

END OF SECTION 23 05 29

SECTION 23 05 53 - HVAC IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of products installed under Division 23.

1.2 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
B. ASTM B-1, B-3, and B-8 for copper conductors.
C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 – 2kV Cables.
D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.
E. NFPA-99 – Health Care Facilities.
F. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00. Include list of items identified, wording, letter sizes, and color coding.

B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.2 MATERIALS

A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or insulation	Marker Length	Size of Letters
Up to and including 1-1/4”	8”	1/2”
1-1/2” to 2”	8”	3/4”
2-1/2” to 6”	12”	1-1/4”
8” to 10”	24”	2-1/2”
Over 10”	32”	3-1/2”

Plastic tags may be used for outside diameters under 3/4".

B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.

C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.

E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.

G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

H. Stencil Painted Pipe Markers: Use industrial enamel spray paint per ANSI Standard A13.1. Indicate fluid conveyed and flow direction.

I. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.

J. Tracer Wire:

1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.

2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.

3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

K. Ductwork Markers:

1. Ductwork systems containing hazardous materials shall be provided with minimum 2”x4” ANSI Z535.2 biohazard warning labels with custom labeling describing hazard. Refer to table in Part 3 for system and label description.

2. Vinyl Markers: Colored vinyl with permanent pressure sensitive adhesive backing suitable for indoor and outdoor application.

L. Maintenance Access Doors:

1. Doors and roof hatches used to access equipment serving hazardous ductwork systems shall be provided with a minimum 4”x6" ANSI Z5353.2 biohazard warning label. Label shall read “WARNING – BIOHAZARD. ONLY AUTHORIZED PERSONNEL BEYOND THIS POINT”.

2. Coordinate location of warning label with Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturer’s recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Valves:

1. All valves (except shutoff valves at equipment) shall have numbered tags.

2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.

3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.

4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.

5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.

6. Number all tags and show the service of the pipe.

7. Provide one Plexiglas framed valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.

D. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.

2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.

3. Stencil Painted Pipe Markers:

   a. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
   b. Apply primer on non-insulated pipes before painting.
   c. Use background and letter colors as scheduled later in this section.

4. Apply markers and arrows in the following locations where clearly visible:

   a. At each valve.
   b. On both sides of walls that pipes penetrate.
   c. At least every 20 feet along all pipes.
   d. On each riser and each leg of each "T" joint.
   e. At least once in every room and each story traversed.

5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Ductwork Markers:

1. Apply ductwork markers on ductwork systems containing hazardous materials in the following locations where clearly visible:

   a. On both sides of walls that ducts penetrate.
   b. At least every 20 feet along all ducts.
   c. On each riser and each leg of each branch connection.
   d. At least once in every room and each story traversed.
   e. At all ductwork access doors.
   f. At all fans and equipment serving ductwork system. Markers shall be clearly visible from the normal maintenance access path to the equipment. Coordinate placement location with Owner.

F. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function such as air handling units, exhaust fans, filters, reheat coils, dampers, etc.; shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.

2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.

3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

G. Miscellaneous:

1. Attach self-adhesive vinyl labels at all duct access doors used to reset fusible links or actuators on fire, fire/smoke, or smoke dampers. Lettering shall be a minimum of 1/2" high. Labels shall indicate damper type.

2. Provide engraved plastic tags at all hydronic or steam system make-up water meters.

H. Tracer Wire:

1. Tracer wire shall be installed on top of all non-metallic buried utilities.

2. Tracer wire shall be taped directly to plastic water or drain pipe.

3. Tracer wire shall not be fastened directly or indirectly to gas piping.

4. Tracer wire when attached shall be secured to the pipe a minimum of every 10 feet and at all changes of direction.

5. Tape shall be Polyken “930-35”, Protecto-Wrap “310”, or approved equal.

6. Tracer wire shall be continuous between boxes and shall be tested for continuity.

7. Splices in tracer wire shall be made with a water proof splice kit to prevent corrosion. Wire nuts shall not be used.

8. The tracer wire shall daylight to grade through a 2" PVC conduit, at the point of the utility entrance to building. PVC conduit shall be capped and labeled as future contact point to locate the utility.

3.2 SCHEDULE

A. Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

Pipe Service	Lettering Color	Background Color
HIGH TEMP HOT WATER - OVER 240ºF	Black	Yellow
STEAM - 90 PSI	Black	Yellow
STEAM - 60 PSI	Black	Yellow
STEAM - 30 PSI	Black	Yellow
STEAM - 15 PSI	Black	Yellow
STEAM - 5 PSI	Black	Yellow
CLEAN STEAM - 0 PSI	Black	Yellow
HEATING WATER SUPPLY	Black	Yellow
HEATING WATER RETURN	Black	Yellow
HIGH PRESSURE CONDENSATE	Black	Yellow
MEDIUM PRESSURE CONDENSATE	Black	Yellow
LOW PRESSURE CONDENSATE	Black	Yellow
PUMPED CONDENSATE	Black	Yellow
CHILLED WATER SUPPLY	White	Green
CHILLED WATER RETURN	White	Green
CONDENSER WATER SUPPLY	White	Green
CONDENSER WATER RETURN	White	Green
CONDENSATE DRAIN	Black	Yellow
COMPRESSED AIR	Black	Yellow
CONTROL COMPRESSED AIR	Black	Yellow
NATURAL GAS	Black	Yellow
MEDICAL VACUUM - 15-30 IN. HG	Black	White
WASTE ANESTHETIC GAS DISPOSAL - 15-30 IN. HG	White	Violet
CARBON DIOXIDE - 50-55 PSI	White	Gray
INSTRUMENT AIR - 160-185 PSI	White	Red
MEDICAL AIR - 50-55 PSI	Black	Yellow
NITROGEN - 160-185 PSI	White	Black
NITROUS OXIDE - 50-55 PSI	White	Blue
OXYGEN - 50-55 PSI	White	Green
HYPERBARIC OXYGEN - 70-75 PSI	White	Green
REFRIGERANT LIQUID	Black	Yellow
REFRIGERANT SUCTION	Black	Yellow
REFRIGERANT HOT GAS	Black	Yellow
FUEL OIL SUPPLY	Black	Yellow
FUEL OIL RETURN	Black	Yellow
Underground Piping	Varies	Varies
Tracer Wire - Natural Gas Pipe Lines	---	Yellow
Tracer Wire - All other buried types	---	Green

B. Steam pipe markers shall include operating steam pressure within pipes shown in table above.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjusting, and balancing of air systems.
B. Testing, adjusting, and balancing of heating systems.
C. Testing, adjusting, and balancing of cooling systems.
D. Testing, adjusting, and balancing of plumbing systems.
E. Measurement of final operating condition of HVAC systems.

1.2 QUALITY ASSURANCE

A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, SMARTA Certified Air and Hydronic Balancer, or TABB Certified Supervisor.

B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.3 REFERENCES

A. AABC - National Standards for Total System Balance, 2002.
B. ADC – Test Code for Grilles, Registers, and Diffusers.
C. AMCA – Publication 203-90; Field Performance Measurement of Fan Systems.
D. ASHRAE - 2003 HVAC Applications Handbook; Chapter 37, Testing, Adjusting and Balancing.
E. ASHRAE/ANSI - Standard 111-1988; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.
F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Sixth Edition, 1998.
G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing, Third Edition, 2002.
H. TABB – International Standards for Environmental Systems Balance.

1.4 SUBMITTALS

A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.

B. Electronic Copies:

1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.

3. All text shall be searchable.

4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

C. Paper Copies:

1. Submit four (4) certified copies of test reports to the Architect/Engineer for approval in soft cover, 3-hole binder manuals, with cover identification. Include index page and indexing tabs.

1.5 REPORT FORMS

A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.

B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.

C. Refer to PART 4 for required reports.

1.6 WARRANTY/GUARANTEE

A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.

B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.7 SCHEDULING

A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

B. Project will be constructed in phases. Provide balancing report after each phase is complete.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the

contract documents shall be balanced using a procedure from a published standard listed in the References article.

B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.

C. Recorded data shall represent actual measured or observed conditions.

D. 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 is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.

E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.

G. The Balancing Contractor shall measure terminal air box air flow, and the TCC shall adjust DDC readout to match. Refer to Section 23 09 00 for additional information.

H. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.2 EXAMINATION

A. Before beginning work, verify that systems are complete and operable. Ensure the following:

1. General Equipment Requirements:

    a. Equipment is safe to operate and in normal condition.
    b. Equipment with moving parts is properly lubricated.
    c. Temperature control systems are complete and operable.
    d. Proper thermal overload protection is in place for electrical equipment.
    e. Direction of rotation of all fans and pumps is correct.
    f. Access doors are closed and end caps are in place.

2. Duct System Requirements:

    a. All filters are clean and in place. If required, install temporary media.
    b. Duct systems are clean and free of debris.
    c. Fire/smoke and manual volume dampers are in place, functional and open.
    d. Air outlets are installed and connected.
    e. Duct system leakage has been minimized.

3. Pipe System Requirements:

    a. Coil fins have been cleaned and combed.
    b. Hydronic systems have been cleaned, filled, and vented.
    c. Strainer screens are clean and in place.
    d. Shutoff, throttling and balancing valves are open.

B. Report any defects or deficiencies to Architect/Engineer.

C. Promptly report items that are abnormal or prevent proper balancing.

D. If, for design reasons, system cannot be properly balanced, report as soon as observed.

E. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.

B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.4 INSTALLATION TOLERANCES

A. ± 10% of scheduled values:

1. Adjust air inlets and outlets to ± 10% of scheduled values.

2. Adjust piping systems to ± 10% of design values.

B. ± 5% of scheduled values:

1. Adjust fume exhaust systems to ± 5% of scheduled values.

2. Adjust supply and exhaust air-handling systems for space pressurization to ± 5% of scheduled values, and to provide proper pressurization.

C. + 5% of scheduled values

1. Adjust outdoor air intakes to within + 5% of scheduled values.

2. Adjust exhaust air through energy recovery equipment to within +5% of scheduled values.

D. Adjust supply, return, and exhaust air-handling systems to +10% / -5% of scheduled values.

3.5 ADJUSTING

A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.

B. Once balancing of systems is complete, at least one damper or valve must be 100% open.

C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.

D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.

E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

3.6 SUBMISSION OF REPORTS

A. Fill in test results on appropriate forms.

B. Complete all applicable tests, certifications, forms, and matrices listed in the Illinois Department of Public Health (IDPH) Final Occupancy Checklist Certifications for Request of Inspection.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.1 VERIFICATION OF EXISTING SYSTEMS

A. Perform a pre-balance of systems serving the area of construction prior to the start of any other work. Do not make adjustments to the systems. If the systems are not operating at maximum capacity, temporarily drive system to maximum and take readings for the system. Return the system to its original state when measurements are complete.

1. Air Handling Unit

a. General Requirements:
   1) Existing Equipment Tag (if available).
   2) Location.
   3) Manufacturer, model, arrangement, class, discharge.
   4) Fan RPM.
b. Flow Rate:
   1) Supply flow rate (cfm)
   2) Return flow rate (cfm)
   3) Outside flow rate (cfm)
   4) Exhaust flow rate (cfm)
c. Pressure Drop and Pressure:
   1) Filter pressure drop.
   2) Total static pressure. (Indicate if across fan or external to unit).
   3) Inlet pressure.
   4) Discharge pressure.

2. Exhaust Fan

a. Drawing symbol.
b. Location.
c. Manufacturer and model.
d. Flow rate (cfm).
e. Total static pressure. (Indicate measurement locations).
f. Inlet pressure.
g. Discharge pressure.
h. Fan RPM.

3. Air Terminal (Inlet or Outlet):

a. Room number/location.
b. Terminal type and size.
c. Velocity.

d. Flow rate (cfm)
e. Percent of design flow rate.

B. Report findings to Architect/Engineer on standard forms. Provide four (4) copies of report.

4.2 GENERAL REQUIREMENTS

A. Title Page:

1. Project name.
2. Project location.
3. Project Architect.
4. Project Engineer (IMEG Corp.).
5. Project General Contractor.
6. TAB Company name, address, phone number.
7. TAB Supervisor's name and certification number.
8. TAB Supervisor's signature and date.
9. Report date.

B. Report Index

C. General Information:

1. Test conditions.
2. Nomenclature used throughout report.
3. Notable system characteristics/discrepancies from design.
4. Test standards followed.
5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

4.3 AIR SYSTEMS

A. Duct Leakage Test:

1. Air system and fan.
2. Leakage class.
3. Test pressure.
4. Construction pressure.
5. Flow rate (cfm): specified and actual.
6. Leakage (refer to Section 23 31 00 in the specifications): specified and actual.
7. Statement that fire dampers, reheat coils and other accessories were included in the test.
8. Pass or Fail.
9. Test performed by.
10. Test witnessed by.

B. Air Moving Equipment:

1. General Requirements:
   a. Drawing symbol.
   b. Location.
   c. Manufacturer, model, arrangement, class, discharge.
   d. Fan RPM.
   e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
   f. Final frequency of motor at maximum flow rate (on fans driven by VFD).
2. Flow Rate:
   a. Supply flow rate (cfm): specified and actual.
   b. Return flow rate (cfm): specified and actual.
   c. Outside flow rate (cfm): specified and actual.
   d. Exhaust flow rate (cfm): specified and actual.
3. Pressure Drop and Pressure:
   a. Filter pressure drop: specified and actual.
   b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
   c. Inlet pressure.
   d. Discharge pressure.

C. Fan Data:

1. Drawing symbol.
2. Location.
3. Manufacturer and model.
4. Flow rate (cfm): specified and actual.
5. Total static pressure: specified and actual. (Indicate measurement locations).
6. Inlet pressure.
7. Discharge pressure.
8. Fan RPM.

D. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, Model, Frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps in each phase.

E. Duct Traverse:

1. System zone/branch/location.
2. Duct size.
3. Free area.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Duct static pressure.
7. Air temperature.
8. Air correction factor.

F. Air Terminal (Inlet or Outlet):

1. Drawing symbol.
2. Room number/location.

3. Terminal type and size.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Percent of design flow rate.

G. Air Flow Measuring Station:

1. Drawing symbol.
2. Service.
3. Location.
4. Manufacturer and model.
5. Size.
6. Flow rate (cfm): specified and actual.
7. Pressure drop: specified and actual.

H. Positive Air Flow Test:

1. Occupied Supply Air (Max./Min.) Flow rate (cfm): specified and actual.
2. Occupied Return Air (Max./Min.) Flow rate (cfm): specified and actual.
3. Unoccupied Supply Air (Max./Min.) Flow rate (cfm): specified and actual.
4. Unoccupied Return Air (Min./Max.) Flow rate (cfm): specified and actual.

I. Fire, Smoke, and Fire/Smoke Dampers:

1. Damper ID #.
2. System identification.
3. Type.
4. Size.
5. UL assembly number.
6. Location of damper and access door.
7. Fusible link temperature rating.
8. Manufacturer and model.
9. Operation pass/fail/reset.

4.4 HEATING SYSTEMS

A. Pump Data (Primary and Secondary Heating Water Loop Pumps):

1. Existing drawing symbol or equipment TAG
2. Service.
3. Manufacturer, size, and model.
4. Impeller size: specified, actual, and final (if trimmed).
5. Flow Rate (gpm): specified and actual.
6. Pump Head: specified, operating and shutoff.
7. Suction Pressure: Operating and shutoff.
8. Discharge Pressure: Operating and shutoff.
9. Final frequency of motor at maximum flow rate (on pumps driven by VFD).

B. Electric Motors (Associated Heating Water Loop Pump Motors):

1. Drawing symbol of equipment served.
2. Manufacturer, Model, Frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps in each phase.

C. Heat Exchangers (not all items apply to all units):

1. General Requirements:
   a. Drawing symbol.
   b. Service.
   c. Location.
   d. Manufacturer and model.
2. Primary Heat Exchanger:
   a. Steam pressure in exchanger: specified and actual.
   b. Primary water entering temperature: specified and actual.
   c. Primary water leaving temperature: specified and actual.
   d. Primary water flow: specified and actual.
   e. Primary water pressure drop: specified and actual.
   f. Primary water Btuh (gpm x temperature drop x 500).
3. Secondary Heat Exchanger:
   a. Secondary water entering temperature: specified and actual.
   b. Secondary water leaving temperature: specified and actual.
   c. Secondary water flow: specified and actual.
   d. Secondary water pressure drop: specified and actual.
   e. Secondary water Btuh (gpm x temperature rise x 500).

D. Heating Coils:

1. General Requirements:
   a. Drawing symbol.
   b. Service.
   c. Location.
   d. Manufacturer and model.
   e. Size.
2. Flow Rate:
   a. Flow rate (cfm): specified and actual.
   b. Water flow rate: specified and actual.
3. Temperature:
   a. Entering air temperature: specified and actual.
   b. Leaving air temperature: specified and actual.
   c. Entering water temperature: specified and actual.
   d. Leaving water temperature: specified and actual.
4. Pressure Drop and Pressure:
   a. Air pressure drop: specified and actual.
   b. Steam pressure after valve: specified and actual.
   c. Water pressure drop: specified and actual.
5. Energy:
   a. Air Btuh (cfm x temp rise x 1.09).
   b. Water Btuh (gpm x temp drop x 500). Repeat tests if not within 10% of air Btuh.

E. Terminal Heat Transfer Units:

1. General Requirement:
   a. Drawing symbol.
   b. Location.
   c. Manufacturer and model.
   d. Include air data only for forced air units.

2. Flow Rate:
   a. Flow rate (cfm): specified and actual.
   b. Water flow rate (gpm): specified and actual.
3. Temperature:
   a. Entering air temperature: specified and actual.
   b. Leaving air temperature: specified and actual.
   c. Entering water temperature: specified and actual.
   d. Leaving water temperature: specified and actual.
4. Energy:
   a. Air Btuh (cfm x temperature rise x 1.09).
   b. Water Btuh (gpm x temperature drop x 500). Repeat tests if not within 10% of air Btuh.

F. Hot Water Boiler:

1. General Requirements:
   a. Drawing symbol.
   b. Service.
   c. Location.
   d. Manufacturer, model, and identification number.
   e. Control setting: specified and actual.
2. Temperature:
   a. Entering water temperature: specified and actual.
   b. Leaving water temperature: specified and actual.
3. Flow Rate:
   a. Flow rate (gpm): specified and actual.
4. Pressure Drop and Pressure:
   a. Pressure Drop: specified and actual.
5. Energy:
   a. Rating (Btuh).
   b. Measured output (Btuh).

G. Steam Boiler:

1. General Requirements:
   a. Drawing symbol.
   b. Service.
   c. Location.
   d. Manufacturer, model and identification number.
   e. Control setting: specified and actual.
2. Pressure Drop and Pressure:
   a. Pressure: specified and actual.
3. Energy:
   a. Rating (Btuh).
   b. Measured output (Btuh)

4.5 COOLING SYSTEMS

A. Pump Data:

1. General Requirements:
   a. Drawing symbol.
   b. Service.
   c. Manufacturer, size, and model.

d. Impeller size: specified, actual, and final (if trimmed).
e. Final frequency of motor at maximum flow rate. (On pumps driven by VFD.)

2. Flow Rate:
   a. Flow Rate (gpm): specified and actual.
3. Pressure Drop and Pressure:
   a. Pump Head: specified, operating and shutoff.
   b. Suction Pressure: Operating and shutoff.
   c. Discharge Pressure: Operating and shutoff.

B. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, Model, Frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps for each phase.

C. Cooling Tower:

1. General Requirements:
   a. Drawing symbol.
   b. Manufacturer and model.
   c. Rated capacity.
   d. Fan RPM.
2. Temperature:
   a. Ambient air dry bulb temperature.
   b. Entering air dry bulb temperature.
   c. Entering air wet bulb temperature: specified and actual.
   d. Leaving air wet bulb temperature: specified and actual.
   e. Condenser water entering temperature.
   f. Condenser water leaving temperature.
3. Flow Rate:
   a. Condenser water flow rate (gpm).

D. Water Cooled Chillers:

1. General Requirements:
   a. Drawing symbol.
   b. Manufacturer and model.
   c. Refrigerant type and capacity.
   d. Starter type, size, and thermal protection.
   e. Capacity: specified and actual.
   f. Condenser Btuh (gpm x temperature rise x 500). Recheck results if not 15-25% more than evaporator Btuh.
2. Temperature:
   a. Evaporator entering water temperature: specified and actual.
   b. Evaporator leaving water temperature: specified and actual.
   c. Condenser entering water temperature: specified and actual.
   d. Condenser leaving water temperature: specified and actual.
3. Pressure Drop and Pressure:
   a. Evaporator pressure drop: specified and actual.
   b. Condenser pressure drop: specified and actual.
4. Flow Rate:
   a. Evaporator water flow rate: specified and actual.
   b. Condenser water flow rate: specified and actual.

E. Air Cooled Chillers:

1. General Requirements:
   a. Drawing symbol.
   b. Manufacturer and model.
   c. Refrigerant type and capacity.
   d. Starter type, size, and thermal protection.
   e. Capacity: specified and actual.
2. Temperature:
   a. Evaporator entering water temperature: specified and actual.
   b. Evaporator leaving water temperature: specified and actual.
   c. Condenser entering air temperature.
   d. Condenser leaving air temperature.
3. Pressure Drop and Pressure:
   a. Evaporator pressure drop: specified and actual.
4. Flow Rate:
   a. Evaporator water flow rate: specified and actual.

F. Direct Expansion Chillers:

1. General Requirements:
   a. Drawing symbol.
   b. Manufacturer and model.
   c. Refrigerant type and capacity.
   d. Starter type, size, and thermal protection.
   e. Capacity: specified and actual.
2. Temperature:
   a. Entering water temperature: specified and actual.
   b. Leaving water temperature: specified and actual.
3. Pressure Drop and Pressure:
   a. Pressure drop: specified and actual.
   b. Suction pressure.
4. Flow Rate:
   a. Water flow rate: specified and actual.

G. Heat Exchangers (not all items apply to all units):

1. General Requirements:
   a. Drawing symbol.
   b. Service.
   c. Location.
   d. Manufacturer and model.
2. Primary Heat Exchanger:
   a. Primary water entering temperature: specified and actual.
   b. Primary water leaving temperature: specified and actual.
   c. Primary water flow: specified and actual.
   d. Primary water pressure drop: specified and actual.
   e. Primary water Btuh (gpm x temperature drop x 500).
3. Secondary Heat Exchanger:
   a. Secondary water entering temperature: specified and actual.
   b. Secondary water leaving temperature: specified and actual.
   c. Secondary water flow: specified and actual.
   d. Secondary water pressure drop: specified and actual.
   e. Secondary water Btuh (gpm x temperature rise x 500).

H. Cooling Coils:

1. General Requirements:
   a. Drawing symbol.
   b. Service.
   c. Location.
   d. Size.
   e. Manufacturer and model.
2. Temperature:
   a. Entering air DB temperature: specified and actual.
   b. Entering air WB temperature: specified and actual.
   c. Leaving air DB temperature: specified and actual.
   d. Leaving air WB temperature: specified and actual.
   e. Entering water temperature: specified and actual.
   f. Leaving water temperature: specified and actual.
3. Flow Rate:
   a. Flow rate (cfm): specified and actual.
   b. Water flow rate (gpm): specified and actual.
4. Pressure Drop and Pressure:
   a. Water pressure drop: specified and actual.
   b. Air pressure drop: specified and actual.
5. Energy:
   a. Air Btuh (cfm x enthalpy change x 4.5).
   b. Water Btuh (gpm x temperature drop x 500). Repeat tests if not within 10% of air Btuh.

I. Terminal Heat Transfer Units:

1. General Requirements:
   a. Drawing symbol.
   b. Location.
   c. Manufacturer and model.
   d. Include air data only for forced air units.
2. Temperature:
   a. Entering air DB temperature: specified and actual.
   b. Leaving air DB temperature: specified and actual.
   c. Entering water temperature: specified and actual.
   d. Leaving water temperature: specified and actual.
3. Flow rate:
   a. Flow rate (cfm): specified and actual.
   b. Water flow (gpm): specified and actual.
4. Energy:
   a. Air Btuh (cfm x temperature rise x 1.09).
   b. Water Btuh (gpm x temperature drop x 500). Repeat tests if not within 10% of air Btuh.

4.6 PLUMBING SYSTEMS

A. Pump Data:

1. Drawing symbol.
2. Service.
3. Manufacturer, size, and model.
4. Impeller size: specified, actual, and final (if trimmed).
5. Flow Rate (gpm): specified and actual.

6. Pump Head: specified, operating and shutoff.
7. Suction Pressure: operating and shutoff.
8. Discharge Pressure: operating and shutoff.

B. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, model, frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps for each phase.

C. Balancing Valve:

1. Drawing symbol.
2. Service.
3. Location.
4. Size.
5. Manufacturer and model.
6. Flow rate (gpm): specified and actual.
7. Pressure drop: specified and actual.

D. Heat Exchangers (not all items apply to all units):

1. General Requirements:
   a. Drawing symbol.
   b. Service.
   c. Location.
   d. Manufacturer and model.
2. Primary Heat Exchanger:
   a. Steam pressure in exchanger: specified and actual.
   b. Primary water entering temperature: specified and actual.
   c. Primary water leaving temperature: specified and actual.
   d. Primary water flow: specified and actual.
   e. Primary water pressure drop: specified and actual.
   f. Primary water Btuh (gpm x temperature drop x 500).
3. Secondary Heat Exchanger:
   a. Secondary water entering temperature: specified and actual.
   b. Secondary water leaving temperature: specified and actual.
   c. Secondary water flow: specified and actual.
   d. Secondary water pressure drop: specified and actual.
   e. Secondary water Btuh (gpm x temperature rise x 500).

E. Gas Fired Water Heater:

1. Drawing symbol.
2. Service.
3. Location.
4. Manufacturer and model.
5. Capacity (Btuh): specified, nameplate, and actual.
6. Entering water temperature: specified and actual.
7. Leaving water temperature: specified and actual.
8. Pressure Drop: specified and actual.
9. Control Setting: specified and actual.

4.7 ENERGY RECOVERY SYSTEMS

A. Air Systems - Air energy recovery devices shall be tested at ambient temperatures of less than 40˚F or greater than 85˚F.

1. Energy Recovery Wheel:

a. General Requirements:
1) Drawing Symbol.
2) Location.
3) Wheel RPM.

b. Primary Air:
1) Primary Entering Air Temperature.
2) Primary Leaving Air Temperature.
3) Primary Air Pressure Drop.
4) Primary Air Flow Rate (cfm).

c. Secondary Air:
1) Secondary Entering Air Temperature.
2) Secondary Leaving Air Temperature.
3) Secondary Air Pressure Drop.
4) Secondary Air Flow Rate (cfm).

2. Run-around Coils:

a. General Requirements:
1) Drawing Symbol.
2) Location.
3) Water Flow Rate (gpm).

b. Primary Coil:
1) Primary Coil Air Pressure Drop.
2) Primary Coil Entering Air Temperature.
3) Primary Coil Leaving Air Temperature.
4) Primary Coil Water Pressure Drop.
5) Primary Coil Entering Water Temperature.
6) Primary Coil Leaving Water Temperature.

c. Secondary Coil:
1) Secondary Coil Air Pressure Drop.
2) Secondary Coil Entering Air Temperature.
3) Secondary Coil Leaving Air Temperature.
4) Secondary Coil Water Pressure Drop.
5) Secondary Coil Entering Water Temperature.
6) Secondary Coil Leaving Water Temperature.

3. Air to Air Plate Exchanger:

a. General Requirements:
1) Drawing Symbol
2) Location.

b. Primary Air:
1) Primary Entering Air Temperature.
2) Primary Leaving Air Temperature.
3) Primary Air Flow Rate (cfm).
4) Primary Air Pressure Drop.

c. Secondary Air:
1) Secondary Entering Air Temperature.
2) Secondary Leaving Air Temperature.
3) Secondary Air Flow Rate (cfm).
4) Secondary Air Pressure Drop.

4. Heat Pipe Heat Exchanger DX:

a. General Requirements:
1) Drawing Symbol.
2) Location.
b. Primary Air:
1) Primary Entering Air Temperature.
2) Primary Leaving Air Temperature.
3) Primary Air Flow Rate (cfm).
4) Primary Air Pressure Drop.
c. Secondary Air:
1) Secondary Entering Air Temperature.
2) Secondary Leaving Air Temperature.
3) Secondary Air Flow Rate (cfm).
4) Secondary Air Pressure Drop.

B. Water Systems:

1. Heat Exchanger

a. General Requirements:
1) Drawing Symbol.
2) Location.
b. Primary Water:
1) Primary Entering Water Temperature.
2) Primary Leaving Water Temperature.
3) Primary Water Pressure Drop.
4) Primary Water Flow Rate (gpm).
c. Secondary Water:
1) Secondary Entering Water Temperature.
2) Secondary Leaving Water Temperature.
3) Secondary Water Pressure Drop.
4) Secondary Water Flow Rate (gpm).

END OF SECTION 23 05 93

SECTION 23 07 13 - DUCTWORK INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork Insulation.
B. Insulation Jackets.

1.2 QUALITY ASSURANCE

A. Applicator: Company specializing in ductwork insulation application with five years minimum experience. When requested, installer shall submit manufacturer’s certificate indicating qualifications.

B. Materials: UL listed in Category HNKT; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723.

C. Adhesives: UL listed, meeting NFPA 90A/90B requirements.

1.3 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
B. ANSI/ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
C. ANSI/ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
D. ASTM E84 - Surface Burning Characteristics of Building Materials.
E. ASTM E136 - Standard Test Method for the Behavior of Materials in a Vertical Tube Furnace at 750°C.
F. ASTM E814 - Fire Tests of Through Penetrations Firestops.
G. ASTM E2336-04 – Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
H. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.
I. NFPA 96 - Standard for the Installation of Equipment for Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
J. NFPA 255 - Surface Burning Characteristics of Building Materials.
K. UL - XHEZ - Through Penetration Firestop Systems.
L. UL 263 - Full Scale External Fire Tests with Hose Stream.
M. UL 723 - Surface Burning Characteristics of Building Materials.
N. UL 1479 - Fire Tests of Through Penetrations Firestops.
O. California Title 24 - Building Energy Efficiency Standards
P. CMC California Mechanical Code

1.4 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Include product description, list of materials and thickness for each service, and location.

B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75°F; foil scrim Kraft facing, 1.0 lb./cu. ft. density. Submit both “Out of Package” and “Installed-Compressed 25%” K and R-values.

B. Type B: Semi-rigid Fiberglass Board Wrap - Outside Application; ANSI/ASTM C612, Class 1; 0.25 maximum 'K' value at 75°F; foil scrim Kraft facing, 3 lb./cu. ft. density.

C. Type C: Flexible Fiberglass Liner; ANSI/ASTM C1071; 0.28 maximum 'K' value at 75°F; 1.5 lb/cu ft minimum density; coated air side for 4000 fpm air velocity.

D. Type D: Rigid Fiberglass Liner; 0.23 maximum 'K' value at 75°F; smooth coated mat facing laminated to the insulation, suitable for 5000 fpm air side velocity.

E. Type E: Double wall ductwork insulation; fiberglass; 0.27 maximum ‘K’ value at 75°F mean temperature; 1.5 lb/cu ft density.

F. Type F: Flexible High Temperature Wrap; ASTM E2336 rating as 2-hour separation with zero clearance to combustible materials over the full length. Material to be totally scrim encapsulated. Material to be a minimum 1-1/2” thick with a minimum core density of 6 pcf. Wrap system should offer zero clearance to combustibles per ASTM E2336 at all locations, comply with all applicable codes, and be approved by AHJ. If system is not rated for zero clearance per ASTM E2336 at all locations with single layer, a two-layer system shall be provided with zero clearance per ASTM E2336 at all locations. Material must be tested and listed for installation on grease ducts and installed per listed design. Refer to Section 23 33 00 for prefabricated, pre-insulated access doors required for grease duct systems.

G. Type G: Preformed rigid fiberglass acoustical liner. ANSI/ASTM C1071; 0.23 maximum ‘K’ value at 75°F mean temperature; Noise Reduction Coefficient (NRC) per ASTM C423 Type “A” mounting of 0.75 for 1” thickness, 0.90 for 1.5” thickness. Liner shall be factory coated with an anti-microbial agent to prevent fungus and bacteria growth per ASTM G-21 and G-22. Max flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723.

H. Type I: Flexible Elastomeric Liner; EPDM (NBR/PVC Blend is not permitted) Elastomeric cellular foam sheet; ANSI/ASTM C534; 0.25 maximum 'K' value at 75ºF; 25/50 flame spread/smoke developed when tested in accordance with ASTM E84 (UL 723); coated air side for 4000 fpm air velocity.

2.2 JACKETS

A. Vapor Barrier Jackets: Kraft reinforced foil scrim vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 25 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

2.3 JACKET COVERINGS

A. Aluminum Jackets: ASTM B209; 0.016" thick; smooth or embossed stucco finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.

B. Stainless Steel Jackets: Type 304 stainless steel; 0.010" thick; smooth finish with Z edge seams and stainless steel bands for outdoor use.

C. Laminated 5 ply, flexible, self-adhering, protective jacketing, vapor barrier and weather proofing membrane having high performance acrylic adhesive capable of installation with no additional mechanical attachment. Owner/Architect shall select from manufacturer's standard finishes. For areas exposed to high traffic or rough service, where scheduled or where shown on the drawings, use 13 ply heavy duty protective jacketing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.

B. Install materials after ductwork has been tested.

C. Clean surfaces for adhesives.

D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.

E. Exterior Duct Wrap - Flexible, Type A:

1. Apply with edges tightly butted.

2. Cut slightly longer than perimeter of duct to insure full thickness at corners. Do not wrap excessively tight.

3. Seal joints with adhesive backed tape.

4. Apply so insulation conforms uniformly and firmly to duct.

5. Provide high-density insulation inserts at trapeze duct hangers and straps to prevent crushing of insulation. Maintain continuous vapor barrier through the hanger.

6. Seal all penetrations of the vapor barrier by strap hangers or slip cable hangers with adhesive backed tape.

7. Tape all joints with Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK. No substitutions will be accepted without written permission from the Architect/Engineer.

8. Press tape tightly to the duct covering with a squeegee for a tight continuous seal. Fish mouths and loose tape edges are not acceptable.

9. Staples may be used, but must be covered with tape.

10. Vapor barrier must be continuous.

11. Mechanically fasten on 12" centers at bottom of ducts over 24" wide and on all sides of vertical ducts.

F. Semi Rigid Fiberglass Board Wrap - Type B (Indoor Use):

1. Impale on pins welded to the duct and secured with speed clips. Clip pins off close to speed clips.

2. Space pins as needed to hold insulation firmly against duct, but not less than one pin per square foot. Pins must be long enough to avoid compressing the insulation.

3. Seal all joints and speed clips with glass fabric set in adhesive or a 3" wide strip of Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK facing tape.

4. For small areas, secure insulation with adhesive over the entire surface of the duct. Use adhesive in addition to pins as needed to prevent sagging on horizontal surfaces.

G. Semi Rigid Fiberglass Board Wrap - Type B (Outdoor Use):

1. Impale on pins welded to the duct and secured with speed clips. Clip pins off close to speed clips.

2. Space pins as required to hold insulation firmly against duct, but not less than one pin per square foot. Pins must be long enough to avoid compressing the insulation.

3. Seal all joints and speed clips with glass fabric set in adhesive or a 3" wide strip of the same facing tape with adhesive.

4. For small areas, secure insulation with adhesive over the entire surface of the duct. Use adhesive in addition to pins as needed to prevent sagging on horizontal surfaces.

5. Install vapor barrier jacket. Cover with aluminum jacket covering with seams on the bottom of horizontal ductwork.

6. Seal all butt joints with metal draw bands screwed to jacket and filled with sealant. Seal all joints watertight.

7. Provide positive slope on top of all horizontal surfaces to prevent ponding of water.

H. Exterior Fire Protection, Flexible Type - Type F:

1. Cut and secure duct wrap around ductwork, support angles, and hangers per manufacturer’s recommendations.

2. Seal all joints as required to maintain enclosure rating.

3. Installation shall be rated for 2 hours, unless otherwise noted.

4. Provide manufacturer's recommended assembly to protect all access doors to maintain enclosure rating and to permit easy replacement of insulation.

I. Preformed Fiberglass Acoustical Liner, Rigid - Type G:

1. Cut and secure duct liner inside duct.

2. Install insulation pins or adhesives in locations as recommended by the manufacturer.

3. Seal all damaged duct liner and fill all gaps with manufacturer approved sealant. Do not damage duct liner surface coatings.

4. Where edges show evidence of delamination, the damaged areas shall be secured by manufacturer approved sealant.

5. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.

J. Exterior Duct Wrap – Type I:

1. On ducts with any sides having a dimension 20” and greater: Impale insulation on spindle anchors welded or mechanically fastened to the duct and secured with speed clips. Clip pins off close to speed clips. Adhesive or glue fastened anchors are not acceptable. Maximum anchor spacing per SMACNA Duct Construction Standards or manufacturer's recommendations, whichever is more restrictive. Locate pins within 4” from edges and at intervals not over 16” in all directions. Pins shall be long enough to prevent compressing the insulation.

K. Continue insulation with vapor barrier through penetrations unless code prohibits.

L. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

3.2 SCHEDULE

A. Refer to Section 23 31 00 for scheduling of insulation.

B. Unless noted otherwise, HVAC plenums and unit housings not pre-insulated at factory shall be insulated to geographical R-value requirements based on California Title 24, R-4.2, R-6 or R-8.

END OF SECTION 23 07 13

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping Insulation.
B. Insulation Jackets.

1.2 QUALITY ASSURANCE

A. Applicator: Company specializing in piping insulation application with five years minimum experience.

B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).

1.3 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
B. ANSI/ASTM C195 - Mineral Fiber Thermal Insulation Cement.
C. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
D. ANSI/ASTM C534 - Elastomeric Foam Insulation.
E. ANSI/ASTM C547 - Mineral Fiber Preformed Pipe Insulation.
F. ANSI/ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.
G. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
H. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.
I. ASTM C578 - Preformed Cellular Polystyrene Thermal Insulation.
J. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.
K. ASTM C1767 - Standard Specification for Stainless Steel Jacketing for Insulation.
L. ASTM E84 - Surface Burning Characteristics of Building Materials.
M. NFPA 255 - Surface Burning Characteristics of Building Materials.
N. UL 723 - Surface Burning Characteristics of Building Materials.
O. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

1.4 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Include product description, list of materials and thickness for each service, and locations.

PART 2 - PRODUCTS

2.1 INSULATION

A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75ºF; non-combustible. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

B. Type H: Glass Fiber Blanket; ANSI/ASTM C612; 0.40 maximum 'K' value at 300ºF. 3.0 lb./cu ft density. Suitable for 850ºF.

2.2 VAPOR BARRIER JACKETS

A. Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

B. Polyvinylidene Chloride (PVDC or Saran) film and tape: Durable and highly moisture and moisture vapor resistant. Please refer to manufacturer's recommended installation guidelines.

2.3 JACKET COVERINGS

A. Aluminum Jackets: ASTM C1729; 0.016" thick (thicker where required by ASTM C1729); stucco embossed finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.

B. Stainless Steel Jackets: ASTM C1767. Type 304 stainless steel; 0.010" thick (thicker where required by ASTM C1729); smooth finish with Z edge seams and stainless steel bands for outdoor use.

C. Plastic Jackets and Fitting Covers: High impact, glossy white, 0.030" thick, self-extinguishing plastic. Suitable for use indoors or outdoors with ultraviolet inhibitors. Suitable for -40ºF to 150ºF. 25/50 maximum flame spread/smoke developed.

2.4 REMOVABLE INSULATION JACKETS

A. Removable insulation jackets shall consist of outer covering, interstitial insulation material, and inner covering.

B. Inner and outer covering shall be constructed from a minimum 16.5 oz./yd^2 PTFE fiberglass composite and suitable for insulating surface temperatures up to 550ºF.

C. Interstitial insulation blanket shall be minimum 1-1/2" thick and shall consist of either:

1. Silica and glass-fiber insulation felts and blankets – minimum 6 lb./ft^3 density.
2. E-type glass-fiber felts and blankets – minimum 6 lb./ft^3 density.

D. Construction: Inner and outer covering with interstitial insulation material shall be joined into a single assembly using a double sewn lock stitch with 4-6 stitches/inch. The thread used shall be able to withstand minimum 550ºF surface temperatures without degradation. The use of hog rings, staples, and wires for closure of assembly are not acceptable. The interstitial insulation shall be sewn as an integral part of the inner and outer coverings to prevent shifting of the insulation. Insulation pins are not an allowable method of preventing the insulation from shifting and shall not be used.

E. No raw cut jacket edges shall be exposed.

F. Jackets shall be fastened to equipment and piping components using hook and loop (Velcro) straps and minimum 1" slide buckles.

G. Jacket coverings shall have an inner covering edge with a continuous strip of hook & loop closure (Velcro) that is parallel to the seam and overlaps the outer covering by a minimum of 2 inches.

H. Acceptable Manufacturers: Firwin Corp, Lewco Specialty Products, ThermaXX Jackets LLC or approved equivalent.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

B. Patch and repair torn insulation. Paint to match adjacent insulation surface.

3.2 INSTALLATION

A. General Installation Requirements:

1. Install materials per manufacturer's instructions, building codes and industry standards.

2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.

3. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a 180° cylindrical segment the same length as metal shields. Inserts shall be a cellular glass (for all temperature ranges) or molded hydrous calcium silicate (for pipe with operating temperatures above 70°F, with a minimum compressive strength of 50 psi. Polyisocyanurate insulation with a minimum compressive strength of 24 psi is acceptable for pipe sizes 3” and below, minimum 60 psi for pipe sizes 4” and above, and operate below 300°F. Factory fabricated inserts may be used. Rectangular blocks, plugs, or wood material are not acceptable. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.

4. Neatly finish insulation at supports, protrusions, and interruptions.

5. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.

6. Shields shall be at least the following lengths and gauges:

	Pipe Size	Shield Size
a.	1/2" to 3”	12" long x 18 gauge
b.	4"	12" long x 16 gauge
c.	5” to 6"	18" long x 16 gauge
d.	8” to 14"	24" long x 14 gauge
e.	16” to 24"	24" long x 12 gauge

7. All piping and insulation that does not meet 25/50 that is in an air plenum shall have written approval from the Authority Having Jurisdiction and the local fire department for authorization and materials approval. If approval has been allowed, the non-rated material shall be wrapped with a product that has passed ASTM E84 and/or NFPA 255 testing with a rating of 25/50 or below.

B. Insulated Piping Operating Below 60°F:

1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.

2. On piping operating below 60ºF in locations that are not mechanically cooled (e.g., penthouses, mechanical rooms, tunnels, chases at exterior walls, etc.), Type B insulation shall be used.

3. All balance valves with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.

C. Insulated Piping Operating Between 60°F and 140°F:

1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.

D. Insulated Piping Operating Above 140°F:

1. Insulate fittings, valves, flanges, float & thermostatic steam traps, and strainers. On gate valves, the insulation shall be extended to cover the entire valve bonnet, leaving only the portion of the stem that is above the bonnet and valve operator exposed.

2. All balance valves with fluid operating above 140°F shall be insulated and an opening shall be left in the insulation to allow for reading and adjusting the valve.

3. The use of removable insulation jackets is acceptable for insulating large and non-cylindrical shaped piping components (e.g., check valves, pressure regulating valves, calibrated balance valves, gate valve bonnets, F&T traps, strainers, line sets, and the like).

E. Exposed Piping:

1. Locate and cover seams in least visible locations.

2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.

3.3 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.

2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.

3. Apply insulation with laps on top of pipe.

4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60ºF, seal fitting covers with vapor retarder mastic in addition to tape.

B. Type B Insulation:

1. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.

2. Self-seal insulation may be used on pipes operating below 170ºF.

C. Type C Insulation:

1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.

2. Insulate fittings with prefabricated fittings.

D. Type F, G, and H Insulation:

1. Apply with edges tightly butted, joints broken.

2. Secure with 16 gauge galvanized, annealed steel wire or 1/2" x 0.015" galvanized steel bands, 12" maximum centers.

3. Install welding studs, clips and angles where required to anchor wires and bands.

3.4 JACKET COVER INSTALLATION

A. Metal Covering:

1. Provide vapor barrier as specified for insulation type. Cover with aluminum jacket covering with seams located on the bottom of horizontal piping. Include fittings, joints and valves.

2. Seal all interior and exterior butt joints with metal draw bands and sealant. Seal all exterior joints watertight.

3. Interior joints do not need to be sealed.

4. Use metal covering on the following pipes:

    a. All exterior piping.

B. Plastic Covering:

1. Provide vapor barrier as specified for insulation type. Cover with plastic jacket covering. Position seams to shed water.

2. Solvent weld all joints with manufacturer recommended cement.

3. Overlap all laps and butt joints 1-1/2" minimum. Repair any loose ends that do not seal securely. Solvent weld all fitting covers in the same manner. Final installation shall be watertight.

4. All joints in areas noted shall meet USDA standards for Totally Sealed Systems, including overlaps of 1” on circumferential and 1.5” to 2” on longitudinal seams.

5. Use plastic insulation covering on all exposed pipes including, but not limited to:

    a. All exposed piping in finished spaces.
    b. All exposed piping in areas noted on drawings.
    c. All exposed piping in locker rooms.
    d. All exposed piping below 8'-0" above floor.
    e. All piping in mechanical rooms and/or tunnels that is subject to damage from normal operations. (Example: Piping that must be stepped over routinely.)

3.5 SCHEDULE

A. Refer to attached insulation schedule.

END OF SECTION 23 07 19

HEATING for Use With: IECC -2012 | IECC -2015																
	Insulation Thickness per Pipe Size															
Piping System	<1"			1" to < 1-1/2"			1-1/2" to < 4"			4" to < 8"			8" <			
Saturated Steam, Condensate Return, and Boiler Feedwater (Up to 29 psig, 250°F)	A 2-1/2"			A 2-1/2"			A 2-1/2"			A 3"			A 3"			
Below Grade			D 4"			D 4"			D 4"			D 5"				D 5"
Saturated Steam, Condensate Return (30 to 134 psig, 350°F)	A 3"			A 4"			A 4.5"			A 4.5"			A 4.5"			
Below Grade			D 4"			D 4"			D 4"			D 5"				D 5"
Saturated Steam, Condensate Return (135 to 250 psig, 450°F)	A 4-1/2"			A 5"			A 5"			A 5"			A 5"			
Below Grade, above 10" pipe size			D 4"			D 4"			D 4"			D 5"				D 5"
Chilled Water Supply & Return (40°F-60°F Supply Water Temp)																
located in air conditioned spaces	A 1/2"	B 1/2"	J 1/2" *	A 1/2"	B 1/2"	J 1/2" *	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *	
located in non-air conditioned spaces (mechanical rooms; exterior; attic, etc.)		B 1/2"	J 1/2" *		B 1/2"	J 1/2" *		B 1"	J 1" *		B 1"	J 1" *		B 1"	J 1" *	
located in modular chiller enclosure		B 1/2"			B 1/2"			B 1"			B 1"			B 1"		
located inside air handling unit airstream		B 1/2"			B 1/2"			B 1"			B 1"			B 1"		
Cooling Coil Condensate Drains below 55°F		B 1/2"			B 1/2"			B 1/2"			B 1/2"			B 1/2"		
Heating Water Supply & Return; Reheat Water Supply & Return; Heating/Chilled Water Supply and Return (105°-140°F Supply Water Temp)	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *	A 1-1/2"		J 1" *	A 1-1/2"		J 1" *	A 1-1/2"		J 1" *	
Heating Water Supply & Return; Reheat Water Supply & Return; Heating/Chilled Water Supply and Return (141°-200°F Supply Water Temp)	A 1-1/2"		J 1" *	A 1-1/2"		J 1" *	A 2"		J 1" *	A 2"		J 1" *	A 2"		J 1" *	
Condenser Water Supply & Return (Indoor)	A 1"	B 3/4"	J 3/4" *	A 1"	B 3/4"	J 3/4" *	A 1"	B 3/4"	J 3/4" *	A 1"	B 3/4"	J 3/4" *	A 1"	B 3/4"	J 3/4" *	
located in modular chiller enclosure		B 3/4"			B 3/4"			B 3/4"			B 3/4"			B 3/4"		
Condenser Water Supply & Return (Outdoor)	A 1"	B 3/4"	J 1"	A 1"	B 3/4"	J 1"	A 1"	B 3/4"	J 1"	A 1"	B 3/4"	J 1"	A 1"	B 3/4"	J 1"	
Geothermal/Loop Water Supply & Return (Indoor)																
located in air conditioned spaces	A 1/2"	B 1/2"	J 1/2" *	A 1/2"	B 1/2"	J 1/2" *	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *	

HEATING for Use With: IECC -2012 | IECC -2015															
	Insulation Thickness per Pipe Size														
Piping System	<1"			1" to < 1-1/2"			1-1/2" to < 4"			4" to < 8"			8" <		
located in non-air conditioned spaces (mechanical rooms; exterior; attic, etc.)	A 1/2"	B 1/2"	J 1/2" *	A 1/2"	B 1/2"	J 1/2" *	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *
Heat Recovery Water Supply & Return 105°F ≤ 140°F	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *	A 1-1/2"		J 1" *	A 1-1/2"		J 1" *	A 1-1/2"		J 1" *
Heat Recovery Water Supply & Return 40°F ≤ 60°F	A 1/2"	B 1/2"	J 1/2" *	A 1/2"	B 1/2"	J 1/2" *	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *	A 1"	B 1"	J 1" *
Glycol Water Supply & Return (<40°F)		B 1/2"	J 1/2" *		B 1"	J 1" *		B 1"	J 1" *		B 1"	J 1" *		B 1"	J 1" *
Engine Exhaust Piping															
From engine to muffler	E 4"			E 4"			E 4"			E 4"			E 4"		
From muffler to discharge	E 4"	F 4" **	G/2" & H/2"	E 4"	F 4" **	G/2" & H/2"	E 4"	F 4" **	G/2" & H/2"	E 4"	F 4" **	G/2" & H/2"	E 4"	F 4" **	G/2" & H/2"
Drain piping from muffler to floor drain	E 3"	F 3"		E 3"	F 3"		E 3"	F 3"		E 3"	F 3"		E 3"	F 3"	
Underground Heating Water Supply & Return (105°-140°F Supply Water Temp)	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"
Underground Heating Water Supply & Return (141°-200°F Supply Water Temp)	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"
Underground Chilled Water Supply & Return	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"
Underground Refrigeration Lines	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"	C 1"		J 1"
VRF Refrigerant Pipe Insulation	Refer to Section 23 81 45														
Mini-Split System Refrigerant Pipe Insulation	Refer to Section 23 81 26														
Refrig. Hot Gas Lines		B 1/2"			B 1/2"			B 1"			B 1"			B 1"	
Refrig. Suction Lines (25°F & Above)		B 1-1/2" +			B 1-1/2" +			B 1-1/2" +			B 1-1/2" +			B 1-1/2" +	
Refrig. Suction Lines (40°F & Above)		B 1/2"			B 1/2"			B 1"			B 1"			B 1"	
Low Temp. Refrigeration Suction Lines (25°F to 0°F)	C 1-1/2"		J 1-1/2" *	C 2"		J 2" *	C 2"		J 2" *	C 2-1/2"		J 2-1/2" *	C 2-1/2"		J 2-1/2" *
Low Temp. Refrigeration Suction Lines (-1°F to -25°F)	C 2"		J 2" *	C 2-1/2"		J 2-1/2" *	C 2-1/2"		J 2-1/2" *	C 3"		J 3" *	C 3"		J 3" *
Low Temp. Refrigeration Suction Lines (-26°F to -75°F)	C 2-1/2"		J 2-1/2" *	C 3-1/2"		J 3-1/2" *	C 3-1/2"		J 3-1/2" *	C 4"		J 4" *	C 4"		J 4" *
Low Temp. Refrigeration Suction Lines (-76°F to -125°F)	C 3"		J 3" *	C 4"		J 4" *	C 4"		J 4" *	C 5"		J 5" *	C 5"		J 5" *

HEATING for Use With: IECC -2012 | IECC -2015					
	Insulation Thickness per Pipe Size				
Piping System	<1"	1” to < 1-1/2"	1-1/2" to < 4"	4” to < 8"	8" <
Insulation Inserts at hangers	Type C or E or J* - match pipe insulation thickness				
Medical Air Compressor Intake	A 2"	A 2"	A 2"	A 2"	A 2"
Medical Vacuum System Exhaust (within 10’ of outside wall/roof penetration)	A 1"	A 1"	A 1"	A 1"	A 1"
SPARE					
SPARE					
SPARE					
SPARE					

KEY NOTES FOR CONTRACTORS:

* Type J not allowed in return air plenum (not 25/50 rated)
+ Type B < 1" thickness shall be installed using multiple layers of 3/4" or 1"
** Two (2) 2" layers with staggered seams

SECTION 23 21 00 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings.
B. Valves.
C. Heating Water Piping System.
D. Glycol Water Piping System.
E. Chilled Water Piping System.
F. Condenser Water Piping System.
G. Heating/Cooling Water Piping System.
H. Dielectric Connections.

1.2 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.

B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.

1.3 REFERENCES

A. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.
B. ANSI/AWS D1.1 - Structural Welding Code.
C. ANSI/AWWA C104/A21.4 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
D. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3" through 48", for Water and Other Liquids.
E. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
F. ANSI/AWWA C150/A21.50 - Thickness Design of Ductile Iron Pipe.
G. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
H. ANSI/AWWA C153/A21.51 - Ductile Iron Compact Fittings, Centrifugally Cast for Water or Other Liquids.
I. ASME - Boiler and Pressure Vessel Code.
J. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
K. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
L. ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
M. ASME B16.5 - Pipe Flanges and Flanged Fittings.
N. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
O. ASME B16.12 - Cast Iron Threaded Drainage Fittings.
P. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
Q. ASME B16.21 - Nonmetallic Flat Gaskets for Pipes Flanges.
R. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
S. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
T. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
U. ASME B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
V. ASME B18.2.2 - Square and Hex Nuts, Inch Series.
W. ASME B31.3 - Chemical Plant and Petroleum Refinery Piping.

X. ASME B31.9 - Building Services Piping.
Y. ASME Section 9 - Welding and Brazing Qualifications.
Z. ASTM A126 - Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings.
AA. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
BB. ASTM A181 - Forgings, Carbon Steel for General Purpose Piping.
CC. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
DD. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
EE. ASTM A536 - Standard Specification for Ductile Iron Castings
FF. ASTM A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.
GG. ASTM B32 - Standard Specification for Solder Metal.
HH. ASTM B88 - Seamless Copper Water Tube.
II. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.
JJ. ASTM D1599 - Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Tubing and Fittings.
KK. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
LL. ASTM D2105 - Standard Test Method for Longitudinal Tensile Properties of Fiberglass Pipe and tube.
MM. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate loading.
NN. ASTM D2513 – Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
OO. ASTM D2683 – Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
PP. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
QQ. ASTM D2992 – Standard Practice for Obtaining Hydrostatic Design Basis for Fiberglass pipe and fittings.
RR. ASTM D2996 - Standard Specification for Filament Wound Fiberglass Pipe.
SS. ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
TT. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
UU. ASTM D4024 - Standard Reinforced Thermosetting Resin Flanges.
VV. ASTM D5685 - Standard for Fiberglass Pressure Pipe Fittings.
WW. ASTM E90-02 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
XX. ASTM E413-87 - Classification for Rating Sound Insulation
YY. ASTM F2389 – Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.
ZZ. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 23 05 00. Include data on pipe materials, fittings, valves, and accessories. Include manufacturers' support spacing requirements for plastic piping.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.

B. Deliver and store valves in shipping containers with labeling in place.

1.6 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 23 05 00 for required hydronic systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 HEATING WATER
CHILLED WATER
GLYCOL WATER
HEATING/COOLING WATER

A. Design Pressure: 150 psig.
Maximum Design Temperature: 225ºF.

B. Piping - 2" and Under:

1. Tubing: Type L drawn temper seamless copper tube, ASTM B88.

2. Joints: Solder with Type 95-5 solder. 50-50 solder is not acceptable.

3. Fittings: Wrought copper solder joint, ASME B16.22.

C. Piping - 2-1/2" and Over:

1. Pipe: Standard weight black steel, beveled ends, ASTM A53, Type E or S, Grade B.

2. Joints: Butt-welded or flanged.

3. Fittings: Standard weight wrought steel, butt-welding type, ASTM A234, ASME B16.9.

4. Flanges: Class 150 forged steel, welding neck or slip-on, ASTM A181 or A105, Class 60, ASME B16.5 up to 24” and B16.47 above 24”. ASME B16.1 for flanges mating with flat face equipment flanges. Flange face seal weld (backweld) is required for slip-on flanges.

D. Shutoff Valves:

1. Gate Valves:

a. GA-1: 2" and under, 125 psi S @ 353ºF, 300 psi WOG @ 150ºF, screwed, bronze, rising stem, screwed bonnet. Crane #431, Hammond #IB641, Stockham #B122, Walworth #56, Milwaukee #1150, Watts #B-3210, NIBCO #T-131.

b. GA-2: 2-1/2" thru 12", 125 psi S @ 353°F, 200 psi WOG @ 150ºF, flanged, iron body, bronze mounted, OS&Y. Crane #465-1/2, Hammond, Stockham #G623, Walworth, Milwaukee #F2885, Watts #F-503, NIBCO F-617-O.

c. GA-5: 2" and under, 125 psi S @ 353ºF, 200 psi WOG @ 150ºF, solder bronze. Crane #1334, Stockham #B108, Walworth #4SJ, Watts #B-3101, NIBCO #S-111.

2. Ball Valves:

   a. BA-1: 3" and under, 150 psi saturated steam, 600 psi WOG, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and stem, Teflon seats and seals. Apollo #77C-140, Stockham #S-206 BR1-R, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.

      NOTES:

      1) Provide extended shaft with operating handle of non-thermal conductive material and protective sleeve that allows operation of valve, adjustment of the packing, and adjustment of the memory stop without breaking the vapor seal or disturbing the insulation for all valves in insulated piping.

      2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, compressed air piping and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

   b. BA-1A: 2-1/2" and 3", 150 psi saturated steam, 275 psi WOG ANSI Class, 150 psi standard port, carbon steel body stainless steel ball and trim, Teflon seats and seals. Apollo #88A-100, Nibco #F510-CS/66, Milwaukee #F90.

      NOTES:

      1) Provide extended shaft for all valves in insulated piping.

      2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, compressed air piping and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

3. Butterfly Valves:

   a. BF-1:

      1) 2-1/2" thru 6", 175 psi WOG, elastomers rated for 20°F to 250°F at 125 psig, fully lugged end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or EPDM coated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system), 10 position locking operator up to 6" size. Cv of at least 1580 in 6" size. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1P, Nibco N200 Series or LD2000 Series, Milwaukee CL series, Hammond 5200 series.

2) 8" thru 12", 175# WOG, elastomers for 20°F to 225°F at 130 psi, fully lugged end, ductile or cast iron body (not in contact with fluid), bronze, EPDM coated ductile iron or aluminum-bronze disc, EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to the centerline of the valve body (to permit pipe extension without draining system), weatherproof gear operator. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1G, Nibco N200 Series or LD2000 Series, Milwaukee CL series, Hammond 5200 series.

b. BF-5:

1) 14" through 24", 150 psi WOG, elastomers rated for 20ºF to 250ºF at 125 psig, fully lugged or grooved end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or nickel plated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 150 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system). Weatherproof gear operator. Cv of at least 12,000 in 16" size. Victaulic #709, Center Line Series 200, Keystone #AR2, Watts DBF-03-121-1G, NIBCO LD2000 Series, Victaulic #W761, Milwaukee CL series, Hammond 5200 series.

E. Throttling Valves:

1. Globe Valves:

a. GL-1: 2" and under, 125 psi saturated steam, 300 psi WOG, screwed, bronze. Crane #7TF, Stockham #B22T, Walworth #95, Milwaukee #590, Hammond #IB413T, Watts #B-4010-T, NIBCO #T-235.

b. GL-2: 2-1/2" thru 10", 125 psi S @ 353ºF, 200 psi WOG @ 150ºF, flanged, iron body, bronze mounted. Crane #351, Hammond #IR116, Stockham #G-512, Walworth #906F, Milwaukee #F2981, Watts #F-501, NIBCO #F-718-B.

c. GL-5: 2" and under, 300 psi WOG, solder, bronze. Hammond #IB423, Stockham #B24T, Milwaukee #1590, Watts #B-4011-T, NIBCO #S-235.

2. Butterfly Valves:

a. BF-4:

1) 2-1/2" thru 6", 175 psi WOG, elastomers rated for 20ºF to 250ºF at 125 psig, fully lugged or grooved end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or EPDM coated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system), infinite position locking operator with memory stop up to 6" size. Cv of at least 1580 in 6" size. Victaulic #300, Center Line Series 200, Keystone #222, Watts #DBF-03-121-1P,

NIBCO N200 Series or LD2000 Series, Milwaukee CL series, Hammond 5200 series.

2) 8" thru 12", 175# WOG, elastomers for 20ºF to 225ºF at 130 psi, fully lugged end, ductile or cast iron body (not in contact with fluid), bronze, EPDM coated ductile iron or aluminum-bronze disc, EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to the centerline of the valve body (to permit pipe extension without draining system), weatherproof gear operator. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1G, NIBCO N200 Series or LD2000 Series, Victaulic #300, Milwaukee CL series, Hammond 5200 series.

b. BF-5:

1) 14" through 24", 150 psi WOG, elastomers rated for 20ºF to 250ºF at 125 psig, fully lugged or grooved end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or nickel plated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 150 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system). Weatherproof gear operator. Cv of at least 12,000 in 16" size. Victaulic #709, Center Line Series 200, Keystone #AR2, Watts DBF-03-121-1G, NIBCO LD2000 Series, Victaulic #W761, Milwaukee CL series, Hammond 5200 series.

F. Check Valves:

1. CK-1: 2" and under, 125 psi S @ 353ºF, 200 psi WOG @ 150ºF, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319, Walworth #406, Milwaukee #509, Watts #B-5000, or NIBCO #T-413.

2. CK-4: 2" and under, 200 psi WOG @ 150ºF, solder, bronze, horizontal swing. Crane #1342, Hammond #IB912, Stockham #B309, Walworth #406SJ, Milwaukee #1509, Watts #B-5001, or NIBCO #S-413.

3. CK-13: 2-1/2" thru 12", 200# WOG, double disc wafer type, iron body, bronze or aluminum-bronze discs, 316SS shaft and spring, Viton, EPDM or BUNA-N, Cv of at least 700 in 6" size. Mueller Steam Specialty Co. #71-AHB-6-H, Stockham #WG-961, NIBCO W-920-W, Crane, Victaulic #716/716H.

G. Strainers:

1. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi WOG @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777, NIBCO T-122.

2. ST-2: Cast iron body, 125 lb. flanged ends, bolted cover, 125 psi S @ 350°F, 175 psi WOG @ 150°F. Armstrong #A1FL, Metraflex #TF, Mueller Steam Specialty Co.#758, Sarco #CI-125, Watts #77F-D, Victaulic #732 or #W732, NIBCO F-721-A.

2.2 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53, Schedule 40 galvanized.

1. Fittings: Galvanized cast iron screwed drainage type, ASME B16.12.

2. Joints: Screwed.

3. Service: Not allowed on boiler drains and overflow.

B. Steel Pipe: ASTM A53. [for boiler drains only]

1. Pipe: Standard weight black steel, threaded and coupled, ASTM A53.

2. Joints: Screwed.

3. Fittings: Class 125 cast iron, ASTM A126, ASME B16.4.

C. Copper Tubing: DWV drawn temper seamless copper drainage tube, ASTM B306.

1. Fittings: ASME B16.23 cast brass, or ASME B16.29 solder wrought copper.

2. Joints: Solder with Type 95-5 solder. 50-50 solder is not acceptable.

D. Piping 4” and Under (Contractor’s Option):

1. Tubing: Type M (or thicker) drawn temper seamless copper tube, ASTM B88.

2. Joints: Mechanical press connection.

3. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring, NSF-61.

4. Acceptable Manufacturers: Viega ProPress, Elkhart Xpress, NIBCO Press System Fittings and Valves, Mueller Streamline PRS.

E. Piping Under 1-1/4” Size:

1. In sizes where drainage type fittings are not available, tees with threaded caps to permit rodding are acceptable.

F. Shutoff

1. Ball Valves:

a. BA-1: 3" and under, 125 psi saturated steam, 600 psi WOG, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-206 BR1-R, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.

NOTES:

1) Provide extended shaft for all valves in insulated piping.

2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, compressed air piping and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

b. BA-1A: 2-1/2" and 3", 150 psi saturated steam, 275 psi WOG ANSI Class, 150 psi standard port, carbon steel body stainless steel ball and trim, Teflon seats and seals. Apollo #88A-100, Nibco #F510-CS/66, Milwaukee #F90.

NOTES:

1) Provide extended shaft for all valves in insulated piping.

2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, compressed air piping and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

2.3 AIR VENTS

A. At end of main and other points where large volume of air may be trapped - Use 1/4" globe valve, angle type, 125 psi, Crane #89, attached to coupling in top of main, 1/4" discharge pipe turned down with cap.

B. On branch lines and small heating units - Use coin-operated air vent equal to B&G #4V, attached to 1/8" coupling in top of pipe. Install air vents on all coils and terminal heating units.

2.4 AUTOMATIC AIR VENTS

A. Low capacity automatic air vent (for bladder tank anti-thermosyphon loops). Maximum operating pressure and temperature of at least 240°F and 125 psi, 1/2" or 3/4" inlet. B&G #87, Armstrong, Spirotherm, Taco, or Watts.

B. High/low capacity automatic air vent (for air separator connection). Maximum operating pressure and temperature of at least 240°F and 125 psi, 3/4" inlet, 3/8” minimum outlet. B&G #107, Armstrong, Spirotherm, Taco, or Watts.

2.5 STRAINERS

A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

Pipe Size	1/4" - 2"	2-1/2" - 8"	10” and Up
Air and Gases	1/32”	3/64”	1/16”
Water and Glycol/Water	1/32”	1/16"	1/8"

B. Furnish pipe nipple with ball valve, threaded hose connection, and cap to blow down all strainer screens.

C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

2.6 BASKET STRAINERS

A. Cast iron body, 125 lb. flanged ends, quick release bolted, rated for 125 psi @ 350°F, 175 psi WOG @ 150°F. Strainer to have 1/8” perforated basket or equivalent. Pressure drop not to exceed 5 ft. head maximum.

B. Basket strainer shall be supported from floor. Hanging strainer from pipes will NOT be acceptable.

C. Furnish pipe nipple with ball valve, threaded hose connection, and cap to blow down all strainer screens.

D. Furnish hinged cover for strainers below 6” in size. Furnish lifting lug and lifting device to remove cover of strainers 8” and larger. Provide O-ring gaskets on all covers.

E. Furnish ASTM stamped 126-B or A216 grade WCB.

F. Acceptable Manufacturers: Keckley GFV, Mueller 125F-CI, SureFlow BFC 125C, Watts 97FB-CIB, Metraflex B-1-TC.

2.7 MAKE-UP WATER ACCESSORIES

A. Pressure Reducing Valve:

1. For water fill lines to hydronic systems.

2. Pressure reducing valve. Removable strainer, field adjustable discharge pressure, brass body, disc and seat, union with 1/2" or 3/4" NPT sweat connection, 125 psig maximum working pressure, 225°F maximum temperature.

3. Acceptable Manufacturers: Armstrong, Bell & Gossett, Conbraco, Thrush, Watts.

B. Relief Valve:

1. For water fill lines to hydronic systems.

2. Cast iron or bronze body, 1/2" or 3/4” screwed connections, 125 psig working pressure, 225°F maximum temperature. Minimum 500,000 Btuh capacity at 30 psig. Manual test lever.

3. Acceptable Manufacturers: Armstrong, Bell & Gossett, Conbraco, Taco, Watts.

C. Backflow Preventer:

1. Reduced pressure type as scheduled on the drawings.

2. Provide an air gap fitting and piping to drain.

3. If not indicated on the drawings, unit shall be same size as pipe.

4. Field test and tag units per manufacturer's instructions by a certified tester before initial operation.

2.8 SAFETY RELIEF VALVES

A. SRV-1 (Hydronic Heating Systems): Spring-loaded disc type with cast iron or bronze body, bronze or stainless steel disc, side outlet and lifting lever for maximum service of 125 psig at 250ºF. For relieving water during pressure fluctuations and in case of control failure. Capacities shall be ASME Section IV certified and labeled. Acceptable Manufacturers: Kunkle # 537, B&G, Conbraco, McDonnell & Miller, or Watts.

2.9 SUCTION DIFFUSER

A. Furnish and install on base mounted pumps with inlet size same as pipe size shown on the drawing.

B. In no case shall pressure drop exceed 3.0 psi.

C. Suction diffuser shall consist of angle body with inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16" diameter openings for pump protection, gauge tappings, and blowdown connection. Orifice cylinder, with bronze or stainless steel strainer with free area at least 5 times cross section area of pump suction opening. Furnish adjustable foot to support weight of suction piping. Connect drain valve to blowdown connection. Provide 16 mesh bronze startup strainer. The startup strainer shall be removed after the system has been started, cleaned, and is operating under normal conditions, but before the system is turned over to the Owner. Hang the startup strainer on the piping near the pump after it is removed.

D. Acceptable Manufacturers: Amtrol, Armstrong, Bell & Gossett, Patterson, Taco, Wheatley, Victaulic.

2.10 SELF-CONTAINED CONTROL VALVES

A. Thermostatic hot water control valves, self-contained bellows, nickel-plated body with EPDM disc, stainless steel spindle, and lifetime lubricated packing gland. Gland shall be replaceable with valve in operation.

B. Size for maximum pressure drop of 1 psi.

C. Configuration SCCV-1: Mount sensor and operator on valve body. Provide tamper-proof cover.

D. Configuration SCCV-2: Mount operator on valve body with remote sensor and capillary connection. Provide tamper-proof cover.

E. Configuration SCCV-3: Mount actuator on valve body with remote sensor, remote operator and capillary connections.

F. Acceptable Manufacturers: Danfoss, Type RA, Bell & Gossett, Honeywell Braukmann, Sterling, Rittling.

2.11 BALANCING VALVE

A. Rated for 125 psi working pressure and 250ºF operating temperature, taps for determining flow with a portable meter, positive shutoff valves for each meter connection, memory feature, tight shutoff, and a permanent pressure drop between 1' and 2' water column at full flow with valve 100% open. Furnish with molded, removable insulation covers.

B. Provide a nomograph to determine flow from meter reading (and valve position on units which sense pressure across a valve). Graph shall extend below the specified minimum flow.

C. Furnish one meter kit equivalent to Bell & Gossett Model RO-5 meeting the following requirements:

1. Carrying case with handle.

2. Pressure gauge with 0-25 feet of head scale with 3.0% full scale accuracy.

3. High and low side hoses with 5 feet length and 250 psig pressure rating, equipped with shutoff valves, vent valves, and probes for insertion into pressure and temperature plugs.

D. Valves in copper piping shall be brass or bronze.

1. Quarter-Turn Ball Valve Style:

a. Bell & Gossett "Circuit Setter Plus",

2. Quarter-Turn Venturi Style:

a. Presso “B+”
b. Griswold “Quickset”
c. Gerand “BALVALVE Venturi”
d. HCI “Terminator B”
e. Nexus Valve “UltraXB Orturi”
f. MI Hydronic Engineering “Accusetter”

3. Multi-Turn Style:

a. Tour&Anderson (STAD)
b. Armstrong "CBV"
c. Victaulic 785
d. Macon STVL/STV
e. MEPCO MBV
f. Wheatly GS
g. NIBCO 1710

E. Valves in ferrous piping 2" or smaller shall have threaded ends and steel, brass or bronze construction. Option to balancing valves noted above are flow sensors specified in Section 23 09 00 with a specified throttling valve.

1. Quarter-Turn Ball Valve Style:

a. Bell & Gossett "Circuit Setter Plus"

2. Quarter-Turn Venturi Style:

a. Presso “B+”
b. Gerand “BALVALVE Venturi”
c. HCI “Terminator B”
d. Nexus Valve “UltraXB Orturi”
e. IMI Hydronic Engineering “Accusetter”

3. Multi-Turn Style:

    a. TA Hydronics “786-789”
    b. Armstrong "CBV"
    c. Victaulic 787
    d. Macon STVL/STV
    e. MEPCO MBV
    f. Wheatly GSNIBCO 1710 (T1710L)

F. Balancing valves in ferrous piping over 2" size shall have flanged or grooved ends and steel or cast iron construction. Option to balancing valves noted above are flow sensor specified in Section 23 09 00 with a specified throttling valve.

1. Quarter-Turn Ball Valve Style:

    a. B&G “Circuit Setter”

2. Quarter-Turn Venturi Style:

    a. Presso “B+”,
    b. Taco “Accu-flo”,
    c. HCI “Terminator G”
    d. Nexus Valve “Nextrol NXFB”,
    e. IMI Hydronic Engineering “Accusetter”,

3. Multi-Turn Style:

    a. Armstrong "CVB-II",
    b. Tour&Anderson (STAF, STAG),
    c. Victaulic 788/789
    d. Macon STVA
    e. MEPCO MBV
    f. NIBCO 737

2.12 AUTOMATIC FLOW CONTROL VALVES (AUTOMATIC BALANCING VALVES)

A. The GPM for the automatic flow control valves shall be factory set and shall automatically limit the rate of flow to within ± 10% of the specified GPM over at least 95 percent of the control range.

B. Pump Head Requirements:

1. The permanent pressure loss added to the pump head shall not exceed 7 feet.

C. Each valve shall have two P/T ports.

D. Five-year product warranty and first year cartridge exchange, up to 10 percent.

E. The internal wear surfaces of the valve cartridge shall be stainless steel or polyphenylsulfone orifice with an elastomeric diaphragm.

F. The internal flow cartridge shall be permanently marked with the GPM and spring range.

G. Valve body shall be brass on all valves 2” and under and ductile iron on all valves 2-1/2” and larger.

H. All valves shall be factory leak tested at 100 psi air under water.

I. A differential pressure test kit shall be supplied to verify flow and measure over-heading. The kit shall consist of a 4-1/2" diaphragm gauge equipped with 10 foot hoses and P/T adapters all housed in a vinyl case. Calibration shall be 0-35 PSID for 2-32 PSI spring range or 0-65 PSID for 5-60 PSI range.

J. Acceptable Manufacturers: Griswold, Autoflow, Versa Flow, Nexus, B&G, Victaulic, Hays Fluid Controls.

K. Complete integral piping package, which integrate shutoff valves, automatic flow control valves, vents, strainers and drains, are acceptable.

2.13 COMBINATION PIPING PACKAGES

A. Combination piping packages are allowed in lieu of individual components specified for hydronic coils and devices containing hydronic coils. Combination piping packages shall include shutoff valves, wye strainers, 1/4 turn strainer blow down valves with hose thread and cap, manual balancing valves with memory stop, test plugs, manual air vents, and unions. Automatic flow control devices are not allowed. Configuration of combination pieces shall match layouts on the drawings. Each component of the combination piping packages shall meet these specifications for the individual components being combined.

B. Acceptable Manufacturers: FDI Flowset, Griswold, Hays Fluid Controls, HCI Terminator, Nexus Coil Pak, NIBCO, Victaulic.

2.14 EXPANSION TANK

A. Compression Type:

1. Tank shall be welded steel, guaranteed air-tight and leakproof, ASME construction, stamped for 125 psig working pressure.

2. Furnish with air control fitting and drain valve.

3. 375ºF maximum operating temperature.

4. Furnish bronze 3/4" gauge glass, tested for at least 200 psi, hand wheel automatic valves with rubber washer for glass and 1/4" drain cock.

5. Acceptable Manufacturers: Bell & Gossett, Adamson, Taco, Armstrong, Ace Buehler, Wessels, Wheatley, Amtrol, Patterson, Grundfos.

B. Bladder Type:

1. Tank shall be welded steel, ASME construction and stamped.

2. Tank shall be complete with heavy-duty replaceable butyl bladder, charging valve, lifting ring, drain tapping, and system connection.

3. 125 psig working pressure and 240ºF maximum operating temperature.

4. Acceptable Manufacturers: Thrush, Taco, Bell & Gossett, Armstrong, Watts, Wessels, Wheatley, Amtrol, Patterson, Grundfos.

2.15 AIR SEPARATORS

A. Separators shall be ASME constructed and stamped for 125 psi working pressure and 350ºF operating temperature.

B. Provide openings for inlet, outlet, blowdown, and expansion tank.

C. Separators shall be line size or larger, with maximum pressure drop of 1 psi. Refer to drawing for separator sizing.

D. Separators shall not include strainers, unless noted on the drawings. When furnished, strainers shall be removable and the blowdown fittings shall have drain valves.

E. Acceptable Manufacturers: Amtrol, Armstrong, Bell & Gossett, Taco, Wheatley, Patterson, Wessels, Grundfos.

2.16 DRAIN VALVES AND BLOWDOWN VALVES

A. Drain valve and blowdown valve shall mean a shutoff valve as specified for the intended service with added 3/4" male hose thread outlet, cap, and retaining chain.

2.17 CONNECTIONS BETWEEN DISSIMILAR METALS

A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.

B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.

C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel, and stainless steel are commonly used and require isolation from each other with the following exceptions:

1. Iron and steel connected to each other.

2. Brass, copper, and bronze connected to each other.

3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.

D. Dielectric protection is required at connections to equipment of a material different than the piping.

E. Screwed Joints (acceptable up to 2" size):

1. Dielectric waterway rated for 300 psi CWP and 225°F.

2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 647, Grinnell Series 407, Matco-Norca.

F. Flanged Joints (any size):

1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.

2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.

3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.

4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.

5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.

6. Acceptable Manufacturers: EPCO, Central Plastics, Pipeline Seal and Insulator, F. H. Maloney, or Calpico.

2.18 ETHYLENE GLYCOL

A. Fill glycol systems with a mixture of water and ethylene glycol based low temperature industrial heat transfer fluid with an expected life of at least 12 years in normal use. Water shall meet the glycol manufacturer's recommendations (generally < 25ppm chloride, sulfite, and hardness). Distilled, deionized, or reverse osmosis water is acceptable, as are pre-diluted solutions from the manufacturer. Solution shall contain a fluorescent dye to facilitate leak detection.

B. Fluid suitable for use from -60ºF to 250ºF.

C. Glycol shall pass ASTM D1384 (less than 0.5 mils annual penetration of all system metals). Glycol supplier shall provide a certificate of assurance.

D. A 50% solution by weight shall depress the freezing point to at least -29ºF. At 40ºF the solution shall have viscosity of not over 6 centipoise, thermal conductivity of at least 0.21 Btu/hr*ft*ºF, specific heat of at least 0.79 Btu/lbm*ºF, and specific gravity of at least 1.08.

E. The glycol manufacturer shall analyze the fluid biannually to ensure the corrosion protection properties continue to meet industry standards. This shall be at no cost to the Owner. No chemical additions shall be made to the glycol solution until an analysis is completed.

F. Automotive glycol containing sodium silicate is not acceptable.

G. Acceptable Manufacturers: Dow Chemical "Dowtherm SR-1", Interstate Chemical “Intercool NFE”, Houghton Chemical “Wintrex”, and Texaco.

2.19 GLYCOL FEED SYSTEM

A. Package system complete with storage tank, pump(s) and controls with audio and visual alarm, designed to add glycol solution to a closed loop water system. System shall automatically maintain pressure in the piping system.

B. Provide cut-off and alarm to stop pump in case of low level or high pressure. Provide dry contact for alarm point to the DDC.

C. Complete with polyethylene storage tank and lid. Mount on floor above pumping assembly in a steel frame with legs. Lid shall be removable for filling and provide means for system relief valve outlet to be piped back to tank without removal of piping from relief valve or automatic air vent

D. Pumping system shall consist of a pump, starter, pressure tank with pressure control, pressure reducing valve, shutoff valve and pressure gauge. Refer to schedule for pump requirements.

E. Acceptable Manufacturer: Wessels GMP, Advantage Controls AGF, B&G GMU, Patterson, Grundfos.

2.20 LOCK OUT TRIM

A. Provide lock out trim for all quarter turn valves opening to atmosphere installed in heating water piping over 120°F and as indicated on the drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

D. Connect to all equipment with flanges or unions.

E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for treatment.

3.2 TESTING PIPING

A. Heating Water:
Chilled Water:
Condenser Water:
Glycol Water:
Heating/Cooling Water:

1. Test pipes underground or in chases and walls before piping is concealed.

2. Complete testing before insulation is applied. If insulation is applied before pipe is tested and a leak ruins the insulation, replace all damaged insulation.

3. Test the pipe with water at 175 psig pressure. Hold pressure for at least two hours.

4. Test to be witnessed by the Architect/Engineer or their representative, if requested by the Architect/Engineer.

3.3 CLEANING PIPING

A. Assembly:

1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.

2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.

3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.

4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

B. Chemical Cleaning:

1. Flush pipe and components with clean water until all discharge from system is clean. Maintain minimum velocities at all points of 5 feet/second for 30 minutes. Flow shall be in same direction as when system is in normal operation. Discharge shall be from low points of pipes, ends of headers and as otherwise needed to flush entire system. After flushing, all residual water shall be drained and/or blown out.

2. Add 2 pounds of trisodium phosphate per 100 gallons of system capacity. Use an alternate chemical if discharge of trisodium phosphate is not permitted. Maintain 150°F in the system if possible. If heat is not available, use 3 pounds per 100 gallons.

3. Drain the system after circulating the chemical cleaner for six hours at 150°F, or 12 hours at a lower temperature. Refill. Test a water sample. Drain and fill again if excessive cleaning chemicals remain and until water appears clear.

4. After each system has been cleaned and thoroughly flushed of pretreatment chemicals, it shall be immediately refilled with water and treated with chemical treatment as specified in Section 23 25 00. The system shall not be allowed to sit empty for any length of time.

5. When system water is clear, remove, clean and replace all strainers.

6. Water samples may be taken by the Architect/Engineer to verify a clean system. If system is not clean, the entire process, including chemical treatment specified in Section 23 25 00, shall be repeated at the Contractor's expense.

7. Chemical cleaning applies to the following systems:

a. Heating Water
b. Chilled Water

c. Glycol Water
d. Heating/Cooling Water
e. Condenser Water

3.4 INSTALLATION

A. General Installation Requirements:

1. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.

2. Install piping to conserve building space, and not interfere with other work.

3. Group piping whenever practical at common elevations.

4. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

5. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.

6. Install bell and spigot pipe with bells upstream.

7. Seal pipes passing through exterior walls with a wall seal per Section 23 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.

8. Branch takeoffs shall be from the top side (if branch is two sizes smaller than main), or any angle from the horizontal plane to the top of piping.

B. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment plus its required clearance space.

C. Installation Requirements in MRI (Magnetic Resonance Imaging - Healthcare):

1. All piping in MRI rooms shall be non-ferrous regardless of materials described on Part 2.

D. Buried Piping:

1. Install thrust blocking and restraints on all buried piping at elbows and other changes in pipe direction.

E. Valves/Fittings and Accessories:

1. Provide chain operators for all valves over 2" size that are over 10'-0" above finished floor. Extend to 7'-0" above finished floor.

2. Provide valve position indicator on all valves 10’-0” or greater above finish floor and not located above ceiling.

3. Provide clearance for installation of insulation, and access to valves and fittings.

4. Provide access doors where valves are not exposed.

5. Where a manual balance valve is shown to be installed in series with a service (isolation) valve, separate balance and service (isolation) valves shall be installed.

6. Install balancing valves with the manufacturer's recommended straight upstream and downstream diameters of pipe.

7. Prepare pipe, fittings, supports, and accessories for finish painting.

8. Install valves with stems upright or horizontal, not inverted, except install manual quarter turn valves in radiation cabinets and all butterfly valves with stems horizontal.

9. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.

10. Provide flanges or unions at all final connections to equipment, traps and valves.

11. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.

F. Underground Piping:

1. Lay all underground piping in trenches. Provide and operate pumping equipment to keep trenches free of water.

2. Refer to Section 23 05 00 for Excavation, Fill, Backfill and Compaction requirements.

3.5 PIPE ERECTION AND LAYING

A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.

B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.

C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.

D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.

E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. 2-1/2" and larger fittings shall be long radius type, unless otherwise shown on the drawings or specified. Construct

welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.

F. Use full and double lengths of pipe wherever possible.

G. Unless otherwise indicated, install all inlet and outlet piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or pump.

H. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.

I. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.

3.6 DRAINING AND VENTING

A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate, and venting.

B. Provide drain valves at all low points of water piping systems or where indicated on drawings for complete or sectionalized draining. Drain valves are defined above.

C. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install all liquid lines with top of pipe and eccentric reducers in a continuous line.

D. Provide air vents at all high points and wherever else required for elimination of air in all water piping systems. Do not use automatic air vents in glycol systems unless they are piped to the fill tank.

E. Air vents shall be in accessible locations. If needed to trap and vent air in a remote location, a 1/8" pipe shall connect the tapping location to a venting device in an accessible location.

F. All vent and drain piping shall be of same materials and construction as the service involved.

3.7 BRANCH CONNECTIONS

A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.

B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.

C. Use of forged weld-on fittings is also limited as follows:

1. Must have at least same pressure rating as the main.
2. Header or main must be 2-1/2" or over.
3. Branch line is at least two pipe sizes under header or main size.

3.8 JOINING OF PIPE

A. Threaded Joints:

1. Ream pipe ends and remove all burrs and chips.
2. Protect plated pipe and valve bodies from wrench marks when making up joints.
3. Apply Teflon tape to male threads.

B. Flanged Joints:

1. Bronze flanges shall conform to B16.24 and ductile iron flanges to B16.42. Steel flanges shall be raised face except when bolted to flat face cast iron flange.

2. Bolting shall be ASTM A307 Grade B with bolts and heavy hexagonal nuts conforming to ASME B18.2.1 and B18.2.2.

3. Torque bolts in at least three passes, tightening to 1/3, 2/3, and final torque in a cross pattern with an indicating torque wrench for equal tension in all bolts.

4. Gaskets for flat face flanges shall be full-face type. Gaskets for raised faced flanges shall conform to requirements for "Group I gaskets" in ASME B16.5. All gaskets shall conform to ASME B16.21. Unless otherwise specified, gaskets shall meet the following requirements:

a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.

b. Maximum pressure rating of at least 250 psig.

c. Minimum temperature rating: -10°F.

d. Maximum temperature rating of at least 170°F for water and glycol solution systems operating 140°F and less.

e. Maximum temperature rating of at least 250°F for water and glycol solution systems operating above 140°F and up to 180°F.

C. Solder Joints:

1. Make up joints with 95% tin and 5% antimony (95-5) solder conforming to ASTM B32 Grade 95TA. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, to all surfaces to be joined. Heat joints uniformly to proper soldering temperature so solder flows to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.

2. Flux shall be non-acid type conforming to ASTM B813.

3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470ºF melting point solder. Remove composition discs and all seals during soldering if not suitable for 470ºF.

D. Welded Joints:

1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless local codes take precedence.

2. Furnish certificates qualifying each welder to the Owner's Representative prior to start of work.

3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.

4. Ends of pipe and fittings to be joined by butt-welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.

5. Single-welded butt joints may be employed with or without the use of backing rings in all sizes. Where backing rings are not used on pumped pressurized systems, the root side of the weld shall either be chipped or ground flush with the piping wall. For services such as vents, overflows, and gravity drains, the backing ring may be eliminated, and the root of the weld need not be chipped or ground. Backing rings shall be of the material being welded.

END OF SECTION 23 21 00

SECTION 23 31 00 - DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Galvanized Ductwork
B. Ductwork Reinforcement
C. Ductwork Sealants
D. Rectangular Ductwork
E. Round and Flat Oval Ductwork
F. Exposed Ductwork (Rectangular, Round, or Oval)
G. Flexible Duct
H. Leakage Testing
I. Ductwork Penetrations
J. Duct Cleaning
K. Painting

1.2 REFERENCES: Conform to all applicable requirements of the following publications:

A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.
B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
C. ANSI/AWS A5.11M (1997) - Specification for Nickel and Nickel Alloy Welding Electrodes for Shielded Metal Arc Welding.
D. ASHRAE - Handbook 2012 Systems and Equipment; Chapter 19 - Duct Construction.
E. ASHRAE - Handbook 2013 Fundamentals; Chapter 21 - Duct Design.
F. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.
G. ASTM A90 - Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
H. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.
I. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
J. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
K. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
L. ASTM E90-02 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
M. ASTM E413-87 - Classification for Rating Sound Insulation.
N. AWS A5.14M (1997) - Specification for Nickel and Nickel Alloy Bare Welding Electrodes and Rods.
O. AWS D9.1M/D9.1 - Sheet Metal Welding Code.
P. NADCA ACR 2002 - Assessment, Cleaning, and Restoration of HVAC Systems.
Q. NADCA Standard 05 1997 - Requirements for the Installation of Service Openings in HVAC Systems.
R. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
S. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.
T. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Equipment.
U. SCAQMD Rule 1168 – South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications.
V. SMACNA – Air Duct Leakage Test Manual – 1985 Edition.
W. SMACNA - HVAC Duct Construction Standards - 2005 Edition.
X. SMACNA - Phenolic Duct Construction Standard 022.
Y. SMACNA - Round Industrial Duct Construction Standards - 1999 Edition.

Z. UL 181 - Factory-Made Air Ducts and Air Connectors.
AA. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors
BB. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.
CC. UL 1978 - Standard for Grease Ducts.
DD. UL 2221 - Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies.

1.3 SUBMITTALS

A. Submit shop drawings per Section 23 05 00.

B. Submit duct fabrication standards in compliance with SMACNA and these specifications. Clearly indicate metal gauges, reinforcement, and joining methods intended for use for each pressure classification. Furnish details of all common duct fittings and joint connections to be used on this project.

C. The Architect/Engineer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Architect/Engineer, the contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.

D. Duct Layout Drawings: Submit detailed duct layout drawings at 1/4" minimum scale complete with the following information:

1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.

2. Differentiate ducts that are wrapped. Include insulation thickness, type of insulation, and acoustical lagging.

3. Room names and numbers, ceiling types, and ceiling heights.

4. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.

5. Verify clearances and interferences with other trades prior to preparing drawings. IMEG will provide electronic copies of ventilation drawings for contractor’s use if the contractor signs and returns the “Electronic File Transfer” waiver. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for this submittal. Refer also to Section 23 05 00.

1.4 DEFINITIONS

A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.

B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.

1.5 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 23 05 00 for required duct systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

B. Duct drawings shall be at 1/4" minimum scale complete with the following information:

1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.

2. Differentiate ducts that are lined or wrapped. Include insulation thickness, type of insulation, and acoustical lagging.

3. Location and size of all duct access doors.

4. Room names and numbers, ceiling types, and ceiling heights.

5. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.

C. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings. Architectural plans will need to be obtained from the Architect.

PART 2 - PRODUCTS

2.1 GALVANIZED DUCTWORK

A. General Requirements:

1. Duct and reinforcement materials shall conform to ASTM A653 and A924.

2. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.

3. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.

4. Ductwork reinforcement shall be of galvanized steel.

5. Ductwork supports shall be of galvanized or painted steel.

6. Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel attached to the bottom of ducts with spacing as required by SMACNA at 8'-0" OC and as required by CMC/UMC and SMACNA guidelines.

7. Aircraft cable and slip cable hangers are acceptable for ducts up to 18"ø. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.

8. All fasteners shall be galvanized or cadmium plated.

2.2 DUCTWORK REINFORCEMENT

A. General Requirements:

1. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.

a. Ducts must be over 18” wide.

b. Duct dimensions must be increased 2” in one dimension (h or w) for each row of tie rods installed.

c. Tie rods must not exceed 1/2” diameter.

d. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

2.3 DUCTWORK SEALANTS

A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.

B. Two-part joint sealers shall consist of a minimum 3” wide mineral-gypsum compound impregnated fiber tape and a liquid sealant. Sealant system shall meet the following requirements: maximum 48-hour cure time, service temperature of 0°F to 200°F, resistant to mold, mildew, and water, flame spread rating below 25 and smoke developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.

C. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20°F to +250°F.

D. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20°F to +250°F. Acceptable manufacturers include: Venture Tape 1581A, Compac #340, Scotch Foil Tape 3326, Polyken 339.

2.4 RECTANGULAR DUCT - SINGLE WALL

A. General Requirements:

1. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.

2. Transitions shall not exceed the angles in Figure 4-7.

B. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:

1. All ducts shall be cross-broken or beaded.

2. Snap lock seams are not permitted.

3. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:

a. Type 1:

1) Description: Single wall type with 22-gauge (0.029”) or heavier vanes, 3-1/4" blade spacing, and 4” to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.

2) Usage: Limited to 3,000 fpm and vane lengths 36” and under.

b. Type 2:

1) Description: Double wall type with 3-1/4" blade spacing, 4-1/2" radius, 24-gauge minimum, and SMACNA Type 1 runners. C-value below 0.27.

2) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48” long.

c. Type 3 (acoustical - where acoustical lagging is located or as noted on drawings):

1) Description: Same as Type 2, except filled with fiberglass and with slotted or perforated inner curve. Minimum insertion loss of 9 dB at 250 Hz and 6 dB at 1 KHz.

2) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48” long.

d. Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.

e. Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.

f. Omitting every other vane is prohibited.

4. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.

5. Rectangular branch and tee connections in ducts over 1” pressure class shall be 45° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1” pressure class.

6. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.

7. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1” or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.

8. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.

9. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.

10. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6” in length.

11. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.

    a. Apply sealant to all inside corners. Holes at corners are not acceptable.

    b. Acceptable Manufacturers: Ductmate Industries - 25/35/45, Nexus, Mez, or WDCI. Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer’s approval before any fabrication begins.

12. Formed-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.

    a. Apply sealant to all inside corners. Holes at corners are not acceptable.

    b. Flanges shall be 24-gauge minimum (not 26 gauge).

    c. Acceptable Manufacturers: Lockformer TDC, TDF, United McGill, or Sheet Metal Connectors. Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer’s approval before any fabrication begins.

2.5 ROUND AND FLAT OVAL SPIRAL SEAM DUCTWORK - SINGLE WALL

A. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.

B. Flat oval duct in negative pressure applications shall have flat sides reinforced as required for rectangular ducts of the same gauge with dimensions equal to the flat span of the oval duct.

C. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.

D. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.

E. Ductwork shall be suitable for velocities up to 5,000 fpm.

F. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.

G. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.

H. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.

I. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.

J. Transverse Joint Connections:

1. Crimped joints are not permitted.

2. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.

3. Ducts and fittings larger than 36" shall have flanged connections.

4. Secure all joints with at least 3 sheet metal screws before sealing.

5. Slide-on flanges as manufactured by Ductmate Industries - SpiralMate, Accuflange, or Sheet Metal Connectors are acceptable. Self-sealing duct systems are also acceptable (Lindab, Ward “Keating Coupling”).

2.6 ROUND AND FLAT OVAL SPIRAL SEAM DUCTWORK - DOUBLE WALL

A. Conform to applicable portions of Rectangular Duct Section. Spiral seam round or flat oval double wall ductwork may be substituted for double wall rectangular ductwork where approved by the Architect/Engineer. Double wall spiral seam ductwork shall meet the standards set forth in this specification. Ductwork shall meet or exceed the specified cross-

sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation. Interior wall shall be perforated if substituting for lined or double wall rectangular ductwork.

B. Interior ducts shall have an airtight outer pressure shell, a 1" insulation layer, and a perforated inner wall that completely covers the insulation.

C. Exterior ducts shall have an airtight outer pressure shell, a 2" insulation layer, and a perforated inner wall that completely covers the insulation.

D. All perforated inner walls shall have a 25/50 compliant liner between the insulation and the perforated inner wall to prevent contact between fiberglass and air stream. For exterior ductwork this shall form a continuous vapor barrier.

E. Insulation shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.

F. 90° elbows shall be smooth radius or have a minimum of 5 mitered joints, and R/D of at least 1.5.

G. Duct and Fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA standards for the specified pressure class. Ribbed and lightweight duct are not permitted.

H. Ductwork shall be suitable for up to 5,000 fpm velocity.

I. Divided flow fittings may be separate fittings or factory installed taps with the following construction requirements:

1. Sound airtight, continuous welds at intersection of fitting body and tap.

2. Tap liner welded to inner liner with weld spacing not over 3".

3. Insulation packed around the tap area for complete cavity filling.

4. Carefully fit branch connections to cut-out openings in inner liner without spaces for air erosion of insulation or sharp projections for noise and airflow disturbance.

J. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.

K. Support inner liner of ducts and fittings with metal spacers welded to maintain spacing and concentricity.

L. Ducts with minor axis under 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.

M. Transverse Joint Connections:

1. Crimped joints are not permitted.

2. Provide couplings to align the inner liners. Butt joints are not permitted for inner liners. Make alignment by extending the liner of the fitting into the duct or by using a double concentric coupling with the two couplings held by spacers for rigidity and wall spacing.

3. Above 34" ID provide a separate coupling for inner alignment with the pressure shells joined by angle ring flanged connections.

4. Use outside slip couplings for fitting-to-fitting joints.

5. Secure all joints with at least 3 sheet metal screws before sealing.

6. Slide-on flanges as manufactured by Ductmate Industries - SpiralMate, Accuflange or Sheet Metal Connectors are acceptable. Self-sealing duct system is also acceptable (Lindab, Ward “Keating Coupling”).

2.7 ROUND SNAP-LOCK SEAM DUCTWORK - SINGLE WALLFactory sealed snap-lock pipe. Transverse and longitudinal seams shall contain factory-applied self-sealing EPDM and co-polymer gasket. Snap-lock shall conform to SMACNA RL-8. Duct and gasket material shall meet the flame/smoke spread rating of 25/50 per ASTM-E84.

B. G-60 galvanized coating meeting ASTM A653 and ASTM A90 G-90 galvanized steel aluminum meeting ASTM B209 Alloy 3003 Temper H14 304 stainless steel meeting ASTM A480 2B Finish.

C. Snap-lock seams are only permitted on systems between -1”w.c. and 2”w.c. pressure class.

D. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.

E. Duct and fittings shall meet the required minimum gauges listed in Chapter 3 of the SMACNA requirements for the specified pressure class.

F. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.

G. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.

H. Acceptable Manufacturers: GreenSeam Industries.

2.8 EXPOSED DUCTWORK (RECTANGULAR, ROUND, AND FLAT OVAL)

A. The following applies to all ductwork exposed in finished areas in addition to requirements noted above:

1. Provide extra shipping protection. Use Cardboard or other protective means to prevent dents and deformed ends.

2. Provide cardboard or other means of protection during field fabrication. Protect from scratches. Provide stiffeners to retain shape during fabrication.

3. Remove all identification stickers and thoroughly clean exterior of all ducts.

4. Locate fitting seams on least visible side of duct.

5. Provide exterior finish suitable for field painting without further oil removal.

6. Provide ramp-type internal joint couplings. Provide bead of sealant around the inside of the duct about 1/2” from the end of the duct. Slide-on flanges as

manufactured by Ductmate Industries, Accuflange or Sheet Metal Connectors are acceptable. Self-sealing duct system is also acceptable (Lindab, Ward “Keating Koupling”).

7. The system shall be free of visible dents and scratches when viewed from normal occupancy.

8. All insulation shall be internal, except at reheat coils.

B. In addition to the paragraphs above, this section applies to all ductwork specified or shown as “Architecturally Exposed”:

1. All spiral ductwork fittings shall be carbon arc welded.

2. Grind all welds to remove irregularities.

3. Conical taps shall be one piece. Taps for grilles and takeoffs shall be factory installed with a continuous weld and ground smooth.

4. Welds shall be ground smooth and painted.

5. All architecturally exposed ducts shall be round or flat oval except where not possible (grilles, reheat coils, etc.).

C. Alternate manufacturers, including shop fabricated duct, must be reviewed before installation. The following information is required:

1. Metal gauge of duct and fittings.
2. Fitting type and construction.
3. Type and size of reinforcement.

D. Hangers for Exposed Ductwork:

1. Round Ducts:

a. Threaded rod with duct fixing bracket and metal strap. Provide single threaded rod centered on the duct. Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel wrapping the circumference of the duct. Spacing as required by SMACNA guidelines. Aircraft cable and slip cable hangers are acceptable for ducts up to 18”ø. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Spacing and cable size as required by SMACNA guidelines. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.

b. Aircraft cable with 2-point support in standard horseshoe arrangement. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Spacing and cable size as required by SMACNA guidelines.

2. Rectangular Ducts

a. Aircraft cable and slip cable hangers are acceptable for ducts up to 18” in maximum dimension. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork. Spacing and cable size as required

by SMACNA guidelines. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.

b. Aircraft cable with 2-point support in standard horseshoe arrangement. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork. Spacing and cable size as required by SMACNA guidelines.

3. Strut-channel and all-thread rod is not acceptable for exposed ductwork.

4. All fasteners shall be galvanized or cadmium plated.

2.9 FLEXIBLE DUCT

A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.

B. Flame Spread/Smoke Developed: Not over 25/50.

C. Flexible duct shall have corrosion-resistant wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. Usage: All areas unless noted otherwise.

D. Flexible duct shall have polymer wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2" thick, 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of polyester film laminated to glass mesh. Usage: MRI rooms.

E. Inner liner shall be airtight and suitable for 6" WC static pressure through 16” diameter through 10” diameter and shall be airtight and suitable for 4” WC static pressure 12” through 16” diameter. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A. ”R” value shall not be less than 4.0 ft^2*ºF*hr/Btuh. Temperature range of at least 0-180ºF. Maximum velocity of 4,000 fpm.

F. Usage:

1. Take-offs from supply ducts to inlets of terminal air boxes. Do not exceed 36" in length.

2. Connections to air inlets and outlets. Do not exceed 6'-0" in length.

G. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.

H. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is <u>not</u> acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide openings in ducts for thermometers and controllers.

B. Locate ducts with space around equipment for normal operation and maintenance.

C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.

D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork. Supply ductwork shall be free of construction debris, and shall comply with Level “B” “C” of the SMACNA Duct Cleanliness for New Construction Guidelines.

E. Repair all duct insulation and liner tears.

F. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.

G. Insulate terminal air box reheat coils. Seal insulation tight to form a tight vapor barrier.

H. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.

I. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.

J. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.

K. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 23 05 50 for seismic requirements.

L. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by California Building Codes.

M. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.

N. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

O. Kitchen Grease and Dishwasher Ductwork:

1. All kitchen grease and dishwasher ductwork shall be installed with a continuous slope and grease tight welds on all seams and joints.

3.2 DUCTWORK APPLICATION SCHEDULE

USAGE	**MATERIAL**	**PRESSURE CLASS**	**SEAL CLASS †**	**INSULATION** (Refer to Section 23 07 13 for insulation types) ±
Supply Duct from Fan to Terminal Air Boxes – Single Wall	Galvanized Sheet Metal - Rectangular	+3"	A	1-1/2" thick Type A (R=4.5) or 1" thick Type C (R=3.6)
Supply Duct from Fan to Terminal Air Boxes – Single Wall	Galvanized Sheet Metal - Spiral Seam Round	+3"	A	1-1/2" thick Type A (R=4.5) or 1" Type G (R=4.3)
Supply Duct from Fan to Terminal Air Boxes	Galvanized Sheet Metal w/Slide-On Flange System or Formed-on Flanges	+3" (+6”)	A	1-1/2" thick Type A (R=4.5) or 1” thick Type C (R=3.6)
Supply Duct from Fan to Terminal Air Boxes – Double Wall	Galvanized Sheet Metal (spiral seam round or rectangular)	+3"	A	1" thick Type E (R=3.7)
Exterior Supply Duct from Fan to Terminal Air Boxes – Double Wall	Galvanized Sheet Metal (spiral seam round or rectangular)	+3"	A	
Exterior Supply Duct from Fan to Terminal Air Boxes – Single Wall with Aluminum Jacket	Galvanized Sheet Metal (spiral seam round or rectangular)	+3"	A	2” thick Type B with aluminum jacket (R=8.0)
Supply Duct from Terminal Air Boxes to Outlets	Galvanized Sheet Metal - Rectangular	+2”	A	1-1/2" thick Type A (R=4.5) or 1" thick Type C (R=3.6)
Supply Duct from Terminal Air Boxes to Outlets	Galvanized Sheet Metal – Spiral Seam Round or Snap-lock Seam Round	+2”	A	1-1/2" thick Type A (R=4.5) or 1" thick Type G (R=3.6)
Constant Volume from Fan to Outlet	Galvanized Sheet Metal - Rectangular	+2”	A	1-1/2" thick Type A (R=4.5) or 1" thick Type C (R=3.6)
Constant Volume from Fan to Outlet	Galvanized Sheet Metal – Spiral Seam Round or Snap-lock Seam Round	+2”	A	1-1/2" thick Type A (R=4.5) or 1" thick Type G(R=4.3)

USAGE	**MATERIAL**	**PRESSURE CLASS**	**SEAL CLASS †**	**INSULATION** (Refer to Section 23 07 13 for insulation types) ±
Return Duct	Galvanized Sheet Metal	-2"	A	None None
Exterior Return Duct	Galvanized Sheet Metal	-2"	A	1 1/2" thick Type B (R=6)
General Exhaust Duct	Galvanized Sheet Metal	-1"	A	None
Combustion Air Duct	Galvanized Sheet Metal	-1"	A	1 1/2" thick Type B (R=6.0)
AHU Exhaust Air Duct	Galvanized Sheet Metal	+2"	A	1" thick Type C (R=3.6)
Relief/Exhaust Air Duct from fan to Exhaust Outlet	Galvanized Sheet Metal	+2"	A	None
Grease Exhaust Duct	Refer to "Grease Exhaust Duct"	-2"	---	None (with Metal-Fab System). Where concealed 1-1/2" thick Type A where no fire rating is needed; or type F where fire rating is needed.
Dishwasher Exhaust Duct	Refer to "Dishwasher Exhaust Duct"	-1"	A	None or 1-1/2" thick Type A (R=4.5)
Fume Exhaust Duct	Refer to "Fume Exhaust Duct"	---	---	1-1/2" thick Type A (R=4.5) within 15'of penetration of exterior wall or roof
Outside Air Intake from Louver to Heating Coil	Galvanized Sheet Metal	-2"	A	1 1/2" thick Type B (R=6.0)
Mixed/Make-up Air Duct	Galvanized Sheet Metal	-2"	A	1-1/2" thick Type A (R=4.5) 2" thick Type A (R=6.0)
Tempered Outdoor or Makeup Air Duct from Fan to Outlet	Galvanized Sheet Metal	+2"	A	1-1/2" thick Type A (R=4.5) or 1" thick Type C (R=3.6)
Relief Air Louver to Backdraft Damper	Galvanized Sheet Metal	+2"	A	1 1/2" thick Type B (R=6.0) 1 1/2" thick Type B (R=6.0)
Transfer Ducts	Galvanized Sheet Metal	-1/2"	---	1" thick Type C (R=3.6)
Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.)	---	---	---	1-1/2" thick Type A (R=4.5) 2" thick Type A (R=6.0)
All Terminal Air Box/ Reheat Coil Headers and Duct Mounted Coil Headers	--	--	(Note 2)	1-1/2" thick Type A (R=4.5)
Linear Diffuser Supply Plenum	-	-	-	1/2" thick Type C (R=1.8) 1-1/2" thick Type A (R=4.5)

USAGE	**MATERIAL**	**PRESSURE CLASS**	**SEAL CLASS †**	**INSULATION** (Refer to Section 23 07 13 for insulation types) ±
Supply Duct from Fan to Terminal Air Boxes	Phenolic Non-Fibrous Closed Cell - Indoor	+3”	A (Note 1)	None
Exterior Supply Duct from Fan to Terminal Air Boxes	Phenolic Non-Fibrous Closed Cell – Outdoor.	+4”	A	None
Supply Duct from Terminal Air Boxes to Outlets	Phenolic Non-Fibrous Closed Cell - Indoor	+3”	A (Note 1)	None
Constant Volume from Fan to Outlet	Phenolic Non-Fibrous Closed Cell - Indoor	+3”	A	None
Return Duct	Phenolic Non-Fibrous Closed Cell - Indoor	-3”	A	None
Exterior Return Duct	Phenolic Non-Fibrous Closed Cell – Outdoor.	-3”	A	None
General Exhaust Duct	Phenolic Non-Fibrous Closed Cell - Indoor	-3”	A	None

† Seal Class is per SMACNA HVAC Air Duct Leakage Test Manual
± Type A insulation (Flexible Fiberglass Wrap) R-values noted are based on installed values (25% compression).
Note 1: Apply aluminum based adhesive sealant tape at non-flanged joints on ducts serving dedicated outside air supply (DOAS) and exhaust system in addition to Class A sealant.
Note 2: Apply aluminum based adhesive sealant tape on TAB boxes (all seams and joints of the box and duct connections) serving dedicated outside air supply (DOAS) system.

3.3 DUCTWORK SEALING

A. General Requirements:

1. Openings, such as rotating shafts, shall be sealed with bushings or similar.

2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.

3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.

4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.

B. For Seal Class A ducts, all transverse joints, longitudinal seams, and duct wall penetrations shall be sealed. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.

3.4 TESTING

A. Duct - 2" WG or Less (positive or negative):

1. Systems shall not leak more than shown in Table 4-1 of SMACNA HVAC Air Duct Leakage Test Manual for Seal Class A.

2. Leak testing of these systems is not normally required for interior ductwork. However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.

3. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.

4. Seal ducts to bring the air leakage into compliance.

5. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.

3.5 DUCTWORK PENETRATIONS

A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.

B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.

C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

3.6 DUCTWORK CLEANING

A. General:

1. This section applies to the cleaning of ductwork and HVAC system components.

2. The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA) or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.

3. The HVAC system cleaning contractor shall furnish all necessary equipment, materials, and labor to adequately perform the specified services.

4. The HVAC system cleaning contractor shall be capable of remediation of exposed damaged insulation in air handlers and/or ductwork requiring replacement.

5. Regulatory Requirements:

   a. Contractor shall submit to the Owner SDS for all chemical products proposed to be used in the cleaning process.

B. Perform the services specified here in accordance with current NADCA standards.

C. System Component Inspections and Site Preparations:

1. Prior to beginning any cleaning work, perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment needed. The cleanliness inspection should include air handling units, other air moving equipment, and ductwork. In systems with multiple air handling units, a representative sample of the units should be inspected.

2. Coordinate any system shutdowns with the Owner a minimum of 24 hours in advance of any needed shutdowns.

3. The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification, or other debris..

4. Damaged system components found during the inspection shall be documented and brought to the attention of the Owner and Architect/Engineer.

5. Conduct a site evaluation, and establish a specific, coordinated plan detailing how each area of the building will be protected during each phase of the project.

D. HVAC System Cleaning Requirements:

1. Collect debris removed during cleaning and take precautions to avoid dispersing debris from cleaning operations outside the HVAC system.

2. Use HEPA filters if particulate collection equipment exhausts inside the building.

3. When particulate collection equipment exhausts outside the building, precautions shall be taken to locate the equipment downwind and away from all air intakes and other points of entry into the building.

4. Cleaning operations shall be undertaken only with particulate collection equipment in place, including adequate filtration to contain debris removed from the HVAC system.

5. Take measures to control odors, mist, and vapors during the cleaning process.

6. All HVAC system components must be visibly clean as defined in the NADCA Standards.

7. Volume dampers, control dampers, and other mechanical devices inside the HVAC system must have their positions marked prior to cleaning and, upon completion, must be restored to their marked positions.

8. Service Openings:

    a. Use existing service openings where possible.

    b. Create openings where needed. Seal openings per the original duct pressure and leakage classification after use.

    c. Closures must not significantly restrict or alter the system airflow.

    d. Closures must be insulated to prevent heat transfer and condensation.

    e. Openings must not compromise the structural integrity of the system.

    f. Openings shall conform to applicable NFPA and SMACNA standards, and NADCA Standard 05.

    g. Do not cut openings in flexible duct. Disconnect flexible duct at the ends as needed for proper cleaning and inspection.

    h. Clearly mark all service openings that can be reopened and mark their locations in the final report.

9. The Contractor may remove and reinstall ceiling sections for cleaning access. Conform to the Owner's infection control policy for ceiling removal and dust control.

10. Clean all connected inlets and outlets.

11. Air Handling Unit Cleaning (Unit Identification):

    a. Thoroughly clean supply, return, and exhaust fans. Clean fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies. Remove all visible surface deposits in accordance with NADCA Standards. Contractor shall:

        1) Clean all internal surfaces, components, coils (including fins), condensate pans, and drains.

        2) Assure that a suitable operative drainage system is in place prior to beginning washdown procedures. Take care not to wet any insulation during washdown.

12. Duct System Cleaning:

    a. Create service openings as needed for cleaning inaccessible areas.

    b. Mechanically clean all duct systems such that the systems are capable of passing NADCA cleaning verification tests.

    c. Seal all openings, grilles, diffusers, etc. in the system to be cleaned.

    d. Attach high-pressure vacuum unit to ductwork near fan. Do not exceed the negative pressure rating of ductwork.

    e. From farthest opening, work dirt from duct back to extraction point using compressed air, brushes, and scrapers.

f. Do not damage lining or devices during cleaning. Replace any damaged material.

E. Cleaning Methods

1. Source Removal Cleaning Method:

a. Clean the HVAC system using source removal mechanical cleaning methods designed to extract contaminants from the HVAC system and safely remove contaminants from the facility. Select source removal methods that will render the HVAC system visibly clean and capable of passing cleaning verification and other specified tests included in this section. No cleaning method or combination of methods shall be used that could potentially damage the HVAC system or negatively alter the system integrity.

b. Operate vacuum collection devices continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned. The vacuum collection device must maintain sufficient negative pressure in all areas being cleaned to contain debris and protect the indoor environment.

c. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters, including hand-held vacuums and wet vacuums.

d. All vacuum devices exhausting outside the facility shall be equipped with particulate collection devices including a washable cloth filter bag to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any codes or regulations.

e. All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces such that debris may be safely conveyed to vacuum collection devices. Acceptable methods include those that will not potentially damage the integrity of the ductwork nor damage porous surface materials, such as liners inside the ductwork, or system components.

f. Exterior gas-fired vacuum collection equipment shall be located at least 20 feet away from the building.

g. Where vacuum collection hoses run into the building, the Contractor shall seal the opening airtight so dust from the collection equipment cannot re-enter the building.

h. Hoses for mechanical agitation devices should not enter the building in the same location as the vacuum hoses. Utilize a remote building opening for the tool entry location.

2. Coil Cleaning:

a. Any cleaning method may be used that renders the coil visibly clean and capable of passing NADCA Coil Cleaning Verification tests. Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement or erosion of, or

inhibit heat transfer of the coil surface and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water.

3. Biocide Agents and Coatings:

   a. Biocide agents shall only be applied if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified through testing.

   b. Biocide agents shall only be used where the Owner agrees in writing that he/she accepts coating the contaminated materials instead of replacement.

   c. Application of any biocide shall be performed after removal of surface deposits and debris.

   d. When used, apply biocides and coatings in strict accordance with manufacturer's recommendations, including minimum surface thickness for effectiveness and the EPA registration listing.

   e. Coatings shall be sprayed directly onto interior ductwork surfaces rather than “fogged” downstream onto surfaces. A continuous film must be achieved on the surface to be treated by the coating application.

F. Verification of Cleanliness:

1. The HVAC system cleaning contractor shall verify the cleanliness of the system, with help from the Owner.

2. Cleanliness of HVAC systems shall be verified immediately after mechanical cleaning, before application of any treatment or introduction of any treatment-related substance to the HVAC system (including biocides and coatings), and before the HVAC system is restored to normal operation.

3. The HVAC system shall be inspected visually. If no contaminants are evident, the system shall be considered clean. However, the Architect/Engineer and Owner reserve the right to require further verification of system cleanliness through Surface Comparison Testing or the NADCA vacuum test.

4. NADCA vacuum test analysis shall be performed by a qualified third party experienced in testing of this nature.

5. If visible contaminants are evident, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection at the Contractor's expense.

6. Verification of Coil Cleanliness:

   a. Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured or cataloged when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if it is free of foreign matter or residue based on a thorough visual inspection.

G. Final Report:

1. At the conclusion of the project, the Contractor shall provide a report to the Owner and Architect/Engineer indicating the following:

   a. Success of the cleaning project as verified through visual inspection and/or gravimetric analysis.

   b. Areas of the system found to be damaged and/or in need of repair.

   c. Locations of service openings.

H. Systems to be cleaned are as follows:

3.7 PAINTING

A. Paint interior of ducts black within twice the largest duct dimension of inlets and outlets where interior of duct is visible.

B. Paint bottom of ducts black within twice the largest duct dimension where a duct is routed above an unducted perforated grill and the duct is visible.

END OF SECTION 23 31 00

SECTION 23 33 00 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual Volume Dampers.
B. Fabric Connectors.
C. Drip Pans.
D. Duct Access Doors.
E. Duct Test Holes.
F. Air Blenders.

1.2 REFERENCES

A. ASTM E477-06a - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
B. ASTM E2336-04 – Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
C. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
D. SCAQMD Rule 1168 – South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications
E. SMACNA - HVAC Duct Construction Standards – Third Edition - 2005.
F. UL 33 - Heat Responsive Links for Fire-Protection Service.
G. UL 555 - Fire Dampers and Ceiling Dampers.
H. UL 555C – Ceiling Dampers.
I. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00.

B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MANUAL VOLUME DAMPERS

A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.

B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.

C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.

E. Provide locking quadrant regulators on single and multi-blade dampers.

F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.

2.2 FABRIC CONNECTORS

A. Fabric connectors shall be installed between all fans or fan units and metal ducts or casings to prevent transfer of fan or motor vibration.

B. The fabric connectors shall be completely flexible material which shall be in folds and not drawn tight.

C. Fabric connectors shall be of glass fabric double coated with neoprene, with UL approval. Weight = 30 oz. per square yard minimum. Fabric shall not be affected by mildew and shall be absolutely waterproof, airtight and resistant to acids, alkalis, grease and gasoline, and shall be noncombustible.

D. Fabric connections shall not exceed 6" in length on ductwork that has a positive pressure. On ductwork that has a negative pressure, the length shall not exceed 2" in length.

E. All corners shall be folded, sealed with mastic and stapled on 1" centers.

F. Fabric connectors shall not be painted.

G. Unless otherwise shown on the drawings, the fabric connection at the inlet to centrifugal fans shall be at least one duct diameter from the fan to prevent inlet turbulence.

H. Acceptable Materials: Durodyne MFN-4-100, Vent Fabrics, Inc. "Ventglas", or Proflex PFC3NGA.

I. Fabric connectors exposed to sunlight and weather shall be as described above, except the coating shall be hypalon in lieu of neoprene.

J. Acceptable Materials: Durodyne "Duralon MFD-4-100", Vent Fabrics, Inc. "Ventlon", or Proflex PFC3HGA.

2.3 DRIP PANS

A. Install drip pans under all rooftop exhaust fans, intake hoods, exhaust hoods and other roof penetrations that do not have ductwork below them to intercept dripping water.

B. Drip pans shall be 22 gauge minimum cross-broken or reinforced sheet metal with 2" welded upturned lips.

C. Pans shall extend 6" in all directions beyond the opening and shall have the top of the lip located 25% of the maximum throat dimension below the opening.

D. Insulate interior of drip pan with 1” thick elastomeric foam insulation. Adhere foam to drip pan with standard foam adhesive.

2.4 DUCT ACCESS DOORS

A. Fabricate per Fig. 7-2 and 7-3 of the SMACNA HVAC Duct Construction Standards and as indicated.

B. Review locations prior to fabrication. Install access doors at fire dampers, smoke dampers, motorized dampers, fan bearings, filters, automatic controls, humidifiers, louvers, duct coils and other equipment requiring service inside the duct.

C. Provide duct access door in all horizontal return ductwork at 20 foot intervals per NFPA 90A.

D. Construction shall be suitable for the pressure class of the duct. Fabricate rigid, airtight, and close-fitting doors of materials identical to adjacent ductwork with sealing gaskets butt or piano hinges, and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.

E. Access doors with sheet metal screw fasteners are not acceptable.

F. Minimum size for access doors shall be 24" x16" or full duct size, whichever is less.

G. Provide quantity of access doors such that two hands can fit inside ductwork to manually reset fire dampers. This will typically require one access door on the bottom and one access door on an accessible side of the duct for sizes 12x12 and smaller.

2.5 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.6 DUCTWORK ACCESSORY SEALANTS

A. Ductwork accessory sealants and adhesives shall conform to Section 23 31 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install accessories in accordance with manufacturer's instructions.

2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.

3. Coordinate and install access doors provided by others.

4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24” x 24”.

5. Provide duct test holes where indicated and as required for testing and balancing purposes.

B. Manual Volume Damper:

1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing. Use splitter dampers only where indicated.

2. Provide ceiling access doors for manual volume dampers. When manual volume dampers are located above an inaccessible ceiling and an access door cannot be installed, provide a remote-controlled volume control device for operation of the damper. Coordinate location with the Architect/Engineer.

3. Grease duct volume dampers shall be continuously welded to duct and/or hoods so that system is liquidtight.

C. Drain Pan:

1. Drain pans shall be installed per ASHRAE 62.1.

a. All drain pans shall be field tested under normal operating conditions to ensure proper drainage.

b. Field testing of drain pans is not required if units with factory installed drain pans have been certified (attested in writing) by the manufacturer for proper operation when installed as recommended.

END OF SECTION 23 33 00

SECTION 23 34 16 - CENTRIFUGAL FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. In-line Centrifugal Fans.

1.2 QUALITY ASSURANCE

A. Performance Ratings: Bear the AMCA Certified Rating Seal - Air Performance.

B. Fabrication: Conform to AMCA 99.

C. Fan Energy Index (FEI): Fans shall meet or exceed the minimum FEI scheduled at the specified airflow, pressure, and air density (duty point). In no case shall the FEI at the specified duty point fall below 1.0.

1.3 REFERENCES

A. AMCA 99 - Standards Handbook.
B. AMCA 208 - Calculation of the Fan Energy Index (FEI).
C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
G. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
H. SMACNA - HVAC Duct Construction Standards, 1995 Edition.

1.4 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point.

B. Submit operation and maintenance data. Include instructions for lubrication, motor and drive replacement, and spare parts list.

1.5 EXTRA STOCK

A. Provide one extra belt set for each fan unit.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FAN

A. Galvanized steel construction with stainless steel or cadmium plated fasteners and galvanized steel belt guard.

B. Backward inclined, non-overloading, all aluminum wheel and hub. Dynamically balanced.

C. Cast iron, adjustable pitch sheaves. V-belt drive sized for 1.5 of maximum horsepower. Operating point near center of adjustment range.

D. Screw adjustment belt tightener.

E. Regreasable bearings rated for 40,000 hour B-10 life at specified operating point. Extend lubrication lines outside of housing.

F. Steel mounting brackets suitable for any mounting position.

G. Motor per the drawings and Section 23 05 13. Minimum 1/3 HP motors for all fans.

H. Factory installed and wired disconnect switch.

I. Acceptable Manufacturers: Jenco Fan, Carnes, Cook, PennBarry or Greenheck.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

2. Install flexible connections between fan and ductwork. Install metal bands of connectors parallel with minimum 1" flex between ductwork and fan while running.

3. Provide safety screen where inlet or outlet is exposed. Screens shall meet OSHA regulations for size of openings.

END OF SECTION 23 34 16

SECTION 23 37 00 - AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grilles And Registers.
B. Louvers.

1.2 QUALITY ASSURANCE

A. Test and rate performance of air inlets and outlets per ASHRAE 70.

B. Test and rate performance of louvers per AMCA 500L-99.

C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

A. AMCA 500-L-12 - Laboratory Methods of Testing Louvers for Rating.
B. ANSI/ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Inlets and Outlets.
C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
D. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.
E. SMACNA - Duct Construction Standards.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 23 05 00.

B. Submit schedule of inlets and outlets indicating type, size, location, application, and noise level.

C. Review requirements of inlets and outlets as to size, finish, and type of mounting prior to submitting product data and schedules of inlets and outlets.

D. Submit manufacturer's installation instructions.

E. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A.
B. Conform to ASHRAE 90.1.

1.6 EXTRA STOCK

A. Provide clean filters in all filter return grilles at time of installation.

B. Provide one additional set of replacement filters for all filter return grilles. Deliver to Owner at job site.

PART 2 - PRODUCTS

2.1 GRILLES AND REGISTERS

A. Reference to a grille means an air supply, exhaust or transfer device without a damper.

B. Reference to a register means an air supply, exhaust or transfer device with a damper.

C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.

D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.

E. The capacity and size of the unit shall be as shown on the drawings.

F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect. Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70.

G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.

H. Provide with 3/4” blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.

I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.

J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.

K. Where specified to have filters, provide with filter rack suitable for 1” 2” thick MERV-8 pleated media filters. Grille border shall be fabricated from minimum 22 gauge steel or minimum 0.040-inch thick for aluminum grilles. Provide removable grille face with metal knurled knob or quarter turn fastener to allow for filter media replacement.

L. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.

M. Acceptable Manufacturers: Tuttle & Bailey, Titus, Price, Nailor, Carnes, Metalaire, Krueger, Anemostat, Raymon Donco.

2.2 LOUVERS - FIXED - ALUMINUM

A. Louvers shall be minimum 4" deep and constructed of extruded aluminum. Blade, jamb and sill thickness shall be minimum 0.081". Blades shall be spaced at a maximum of 5.1" apart.

B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.

C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.

D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.

E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.19" pressure drop. Maximum water penetration shall be 0.01 ounces per square foot at the scheduled intake velocity based on 15 minute test duration when subjected to a water flow rate of 0.25 gal/min as described under the Water Penetration Test in AMCA 500-L-07.

F. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.

G. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.

H. Louvers shall be suitable for duct connection.

I. Acceptable Manufacturers: Air Flow - “EA-403”, Arrow - “EA-415-D", American Warming & Ventilating - “LE-21", Construction Specialties - “A4097", Dowco - “DBE-4", Louvers & Dampers, Inc. - “IL-23", Ruskin - “ELF375DX”, Vent Products - “2760", Greenheck - “ESD-403", Pottorff - “EFD”.

2.3 LOUVERS - FIXED - GALVANIZED

A. Louvers shall be minimum 4” deep and constructed of galvanized steel with minimum 18 gauge frames and 16 gauge blades.

B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.

C. Louvers shall be furnished with 1/2" mesh 0.041 galvanized wire bird screen mounted on the inside surface.

D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.

E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.19" pressure drop. Maximum water penetration shall be 0.01 ounces per square foot at the scheduled intake velocity based on 15 minute test duration when subjected to a water flow rate of 0.25 gal/min as described under the Water Penetration Test in AMCA 500-L-07.

F. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.

G. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.

H. Louvers shall be suitable for duct connection.

I. Acceptable Manufacturers: Air Flow, Arrow, American Warming & Ventilating, Carnes, Dowco, Louver and Dampers, Inc., Ruskin, Vent Products.

2.4 LOUVERS - ADJUSTABLE

A. Louvers shall be minimum 4” deep and constructed of extruded aluminum. Blade, jamb and sill thickness shall be minimum 0.081". Blades shall be adjustable and spaced at a maximum of 5.1” apart.

B. Louvers shall be furnished with nylon bearings, extruded aluminum blade shafts, non-binding, corrosion resistant hardware with brass pinions. Blades shall have hollow bulb vinyl blade edge seals and be suitable for motor operator. Motor by Temperature Control Contractor.

C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.

D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.

E. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.

F. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.

G. Louvers shall be suitable for duct connection.

H. Acceptable Manufacturers: Air Flow, Arrow, American Warming & Ventilating, Construction Specialties, Dowco, Louvers and Dampers, Inc., Ruskin, Vent Products, Greenheck.

2.5 LOUVERS - HORIZONTAL BLADE WIND DRIVEN RAIN FIXED - ALUMINUM

A. Louvers shall be minimum 4" deep and constructed of extruded aluminum. Frame thickness shall be minimum 0.081". Blade thickness shall be 0.63”.

B. Blades shall be a horizontal, compound sinusoidal type arrangement spaced approximately 2” apart.

C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.

D. Size, cfm, finish, and pressure drop for louvers shall be as scheduled on the drawings.

E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.35" pressure drop.

F. AMCA Certified Wind Driven Rain performance shall be as follows:

1. 29 MPH wind and 3” per hour rainfall at 1,000 FPM free area velocity: Minimum 99.7% and Class A effectiveness.

2. 50 MPH wind and 8” per hour rainfall at 500 FPM free area velocity: Minimum 98.4% and Class B effectiveness.

G. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.

H. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.

I. Louvers shall be suitable for duct connection.

J. Acceptable Manufacturers: Ruskin - “420DD”, Greenheck - “EHH-401".

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install items in accordance with manufacturers' instructions.

2. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3. Install diffusers to ductwork with air tight connections.

4. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.

5. Supply air diffusers in operating rooms (Class B and C surgery) shall be opened and cleaned before the space is used.

6. Supply grille and register blades shall be aimed in the field to provide adequate air distribution in the space. All return grilles and registers blades shall be oriented to minimize sight distance beyond installed device.

B. Volume Damper:

1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.

C. Maintaining Duct Cleanliness:

1. When grilles, registers, and diffusers are installed, Contractor shall prevent construction dust, dirt, and debris from entering ductwork as required by Section 23 05 00.

END OF SECTION 23 37 00

SECTION 23 73 13 - INDOOR MODULAR AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Modular Indoor Handling Units.

1.2 QUALITY ASSURANCE

A. AHU Unit: Manufacturer specializing in design and manufacturing of the products specified in this section with a minimum of five years' experience.

B. Fabrication: Conform to AMCA 99 and AHRI 430.

C. Fan Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

D. Sound Ratings: Tested to AMCA 300.

E. Air Coils: Certify capacities, pressure drops, and selection procedures per AHRI 410.

F. Electrical control wiring shall be in accordance with NEC codes and ETL requirements.

G. Unit shall contain only UL listed components.

H. Conform to ASHRAE 90.1.

1.3 REFERENCES

A. AMCA 208 - Calculation of the Fan Energy Index (FEI).
B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
C. AMCA 300 – Reverberant Room Method for Sound Testing of Fans.
D. AMCA 500 – Test Methods for Louvers, Dampers, and Shutters
E. AMCA 99 - Standards Handbook.
F. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
G. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
H. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
I. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
J. AHRI 430 - Standard for Central-Station Air-Handling Units.
K. ASHRAE/ANSI Standard 111 – Practices for Measurements, Testing, Adjusting and Balancing Heating, Ventilating, Air-Conditioning and Refrigeration Systems.
L. NFPA 70 - National Electrical Code.
M. NFPA 90A - Installation of Air-Conditioning and Ventilation Systems.
N. SMACNA – HVAC Duct Construction Standards – 1995 Edition
O. Standard 62-2004 - Ventilation for Acceptable Indoor Air Quality (ANSI Approved).

1.4 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Indicate ratings, fan performance, motor electrical characteristics, gauges, material finishes, assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

1. Product Data

a. Include data on all fans and accessories. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point.

b. Select fans using external static pressure noted in the schedule. Manufacturer responsible for calculation of internal static pressure. Manufacturer shall include an allowance for clean filters in the internal static pressure. An allowance for the difference between dirty filters and clean filters is included in the external static. Submit static pressure calculations showing total pressure drops, including tabulated internal pressure drops and specified external static pressure drops

c. Submit sound power level data for both fan outlet and casing radiation at rated capacity.

d. Submit shop drawings indicating coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions

e. Submit manufacturer's data showing that coil capacities, pressure drops, and selection procedures meet or exceed specified requirements.

f. Provide a copy of data of filter media, filter performance data, filter assembly, and filter frames with unit submittal for reference only.

B. Submit manufacturer's installation instructions.

C. All base bid pricing shall be based on the drawings, schedules and this specification

1. If a manufacturer requests to deviate from the requirements described herein, the Manufacturer and/or Contractor may list voluntary add or deduct prices on the bid form. These voluntary prices will not be used in determining the low bidder.

2. All voluntary adds or deducts shall be discussed and agreed to by the Owner and Architect/Engineer prior to the award of the air handling unit bid and before the submittal process begins.

D. Any exceptions to the specifications must be clearly noted to the Architect/Engineer prior to acceptance. Contractor is responsible for all expenses due to exceptions.

E. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

F. Submit operation and maintenance data. Include instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists.

1.5 EXTRA STOCK

A. Provide clean filters in all units at time of installation.

B. Provide clean filters in all units at project final completion after all interior finishes are complete.

C. Provide one additional set of replacement filters for all units. Deliver to Owner at job site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site with protective coverings in-place. Loose shipped items must be in factory-provided protective coverings, with factory-installed shipping skids and lifting lugs.

B. Store unit in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.7 WARRANTY

A. Provide a manufacturer's 1-year parts and labor warranty against defects in material and workmanship.

1.8 GENERAL DESCRIPTION

A. Unit Location:

1. The air handling unit (AHU-1, AHU-2) is a constant volume modular unit, located on an elevated equipment platform.

B. Unit Description:

1. The unit shall contain all the components described in these specifications and shown on the drawings and schedules.

2. Refer to air handling unit drawings and schedules for additional information

PART 2 - PRODUCTS

2.1 MODULAR INDOOR AIR HANDLING UNITS

A. Acceptable Manufacturers

1. Trane – "M" Series.
2. Daikin – Vision.
3. Carrier – 39 Series.
4. York – Solutions.

B. Housing:

1. Minimum 18 gauge G60 galvanized steel exterior panels reinforced and braced with galvanized steel framework.

2. Removable access panels for coil and fan removal.

3. Unit shall be double wall insulated constructed panel. Exterior wall shall be minimum 18 gauge galvanized steel. Interior wall shall be minimum 20 gauge galvanized steel. Cover all portions of the interior of the unit exposed to the airstream with steel to allow cleaning and prevent fiberglass erosion into the airstream. Foil facing on insulation shall not be acceptable as a substitute for double wall construction. If casing sections are not provided by the unit manufacturer with double wall construction, the Contractor is responsible for covering exposed insulation with galvanized sheet metal. The minimum R-value of the panel assemblies shall be 8.

4. Install a stainless steel drain pan under each cooling coil meeting requirements as outlined in ASHRAE 62.1. Extend drain pans the entire width of each coil, including piping and header if in the air stream, and from the upstream face of each coil to a distance 1/2 of the vertical coil height downstream from the downstream face. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.

5. Units shall be draw-thru or blow-thru as noted on the drawings and shall not exceed the overall dimensions.

C. Doors:

1. Unit doors shall be double wall and insulated with the same materials used in the surrounding unit walls.

2. Doors shall contain a continuous neoprene bulb type gasket.

3. Each door shall contain a double pane tempered, reinforced or safety glass window.

4. Each door shall have a minimum of two (2) high compression type latches, operable from both sides.

5. Provide minimum 12" x 18" hinged access doors on both sides of the fan housing.

D. Access Sections:

1. Provide access sections to allow access to fan, coil, and filter sections.

E. Air Blender:

1. Shall be of rotary mixing design employing radial blades

2. Shall be completely fixed devices with no moving parts.

3. Shall be provided with proper distances up and downstream such that the mixer is capable of providing a minimum mixing effectiveness of 75% and ±6ºF standard deviation when mixing 50% outside air with 50% return air at 50ºF inlet temperature differential.

4. Shall be sized for maximum velocities between 1,000 and 1,500 FPM.

F. Fan:

1. Single width, single inlet, backward inclined airfoil direct drive plenum type.

2. Statically and dynamically balanced.

3. Factory balanced fans will be used with variable speed controls to operate at all speeds up to the design speed.

4. Fan(s) shall have internal spring isolators.

G. Motors and Drives:

1. Motors shall have slide rails, adjusting screws, anchor bolts and bedplates.

2. Motor mounting bracket shall be adjustable to allow tightening of belts.

3. Motors shall be open drip-proof or TEFC type with grease lubricated bearings.

4. Motors shall be "variable frequency drive rated" when controlled by VFDs. Refer to Section 23 05 13.

H. Variable Frequency Drives:

1. Provided and installed by unit manufacturer. Refer to Section 26 29 23 for requirements.

I. Coils

1. Hot Water Coils:

a. Extended surface type with seamless copper tubes and continuous plate type aluminum fins.

b. Suitable for continuous operation at 200 psi. Maximum air velocity of 1000 fpm.

c. Galvanized steel casing. Coil headers and U-bends shall not be exposed.

d. AHRI rated with 0.0005 fouling factor.

e. Size coils sized based on EWT, EAT, gpm and cfm as scheduled. LAT shall be at least as high as scheduled. APD and WPD shall not exceed scheduled values.

f. Maximum 144 fins per foot.

g. Coils shall have drain and vent connections at supply and return headers with valves. Extend valving outside of the unit casing.

h. Install coils level to allow drainage.

i. Minimum 0.024" tube wall thickness.

j. Acceptable Manufacturers: Trane, York, Carrier, Daikin.

2. Chilled Water and Glycol Coils:

a. Extended surface type with seamless copper tubes and continuous plate type aluminum fins.

b. Stainless steel casing. Coil headers and U-bends shall not be exposed.

c. Maximum air velocity of 500 fpm.

d. AHRI rated with 0.0005 fouling factor.

e. Coils shall be sized based on EWT, EAT, gpm and cfm as scheduled. The leaving DB, leaving WB, APD and WPD shall not exceed the scheduled values.

f. Maximum 144 fins per foot. No water carryover shall occur at design airflow and no anti-carryover coating shall be used.

g. Suitable for 200 psig operation.

h. Coils shall have drain and vent connections at supply and return headers. Install coils level for proper drainage. Coils shall be completely drainable. Minimum 1/2" OD tubes. Minimum 0.024" tube wall thickness.

J. Mixing and Filter Section:

1. Provide with a mixing box and a separate angled filter section. Damper arrangement shall be as shown on the drawings. Furnish dampers with the unit. Dampers shall be extruded aluminum with 6” airfoil blades, compressible metal jamb seals, molded synthetic or stainless steel sleeve bearings. The damper shall not leak more than 4 cfm/sq.ft. at 1” W.C. as tested per AMCA Standard 500-D-98. Maximum damper size shall be 48” in length. Provide multiple damper sections for larger lengths. Multiple dampers shall use individual actuators. Jackshafting is not acceptable. Filters shall be as scheduled and have full size hinged access doors.

K. Electrical Power:

1. Provide factory-mounted, vapor-tight light fixtures in each accessible section of the unit. The fixture shall be complete with junction box, globe, aluminum globe guard, switch, and bulb. Lighting shall be wired to a single 120-volt point, terminating at a designated junction box mounted on the air-handling unit. The Mechanical Contractor is responsible to complete all wiring connection between shipping splits after assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements

1. Install per manufacturer's instructions.

2. During construction provide temporary closures of metal or taped polyethylene over openings into housing ducts to prevent dust from entering ductwork.

3. Seal all contractor installed penetrations airtight. Seal all openings prior to cleaning. Seal holes with proper SMACNA closures conforming to pressure class of the housing.

4. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

B. Coil Requirements:

1. Comb all coils to repair bent fins.

2. Extend coil drain and vent connections to outside unit housing. Provide normally closed valve on drain and vent connection outside of unit housing.

3.2 MANUFACTURER'S FIELD SERVICES

A. Provide factory authorized field representative for starting unit and training operator.

B. Prepare and start systems with installing contractor observation.

END OF SECTION 23 73 13

SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

1.3 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make his portion of the Electrical Work a finished and working system.

C. Description of Systems shall be as follows:

1. Electrical power system to and including equipment, motors, devices, etc.

2. Grounding system.

3. Wiring of equipment furnished by others.

4. Removal work and/or relocation and reuse of existing systems and equipment.

D. Work Not Included:

1. Data/telecommunications, controlled access/security and all other special systems cabling will be by others, in raceways and conduits furnished and installed as part of the Electrical work.

2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

1.4 OWNER FURNISHED PRODUCTS

A. The Owner will supply the following items for installation and/or connection by this Contractor:

B. The following items shall be relocated, installed and/or connected by this Contractor:

C. The Owner will supply manufacturer's installation data for new equipment purchased by him for this project.

D. This Contractor shall make all electrical system connections shown on the drawings **or** required for fully functional units.

E. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

1.5 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.

B. Schedule overtime hours for the following work:

C. Itemize all work and list associated hours and pay scale for each item.

1.6 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, AND CONTROL CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.

2. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.

3. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.

4. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.

5. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.

6. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to

drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.

7. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

8. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.

2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.

3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Code of Regulation Title 24, Article E725.

4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

   a. Gravity flow piping, including steam and condensate.
   b. Sheet metal.
   c. Other piping.
   d. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.

2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.

3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.

4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.

2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.

3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.

2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.

3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.

4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

G. General (Electrical/Technology):

1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".

2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.

3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction

boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.

4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.

5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

1.7 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.

2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Flagstaff Codes, Laws, Ordinances and other regulations having jurisdiction.

2. Conform to all published standards of Northern Arizona University.

3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.

4. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.

5. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.

7. If there are no local codes having jurisdiction, the current issue of the NEC shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.

2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.

3. Pay all charges for permits or licenses.

4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.

5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.

7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter’s Laboratories, Inc. or a nationally recognized testing organization.

E. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.

3. Scaling of the drawings will not be sufficient or accurate for determining these locations.

4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other

sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.

6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.

7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.

8. Where used in electrical documents the word “furnish” shall mean supply for use, the word “install” shall mean connect up complete and ready for operation, and the word “provide” shall mean to supply for use and connect up complete and ready for operation.

9. Any item listed as furnished shall also be installed unless otherwise noted.

10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.

2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.

3. Upon request for electronic media, the Contractor shall complete and return a signed “Electronic File Transmittal” form provided by IMEG.

4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.

5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.

6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.

7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor’s use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.8 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
26 05 03	Through Penetration Firestopping
26 05 13	Wire and Cable
26 05 26	Grounding and Bonding
26 05 33	Conduit and Boxes
26 05 53	Electrical Identification
26 24 16	Panelboards
26 28 13	Fuses
26 28 16	Disconnect Switches

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

a. Submittals shall be submitted using specification sections and the project nomenclature for each item.

b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain

items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).

c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor’s Approval Stamp:

a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.

b. Unstamped submittals will be rejected.

c. The Contractor’s review shall include, but not be limited to, verification of the following:

1) Only approved manufacturers are used.
2) Addenda items have been incorporated.
3) Catalog numbers and options match those specified.
4) Performance data matches that specified.
5) Electrical characteristics and loads match those specified.
6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
7) Dimensions and service clearances are suitable for the intended location.
8) Equipment dimensions are coordinated with support steel, openings, etc.
9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

d. The Contractor shall review, stamp and approve all subcontractors’ submittals as described above.

e. The Contractor’s approval stamp is required on all submittals. Approval will indicate the Contractor’s review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.

b. The Contractor shall clearly indicate the size, finish, material, etc.

c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.

d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.

8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.

9. Reproduction of contract documents alone is not acceptable for submittals.

10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.

11. Submittals not required by the contract documents may be returned without review.

12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.

13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.

14. Contractor’s responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer’s approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

a. Submittal file name: 26 XX XX.description.YYYYMMDD
b. Transmittal file name: 26 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

D. Paper Copy Submittal Procedures:

1. Paper copies are acceptable where electronic copies are not provided.

2. The Contractor shall submit ten (10) paper copies of each shop drawing.

3. Each set shall be bound in a three-ring binder or presentation binder. Copies that are loose or in pocket folders are not acceptable.

1.9 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.

2. Break down all costs into:

a. Material: Delivered cost of product with taxes paid.
b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:

a. Overhead and profit.
b. Bonds.
c. Insurance.
d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than $5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:

a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.
b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.
c. Each conduit system (normal, low voltage systems, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
d. Fire alarm broken down into material and labor for the following:
    1) Engineering
    2) Controllers, devices, sensors, etc.
    3) Conduit
    4) Wiring

5) Programming
6) Commissioning

e. Testing
f. Commissioning
g. Record drawings
h. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

1.10 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.

B. Change order work shall not proceed until authorized.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING AND MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

B. Keep all materials clean, dry and free from damaging environments.

C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.12 WARRANTY

A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.14 CONTINGENCY

A. Include in the Base Bid a contingency of one percent (1%) to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.15 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis of design and establishes the quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fit in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.

D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on his part or on the part of other Contractors whose work is affected.

E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

2.1 GENERAL

A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the

work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Covering exterior walls, interior partitions and chases.

B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.

b. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.

c. All wall penetrations have been sealed.

2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.

3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.3 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.

2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.

4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.

C. The following must be submitted before Architect/Engineer recommends final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.

2. Record documents including marked-up or reproducible drawings and specifications.

3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.

4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed and submit receipt to Architect/Engineer.

5. Inspection and testing report by the fire alarm system manufacturer.

6. Start-up reports on all equipment requiring a factory installation or start-up.

D. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.4 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.

2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

   a. O&M file name: O&M.div26.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title “Operation and Maintenance Instructions”, title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.

7. All text shall be searchable.

8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Paper Copy Submittal Procedures:

1. Once the electronic version of the manuals has been approved by the Architect/Engineer, Two (2) paper copies of the O&M manual shall be provided to the Owner. The content of the paper copies shall be identical to the corrected electronic copy.

2. Binder Requirements: The Contractor shall submit O&M manuals in heavy duty, locking three ring binders. Incorporate clear vinyl sheet sleeves on the front cover and spine for slip-in labeling. “Peel and stick” labels are **not** acceptable. Sheet lifters shall be supplied at the front of each notebook. The three-ring binders shall be 1/2" thicker than initial material to allow for future inserts. If more than one notebook is required, label in consecutive order. For example; 1 of 2, 2 of 2. No other form of binding is acceptable.

3. Binder Labels: Label the front and spine of each binder with “Operation and Maintenance Instructions”, title of project, and subject matter.

4. Index Tabs: Divide information by specification section, major equipment, or systems using index tabs. All tab titling shall be clearly printed under reinforced plastic tabs. All equipment shall be labeled to match the identification in the construction documents.

D. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.

2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.

3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.

4. Copies of all factory inspections and/or equipment startup reports.

5. Copies of warranties.

6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

7. Dimensional drawings of equipment.

8. Detailed parts lists with lists of suppliers.

9. Operating procedures for each system.

10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.

11. Repair procedures for major components.

12. Replacement parts and service material requirements for each system and the frequency of service required.

13. Instruction books, cards, and manuals furnished with the equipment.

14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.

15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.5 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:

1. Maintenance of equipment.
2. Start-up procedures for all major equipment.
3. Description of emergency system operation.

E. Notify the Architect/Engineer of the time and place for the verbal instructions to the Owner's representative so his representative can be present if desired.

F. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner’s representatives for the electrical and specialized systems.

2. If the Contractor does not have staff that can adequately provide the required instructions, he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.6 RECORD DOCUMENTS

A. The following paragraphs supplement the requirements of Division 1.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer’s hourly rates in effect at the time of work.

D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

F. Record actual routing of conduits exceeding 1-1/2 inches.

3.7 PAINTING

A. This Contractor shall paint the following items:

B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.

D. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.

E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect his color preference before ordering.

F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

G. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Architect.

H. Do NOT paint electric conduits in crawl spaces, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.

I. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.

2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.

3. Color of paint shall be as follows:

J. In accordance with LEED EQc4.2: Low-Emitting Materials - Paints and Coatings, all paints and coatings used on the interior of the building must comply with the following criteria:

1. Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.

2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L (2 lb./gal) established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

3.8 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.9 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.10 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Within the limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.

2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

B. Outside the limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.

2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.

3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.

2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01” w.g. minimum relative to all adjacent areas of the building.

    a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.

    b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.

    c. If high levels of Volatile Organic Compounds (VOC’s) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.

    d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.

    e. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross sectional area to minimize the pressure drop and avoid the need for rebalancing.

    f. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.

3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

    a. Minimizing the amount of dust generated.
    b. Reducing solvent fumes and VOC emissions.
    c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.

4. Request that the Owner designate an IAQ representative.

5. Review and receive approval from the Owner’s IAQ representative for all IAQ-related construction activities and negative pressure containment plans.

6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.

7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner’s IAQ representative during unoccupied periods.

8. Request copies of and follow all Owner’s IAQ and infection control policies.

9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.

10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.

11. In addition to the criteria above, provide measures as recommended in the SMACNA “IAQ Guidelines for Occupied Buildings under Construction”.

3.11 SYSTEM STARTING AND ADJUSTING

A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.12 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester’s name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.

2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.

3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.

4. Any wiring device or electrical apparatus if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.

5. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

6. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:

    a. Date of test.

    b. Number of hours since the last rain.

    c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.

    d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.

    e. Make, model, and calibration date of test equipment.

    f. Tabulation of measurements taken and calculations made.

B. Other Equipment:

1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

C. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.

D. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.

E. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

F. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for “benchmark” amperages.

3.13 CONSTRUCTION WASTE MANAGEMENT

A. This Contractor shall comply with all construction and demolition waste disposal and recycling requirements outlined in LEED MRc2: Construction Waste Management (follow latest edition at the time of bidding or as referenced in these specifications).

1. This Contractor shall coordinate with the General Contractor to develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or co-mingled.

2. The Contractor shall track waste disposal and recycling efforts throughout the construction process for all materials associated with this Contractor’s scope of work. The Contractor shall provide this information to the General Contractor so

that it can be incorporated with similar information from all other contractors for the project.

a. Calculations for waste and recycled material can be done by weight or volume, but they must be consistent throughout the project. The Contractor shall coordinate with the General Contractor to establish the preferred calculation method and report the results accordingly.

b. Excavated soil and land-clearing debris do not count towards the waste disposal or recycled material.

3. At a minimum, 50% of the construction and demolition debris for this project must be recycled or salvaged.

END OF SECTION 26 05 00

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Operation and Maintenance manuals have been submitted as per Section 26 05 00.
4. Bound copies of approved shop drawings have been submitted as per Section 26 05 00.
5. Report of instruction of Owner’s representative has been submitted as per Section 26 05 00.
6. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
7. Start-up reports from factory representative have been submitted as per Section 26 05 00.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * * *

SECTION 26 05 03 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials.
B. UL 723 - Surface Burning Characteristics of Building Materials
C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
F. Intertek / Warnock Hersey - Directory of Listed Products
G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
I. The Building Officials and Code Administrators National Building Code
J. 2021 International Building Code
K. NFPA 5000 – Building Construction Safety Code

1.4 SUBMITTALS

A. Submit under provisions of Section 26 05 00.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall construction, manufacturer’s installation instructions, and UL or Interek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F and T ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings**:**
   a. Wall penetrations above corridor ceilings which are not part of a fire-resistive assembly.
   b. Wall penetrations below any ceiling that are larger than 4" diameter or 16 square inches.

3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

F. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.

2. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.

1.7 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.

2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk
4. Tremco; Sealant/Weatherproofing Division
5. Johns-Manville
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Wiremold/Legrand: FlameStopper
10. Dow Corning Corp
11. Fire Trak Corp
12. International Protective Coating Corp

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems allowing continuous insulation for all insulated pipes.

E. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Chase Walls - 1 or 2 Hour Rated
   F Rating = Wall Rating
   T Rating = Wall Rating
   L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated
   F Rating = Wall Rating
   T Rating = 0
   L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

3. Concrete or Masonry Walls - 1 or 2 Hour Rated
F Rating = Wall Rating
T Rating (Walls) = 0 or Wall Rating
L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Insulated Pipes	CAJ 5000-5999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

F. Any opening in walls not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

G. Any openings in walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:

1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."

2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer’s representative name, address, and phone number.

3.5 INSPECTION

A. All penetrations shall be inspected by the manufacturer’s representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer’s instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer’s factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer’s specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer’s discretion and the contractor’s expense.

END OF SECTION 26 05 03

SECTION 26 05 05 - ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. THE DRAWINGS ARE INTENDED TO INDICATE THE SCOPE OF WORK REQUIRED AND DO NOT INDICATE EVERY BOX, CONDUIT, OR WIRE THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS.

B. Where walls, ceilings, structures, etc., are indicated as being removed on general or electrical drawings, the Contractor shall be responsible for the removal of all electrical equipment, devices, fixtures, raceways, wiring, systems, etc., from the removed area.

C. Where ceilings, walls, structures, etc., are temporarily removed and replaced by others, this Contractor shall be responsible for the removal, storage, and replacement of equipment, devices, fixtures, raceways, wiring, systems, etc.

D. Where mechanical or technology equipment is indicated as being removed on electrical, mechanical, or technology drawings, the Contractor shall be responsible for disconnecting the equipment and removing all starters, VFD, controllers, electrical equipment, raceways, wiring, etc. associated with the device.

E. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area. Extended conduit and conductors to match existing size and material.

F. Coordinate scope of work with all other Contractors and the Owner at the project site. Schedule removal of equipment and electrical service to avoid conflicts.

G. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and scope of work.

3.2 PREPARATION

A. The Contractor shall obtain approval from the Owner before turning off power to circuits, feeders, panels, etc. Coordinate all outages with Owner.

B. Coordinate any required 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 personnel experienced in such operations. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.

D. Disconnect electrical systems in walls, floors, structures, and ceilings scheduled for removal.

E. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Service changeover shall be completed on an overtime basis.

F. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Provide a watchman to make required premise observations during all outages, requirements as dictated by codes and Owner's insurance carrier.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of Division 1 of Specifications and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring and raceway to source of supply. Existing conduit in good condition may be reused in place by including an equipment ground conductor in reused conduit. Reused conduit and boxes shall have supports revised to meet current codes. Relocating conduit shall not be allowed.

D. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.

E. Disconnect and remove outlets and devices that are to be demolished. Remove outlet or devices' associated back box, supports, and conduit and conductors back to source. Patch opening created from removal of device to match surrounding finishes.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories. Ballasts in light fixtures installed prior to 1980 shall be incinerated in EPA approved incinerator or disposed of in EPA certified containers and deposited in an EPA landfill certified for PCB disposal or recycled by permitted ballast recycler. Punctured or leaking ballasts must be disposed of according to Federal Regulations under the Toxic Substance Control Act. Provide Owner and Architect/Engineer with a Certificate of Destruction to verify proper disposal.

I. Repair adjacent construction and finishes damaged during demolition and extension work. Patch openings to match existing surrounding finishes.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide junction boxes and access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Extended conduit and conductors to match existing size and material.

L. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

M. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes x-ray or similar non-destructive means. Where conduit is in concrete slab, cut conduit flush with floor, pull out conductors, and plug conduit ends.

N. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or are to be reused.

B. ELECTRICAL ITEMS (E.G., RECEPTACLES, SWITCHES, CONDUIT, WIRE, ETC.) REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF MATERIAL THE OWNER DOES NOT WANT.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Division 1 of Specifications.

END OF SECTION 26 05 05

SECTION 26 05 13 - WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire
B. Cabling for remote control, signal, and power limited circuits
C. Armored cable (AC)
D. Metal-clad cable (MC)

1.2 RELATED WORK

A. Section 26 05 53 – Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. ASTM B800-05 – Standard Specification for 8000 Series Aluminum Alloy Wire Electrical Purposes-Annealed and Intermediate Tempered.
B. ASTM B801-07 – Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
C. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
D. NFPA 70 - National Electrical Code (NEC)
E. UL 44 – Thermoset-Insulated Wires and Cables
F. UL 83 – Thermoplastic-Insulated Wires and Cables
G. UL 854 – Service-Entrance Cables
H. UL 1581 – Standard for Electrical Wires, Cables, and Flexible Cords
I. UL 2196 – Fire Resistive, Fire Resistant and Circuit Integrity Cables
J. California Division of State Architect (DSA) Interpretation of Regulations

1.4 SUBMITTALS

A. Submit shop drawings and product data under the provisions of Section 26 05 00.

B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.

B. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600-volt insulation, USE-2/RHH/RHW-2 or XHHW-2.

C. Aluminum conductors are not allowed.

D. Feeders and Branch Circuits Larger Than 6 AWG in Underground Conduit: Copper, stranded conductor, 600-volt insulation, XHHW-2.

E. Feeders and Branch Circuits Larger Than 6 AWG in Underground Conduit: Copper, stranded conductor, 600-volt insulation, USE-2/RHH/RHW-2.

F. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600-volt insulation, THHN/THWN. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid or stranded conductor, unless otherwise noted on the drawings. Aluminum, compact stranded conductor is not acceptable for feeder and branch circuits 6 AWG and smaller.

G. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on the drawings.

H. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.

I. Aluminum conductors are not to be used for feeds to motor loads.

J. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

2.2 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS:

A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.

1. Fire alarm
2. Low voltage switching
3. Building automation systems and control
4. Electronic control

B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.

C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60ºC, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.

D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

1. MC Cable: Copper conductor, 600V thermoset, low smoke zero halogen silicone rubber insulation, continuously welded corrugated copper armor for equipment grounding conductor, rated 90°C, UL listed 2196. MC fire rated cable shall not be used for branch circuits that required redundant equipment ground paths per code.

a. Approved Manufacturer:

1) VITALink MC
2) Raychem Tycothermal MC

E. Armored cable shall be constructed in strict accordance with Underwriters Laboratories, Inc., Standard for Type AC Cables, UL 4, and include flexible metallic interlocked armor.

F. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used where specified.

2.3 ARMORED CABLE (AC)

A. Conductors shall be copper, 600-volt insulation, THHN. Armored cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Armored Cables, UL 4, and include flexible metallic interlocked armor.

B. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used where specified.

C. Armored cables may be used for branch circuit wiring areas as defined in NEC 320, subject to acceptance by State and local codes.

D. Armored cable shall **NOT** be used for circuits serving the Essential Electrical System.

2.4 METAL-CLAD CABLE (MC)

A. Conductors shall be copper, 600-volt insulation, THHN. Metal clad cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Metal-Clad Cables, UL 15694, exterior of metal interlocked armor.

B. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used where specified.

C. Metal-clad cables may be used for branch circuit wiring in areas as defined in NEC 330, subject to acceptance by State and local codes.

D. Metal-clad cable shall **NOT** be used for circuits serving the Essential Electrical System.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

A. Above Accessible Ceilings:

1. Building wire shall be installed in raceway.

B. All Other Locations: Building wire in raceway.

C. Above Grade: All conductors installed above grade shall be type “THHN”.

D. Underground or In Slab: All conductors shall be type “THWN”.

E. Low Voltage Cable (less than 100 volts): Low voltage cable shall be installed in raceway.

3.2 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.15(B)(16) (formerly 310.16 for NEC 2008 and earlier). Service entrance conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.310.15(B)(2)(7) (formerly B.310.7 for NEC 2008 and earlier).

B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

3.3 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

B. Use no wire smaller than 18 AWG for low voltage control wiring (<100 volts).

C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet. Electrical contractor shall verify and ensure all feeders and branch circuits are sized to limit the voltage drop to a maximum of 3% voltage drop.

D. Use no wire smaller than 8 AWG for outdoor lighting circuits.

E. The ampacity of multiple conductors in one conduit shall be derated per NEC 310. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.

F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.

G. Splice only in junction or outlet boxes.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

I. Make conductor lengths for parallel circuits equal.

J. All conductors shall be continuous in conduit from last outlet to their termination.

K. Terminate all spare conductors on terminal blocks, and label the spare conductors.

L. Cables or wires shall not be laid out on the ground before pulling.

M. Cables or wires shall not be dragged over earth or paving.

N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.

O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.

P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.4 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.

D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

F. Only nylon rope shall be permitted to pull cables into conduit and ducts.

G. Completely and thoroughly swab raceway system before installing conductors.

H. Conductor Supports in Vertical Raceways:

1. Support conductors in vertical raceways in accordance with NEC 300.19 and Table 300.19(A) Spacing of Conductors Supports.

2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

3.5 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Use suitable cable fittings and connectors.

C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4”=1’-0” or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer’s written instructions, applicable codes, the NECA’s “Standard of Installation”, recognized industry standards; and coordinated with other contractors.

D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.

E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.

F. J-hook support spans shall be based on the smaller of the manufacturer’s load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2” horizontal separation and 6” vertical separation between systems.

G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.6 WIRING CONNECTIONS AND TERMINATIONS

A. Splice and tap only in accessible junction boxes.

B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.

C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.

F. Thoroughly clean wires before installing lugs and connectors.

G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.

I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:

1. Facing the front and operating side of the equipment, the phase identification shall be:

a. Left to Right - A-B-C
b. Top to Bottom - A-B-C

J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer’s recommendations.

3.7 AC, MC CABLE INSTALLATION

A. AC/MC shall NOT be used for circuits serving the Essential Electrical System.

B. Cable shall be supported by an approved means every 4.5’ and within 12” of outlet boxes, junction boxes, cabinets, or fittings.

C. Cable may be unsupported in the following conditions:

1. Cable is no longer than 2’ in length at terminals where flexibility is necessary.
2. Cable is not more than 4.5’ from the last point of support for connections within an accessible ceiling to light fixtures or equipment.

D. Conductor ampacity shall be derated as required by the NEC where more than three current carrying conductors are used.

E. Each 120 and 277-volt circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for cable derating.

F. Cables shall be cut using a rotary cutter as recommended by the manufacturer to eliminate nicking and cutting of the conductors.

G. Bending radius shall comply with the requirements listed in the NEC for the type and size of cable being installed, but shall not be less than 5-times the diameter of the cable in any case.

H. At cable terminations, a fitting shall be provided to protect wires from abrasion, unless the design of the outlet boxes or fittings is such as to afford equivalent protection, and, in addition, an insulating bushing or its equivalent protection shall be provided between the conductors and the armor.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a “Megger”. The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.

C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmeter prior to energizing the cables. Tabulate resistance values and submit to Architect/Engineer for acceptance.

D. Inspect wire and cable for physical damage and proper connection.

E. Torque test conductor connections and terminations to manufacturer's recommended values.

F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

G. Provide documentation of the manufacturer’s recommended lug torque value for copper and aluminum conductors, the date the lugs were torqued, and installed torque readings. Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.

H. Protection of wire and cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

I. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION 26 05 13

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment grounding system
B. Bonding system

1.2 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

C. 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.

D. Comply with UL 467 Grounding and Bonding Equipment.

E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

F. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

1.3 REFERENCES

A. NFPA 70 – National Electrical Code (NEC)

1.4 SUMMARY

A. This 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.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section 26 05 13 "Wire and Cable".

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated. Refer to Section 26 05 53 for insulation color.

D. 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.

E. Aluminum Bonding Conductors: As follows:

1. Bonding Cable: 10 strands of No. 14 AWG aluminum conductor, 1/4 inch in diameter.

2. Bonding Conductor: No. 4 or No. 6 AWG, stranded aluminum conductor.

3. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTOR PRODUCTS

A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

PART 3 - EXECUTION

3.1 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. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. 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.

C. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

D. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity. The connection to the non-metallic boxes shall be made to any metallic fitting or device requiring grounding.

E. 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 and UL 486B.

3.2 INSTALLATION

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. 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. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.

C. 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.

D. In raceways, use insulated equipment grounding conductors.

3.3 EQUIPMENT GROUNDING SYSTEM

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
2. Single-phase and three-phase motor and appliance branch circuits.
3. Flexible raceway runs, including FMC and LFMC.
4. Armored and metal-clad cable runs.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.4 BONDING SYSTEM

A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.

B. Isolated Equipment Enclosure: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment bonding conductor.

C. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.

D. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. 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 or copper conductor sized equal to the equipment grounding conductor.

E. Bond metal ducts of dust collectors, particulate conveying, fume hoods, and other hazardous materials to the equipment grounding conductors of associated pumps, fans, or blowers. Use braided-type bonding straps. Provide braided bare copper bonding conductor in nonmetallic dust collector ductwork to each equipment inlet location, and bond to equipment.

F. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.

G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.

H. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.

END OF SECTION 26 05 26

SECTION 26 05 27 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and equipment supports
B. Fastening hardware

1.2 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Allied Support Systems
B. Cooper B-Line
C. Erico, Inc.
D. Hilti
E. Power Fasteners
F. Orbit Industries

2.2 MATERIAL

A. Support Channel: Hot-dip galvanized stainless steel for wet/damp locations; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.

B. Hardware: Corrosion resistant.

C. Anchorage and Structural Attachment Components:

1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.

    a. 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.

2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

3. Welding Lugs: Comply with MSS-SP-69, Type 57.

4. Beam clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

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 the type and size of attachment devices used.

6. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.

7. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

D. Conduit Sleeves and Lintels:

1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.

2. Refer to Structural General Notes for lintel requirements in masonry construction.

3. Refer to Structural plans and specifications for lintel requirements and sizes.

4. Lintels:

a. Lintels in non-bearing masonry wall openings can be sized in accordance with the note below. Lintels that occur in existing bearing walls are to be sized according to similar conditions and spans in the new construction and lintel schedule. Bottom plate size shall be a minimum of 3/8" thick. The width of the plate shall be 3/4" less than the field verified wall thickness. The plate shall be the full length of the lintel member. Lintels are not required over openings that are 12" wide or less and at least 1 course below the top of the wall.

b. All lintels shall have a minimum of 8" end bearing.

c. All lintels in exterior wall construction shall be hot-dip galvanized.

d. For all openings not otherwise detailed or scheduled, minimum lintels shall be for each 4 inch of masonry width:

1)	0 to 2'-0" span	5/16" plate (3/4" less than wall width)
2)	2'-0" to 4'-0" span	L 3 1/2 x 3 1/2 x 1/4
3)	4'-0" to 6'-0" span	L4 x 3 1/2 x 5/16 (llv)
4)	6'-0" to 8'-0" span	L5 x 3 1/2 x 5/16 (llv)

e. All angles that are back to back shall be welded top and bottom 3" at 12" minimum.

5. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Architect or Structural Engineer.

6. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.

7. Sleeves shall not penetrate structural members without approval from the Structural Engineer.

8. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

9. Size sleeves large enough to allow expansion and contraction movement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

C. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.

D. Do not use powder-actuated anchors without specific permission.

E. Do not drill structural steel members.

F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

G. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

H. Do not exceed 25 lbs. per hanger and a minimum spacing of 2’-0” on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2’-0” spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

I. Refer to Section 26 05 33 for special conduit supporting requirements.

3.2 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1” of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6’-6” of finish floor and presents potential injury to personnel.

END OF SECTION 26 05 27

SECTION 26 05 33 - CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical metallic tubing and fittings (EMT)
B. Flexible metallic conduit and fittings (FMC)
C. Liquidtight flexible metallic conduit and fittings (LFMC)
D. Wall and ceiling outlet boxes
E. Electrical connection
F. Pull and junction boxes
G. Rough-ins
H. Handholes
I. Accessories

1.2 RELATED WORK

A. Section 26 05 53 – Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
2. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
3. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
4. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

B. Federal Specifications (FS):

1. A–A–50553A – Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
2. A–A–55810 – Specification for Flexible Metal Conduit

C. NECA “Standards of Installation”

D. National Electrical Manufacturers Association (NEMA):

1. ANSI/NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

E. NFPA 70 – National Electrical Code (NEC)

F. Underwriters Laboratories (UL): Applicable Listings

1. UL 1 – Flexible Metal Conduit
2. UL 360 – Liquid Tight Flexible Steel Conduit
3. UL514-B – Conduit Tubing and Cable Fittings

4. UL797 – Electrical Metal Tubing

G. Definitions:

1. Fittings: Conduit connection or coupling.

2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.

3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.

4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.

5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.

6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.

PART 2 - PRODUCTS

2.1 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

B. Acceptable Manufacturers of EMT Conduit: Allied, Calbond Calpipe, LTV, Steelduct, Wheatland Tube Co, or approved equal.

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression or steel set screw type of steel designed for their specific application.

2. 1/2” and 3/4” Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.

3. Larger than 2": Compression or steel set screw type of steel designed for their specific application.

4. Acceptable Manufacturers of EMT Conduit Fittings: Appleton Electric, O-Z/Gedney Co., Electroline, Raco, Bridgeport, Midwest, Regal, Thomas & Betts, Orbit Industries or approved equal.

2.2 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8” flexible metal

conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8” FMC shall be six (6) feet.

B. Acceptable Manufacturers: American Flex, Alflex, Electri-Flex Co, or approved equal.

C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.

D. Fittings and Conduit Bodies:

1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die-cast zinc.

2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.

3. Acceptable Manufacturers: O-Z/Gedney Co., Thomas & Betts, Appleton Electric, Electroline, Bridgeport, Midwest, Regal, Orbit Industries, or approved equal.

2.3 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

A. Acceptable Manufacturers: Anaconda Type UA, Electri-Flex Type LA, Alflex, Carlon (Lamson & Sessions), or approved equal.

B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

C. Fittings and Conduit Bodies:

1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.

2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.

3. Acceptable Manufacturers: Appleton Electric, O-Z/Gedney Co., Electroline, Bridgeport, Thomas & Betts, Midwest, Regal, Carlon (Lamson & Sessions), Orbit Industries, or approved equal.

2.4 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, minimum of 14 gauge, with 1/2-inch male fixture studs where required.

B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.

C. Cast Boxes: NEMA FB1, Type FD, Aluminum, cast feralloy, or stainless steel deep type, gasketed cover, threaded hubs.

D. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.

E. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.

F. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.

G. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.5 [ECONN]: ELECTRICAL CONNECTION

A. Electrical connection to equipment and motors, sized per NEC. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.6 [JB]: PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.

C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

D. Flanged type boxes shall be used where installed flush in wall.

2.7 ACCESSORIES

A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control – IsoBacker Pad, SpecSeal – SSP Putty and Pads, 3M #MPP-4S or equal.

2.8 CONDUIT INSTALLATION SCHEDULE AND SIZING

A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the NEC shall be required.

B. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to NEC. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the NEC (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

C. Minimum Conduit Size (Unless Noted Otherwise):

1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)

2. Controls Conduit: 1/2 inch.

D. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

2.9 CONDUIT ARRANGEMENT

A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.

B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.

C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):

1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3” concrete cover.

2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.

D. Conduit shall not share the same cell as structural reinforcement in masonry walls.

E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.

F. Contractor shall adapt his work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.

G. Contractor shall cooperate with all Contractors on the project. He shall obtain details of other Contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by him. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

2.10 CONDUIT SUPPORT

A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.

B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.

C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.

F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.

G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2’-0” on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2’-0” spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

H. 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.

I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the NEC requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.

J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.

K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the NEC requirements.

L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.

M. Finish:

1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1” of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6’-6” of finish floor and presents potential injury to personnel.

2.11 CONDUIT INSTALLATION

A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.

2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.

3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.

4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.

2. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.

3. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the NEC.

2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.

3. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5” below bottom of roof decking.

4. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.

5. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. Seal penetrations with intumescent caulk, putty, or sheet installed per manufacturer's recommendations. All materials used to seal penetrations of firewalls and floors shall be tested and certified as a system per ASTM E814 Standard for fire tests or through-penetration fire stops as manufactured by 3M or approved equal; refer to Section 26 05 03 for through penetration firestopping requirements.

6. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.

7. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, equal to O-Z/Gedney type EYD.

8. Horizontal conduit routing through slabs above grade

    a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3” min. concrete cover. Conduits shall run parallel to each other and spaced at least 8” apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1”.

    b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Engineer.

    c. No conduits are allowed to be routed horizontally through slabs above grade.

9. Do not route conduits across each other in slabs on grade.

10. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.

11. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.

2.12 CONDUIT TERMINATIONS

A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.

D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.

E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the NEC, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6’ in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.

F. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

2.13 BOX INSTALLATION SCHEDULE

A. Galvanized steel boxes may be used in:

1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8’ above the highest platform level.
3. Direct contact with concrete except slab on grade.

2.14 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.

D. Locate and install to maintain headroom and to present a neat appearance.

E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

2.15 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be

maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.

2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)

D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.

E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

F. Provide knockout closures for unused openings.

G. Support boxes independently of conduit.

H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

I. Install boxes in walls without damaging wall insulation.

J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.

K. Position outlets to locate luminaires as shown on reflected ceiling drawings.

L. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.

M. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

N. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

O. Provide cast outlet boxes in exterior locations and wet locations.

2.16 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

B. Support pull and junction boxes independent of conduit.

C. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.

2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

2.17 EXPOSED BOX INSTALLATION

A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.

B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.

C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.

D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)

F. Wood, plastic, or fiber plugs shall not be used for fastenings.

END OF SECTION 26 05 33

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Adhesive labels, markings, nameplates, and signs
B. Wire and cable markers
C. Raceway, box, and wire identification
D. Equipment short circuit current rating (SCCR) labeling
E. Electrical equipment labeling
F. Series rating identification
G. Pole identification

1.2 REFERENCES

A. ANSI C2 – National Electrical Safety Code
B. NFPA 70 – National Electrical Code (NEC)
C. ANSI A13.1 – Standard for Pipe Identification
D. ANSI Z535.4 – Standard for Product Safety Signs and Labels

1.3 SUBMITTALS

A. General: Submit the following in accordance with Division 1 Specification Sections and under provisions of Section 26 05 00.

1. Product Data for each type of product specified.

2. Schedule of nomenclature to be used for identification signs and labels for each piece of equipment including, but not limited to, the following equipment types as specified in Division 26.

3. Samples of each color, lettering style and other graphic representation required for identification materials including samples of labels and signs.

4. Identification required in this section shall apply to equipment furnished in Division 26 and any other applicable Divisions including Division 21/22/23.

PART 2 - PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Power, HVAC, Control, Fire).

1. Label Size as follows:

a. Raceways: Kroy or Brother labels 1-inch (25mm) high by 12-inches (305mm) long (minimum).

2. Color: As specified for various systems.

B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch (25mm) to 2 inches (50mm) in width.

C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch (5mm) minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50°F to 350°F (10°C to 176°C). Provide ties in specified colors when used for color coding.

F. Aluminum, Wraparound Marker Bands: 1-inch (25mm) width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

G. Brass or aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch (2mm) metal tags with stamped legend, punched for fastener.

H. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Font: Normal 721 Swiss Bold
b. Adhesive Labels: 3/16 inch (5mm) minimum text height
c. Vinyl / Plastic Laminate Labels: 3/4” inch (19mm) minimum text height

2.2 NAMEPLATES AND SIGNS

A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch (2mm) minimum thick for signs up to 20 square inches (13 square cm), or 8 inches (200mm) in length; 1/8 inch (3mm) thick for larger sizes. Labels shall be punched for mechanical fasteners.

B. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Text Height: 3/8 inch (10mm) minimum

C. Baked–Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting ¼" grommets in corners.

D. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

E. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 PRODUCT COLORS

A. Adhesive Markings and Field Labels:

1. All Labels: Black letters on white face

2. Normal Power and General Labels: Black letters on white face
3. Control Labels: Black letters on white face

B. Nameplates and Signs: NORMAL POWER: Black letters on white face

1. Control Labels: Black letters on white face
2. GROUNDING: White letters on green face.
3. CAUTION: Black letters on yellow face

C. Raceways and Conduit:

1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:

a. Normal Power and General Distribution: Silver

D. Box Covers:

1. Box covers shall be painted to correspond with system type as follows:

a. Normal Power and General: Silver

2. Box cover colors shall match conduit colors listed above.

E. Conductor Color Identification: Refer to Part 3 for additional information.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Install identification devices in accordance with manufacturer’s written instruction and requirements of NEC.

C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.

D. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.

2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.

3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility’s electrical installations.

E. Apply warning, caution and instruction signs as follows:

1. Install warning, caution or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

F. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.

G. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

H. Circuits with more than 600V: Identify raceway and cable with "DANGER—HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot (3m) intervals.

1. Wall surfaces directly external to conduits concealed within wall.

2. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.

3.2 RECEPTACLE COVER PLATES

A. Product:

1. Adhesive labels and field markings
2. Nameplates and signs

B. Identification material to be a clear, 3/8-inch (10mm) Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.

C. Provide identification on all receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. “C1A #24”). Identification for switch cover plates shall be installed on the inside cover.

3.3 CONDUIT AND EXPOSED CABLE LABELING

A. Product:

1. Adhesive labels and field markings

B. Conduit Identification: Pre-printed, flexible, self-adhesive vinyl labels with legend at 25-foot intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible and walls shall be labeled within 3 feet of becoming accessible. Labels for multiple conduits shall be aligned. Refer to color requirements in Part 2 when applicable in addition to the following:

1. Medium Voltage (greater than 1,000 volt): Indicate feeder identification and voltage.
2. 1000 Volt or less Power: Indicate feeder identification and voltage.

3. Grounding: Indicate “GROUND” and equipment and designation.
4. Security System: Indicate "Security".
5. Telephone System: Indicate “Telephone".

C. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

3.4 BOX LABELING

A. Products:

1. Adhesive labels and field markings

B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch (10mm) Kroy tape or Brother self-laminating vinyl label, letters/numbers color coded same as conduits. In rooms that are painted out, provide labeling on inside of cover.

C. All junction, pull, and connection boxes shall be identified as follows:

1. For power circuits, indicate system voltage and identity of contained circuits (“120V, 1LA1-3,5,7”).

3.5 CONDUCTOR COLOR CODING

A. Products:

1. All wire and cables shall be color coded by the manufacturer.

2. All wires and cables, 6 AWG or larger, used in motor circuits, main feeders, sub-main feeders, and branch circuits shall be coded by the application of plastic tape. The tape shall be 3-M, Plymouth or Permacel in colors specified below. The tape shall be applied at each conductor termination with two 1-inch (25mm) tape bands at 6-inch (150mm) centers. Contractor option to use colored cabling in lieu of the tape at each end for conductor 6 AWG to 500 KCM. Wire and cables smaller than 6 AWG shall be color coded by the manufacturer.

B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.

C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches (76mm) from the termination and spaced at 3- inches (76mm) centers. Tighten to a snug fit, and cut off excess length.

D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.

E. Conductors shall be color coded as follows:

1. 120/240 Volt, 3-Wire:

   a. A-Phase – Black
   b. B-Phase – Red
   c. Neutral – White
   d. Ground Bond – Green

2. 208Y/120 Volt, 4-Wire:

   a. A-Phase – Black
   b. B-Phase – Red
   c. C-Phase – Blue
   d. Neutral – White
   e. Ground Bond – Green

3. 480Y/277 Volt, 4-Wire:

   a. A-Phase – Brown
   b. B-Phase – Orange
   c. C-Phase – Yellow
   d. Neutral – Gray
   e. Ground Bond – Green

4. Grounding Conductors:

   a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.

5. Cabling for Remote Control, Signal, and Power Limited Circuits:

   a. Low Voltage Switching: Per manufacturer recommendations and code requirements.
   b. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.
   c. Electronic Control: Per manufacturer recommendations and code requirements.

3.6 CONTROL EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.

C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.

D. Labeling shall include:

1. Equipment type and contract documents designation of equipment being served.
2. Location of equipment being served if it is not located within sight.
3. Voltage and phase of circuit(s).

4. Panel and circuit number(s) serving the equipment.
5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
6. Date of fault current study, refer to one-line diagram

EXHAUST FAN EF-1
("LOCATED ON ROOF")
480V, 3-PHASE
FED FROM “1HA1-1”
AUTO CONTROL BY FCMS
22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

3.7 EQUIPMENT CONNECTION IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.

C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner. The following list of equipment is specifically being listed to receive an equipment connection label; this list does not limit the equipment that shall receive a label:

1. Mechanical heating, ventilation, and air conditioning equipment; chillers, boilers, pumps, air handing ventilation units, condensing units, unit heaters, and similar equipment
2. Owner-provided equipment requiring hard wired connections.

D. Labeling shall include:

1. Equipment type and contract documents designation of equipment being served
2. Location of equipment being served if it is not located within sight.
3. Voltage and rating of the equipment.
4. Panel and circuit numbers(s) serving the equipment
5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
6. Date of fault current study; refer to one-line diagram

UNIT HEATER UH-1
(“LOCATED IN STORAGE ROOM 200”)
480V: 3-PHASE
FED FROM “1HA1-1”
22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

3.8 ELECTRICAL WORKING CLEARANCE IDENTIFICATION

A. Products:

1. Safety Yellow paint and custom stencils

B. Provide custom identification of electrical equipment working clearances in mechanical, electrical, storage, janitorial, and similar non-public areas.

C. Identification shall include a painted rectangular box (on the finished floor) in front of the electrical equipment to define the code-required working clearance. Provide additional diagonal stripping inside the rectangle box. All painted stripping shall be safety yellow paint with 3 inch (76mm) wide stripes.

1. Width of area: Width of equipment or as required by code
2. Depth of area: Depth as required by code

END OF SECTION 26 05 53

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Device plates and box covers
B. Modular connectors

1.2 QUALITY ASSURANCE

A. Provide similar devices from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NEC Article 100, by a testing agency to Authorities Having Jurisdiction and marked for intended use.

C. Comply with the NEC.

1.3 REFERENCES

A. DSCC W-C-896F – General Specification for Electrical Power Connector
B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
C. NEMA WD 1 – General Color Requirements for Wiring Devices
D. NEMA WD 6 – Wiring Devices – Dimensional Requirements
E. NFPA 70 - National Electrical Code (NEC)
F. UL 498 – Standard for Attachment Plugs and Receptacles
G. UL 943 – Standard for Ground Fault Circuit Interrupters

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

C. Submit manufacturer occupancy sensor coverage patterns applicable to this project. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.

1.5 COORDINATION

A. Receptacles for Owner Furnished Equipment: Match plug configurations.

B. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 DEVICE COLOR

A. All switch, receptacle, outlet, and coverplate colors shall be verified with Architect, unless indicated otherwise.

2.2 COVERPLATES

A. All switches, receptacles, and outlets shall be complete with the following:

1. #302 stainless steel coverplates in unfinished spaces for flush boxes.

2. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.

B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.

C. Install nameplate identification as indicated in Section 26 05 53.

D. Plate securing screws shall be metal with head color matching the wall plate finish.

2.3 RECEPTACLES

A. Refer to Electrical Symbols List for device type.

B. [REC-DUP]: NEMA 5-20R Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap.

2. Approved Manufacturers: Hubbell 5352A, Leviton, 5362-S, Pass & Seymour 5362, Cooper 5352.

C. [REC-DUP-GFI]: NEMA 5-20R Ground Fault Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face.

2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.

3. Approved Manufacturers: Hubbell GF20L, Leviton GFNT2, Pass & Seymour 2097, Cooper SGF20.

D. [REC-DUP-GFI-R]: Remote Ground Fault Device:

1. Ground fault device for remote downstream receptacles. 125-volt, 20 amp. Test and reset buttons in impact resistance thermoplastic face.

2. Approved Manufacturers: Hubbell GFBF20, Leviton 6895, Pass & Seymour 2085, Cooper VGFD20.

E. [REC-QUAD]: NEMA 5-20R Double Duplex Receptacle:

1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.

2. Approved manufacturers: Refer to Duplex Receptacle above.

F. [REC-QUAD-GFI]: NEMA 5-20R Double Duplex GFI Receptacle:

1. Consists of two duplex GFI receptacles, double gang box, plaster ring and faceplate.

2. Approved Manufacturers: Refer to Duplex GFI Receptacle above.

G. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

H. Side wired devices shall have four binding screws that are undercut for positive wire retention.

I. Ground fault circuit interrupter (GFCI) receptacles shall comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed

2.4 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded copper conductors, with Type SOW-A jacket; with green insulated grounding conductor and equipment rating ampacity plus a minimum of 30 percent.

2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection, FS/UL listed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.

B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.

C. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.

D. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

E. Install devices and wall plates flush and level.

F. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 05 53 - Electrical Identification.

G. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses
B. Spare Fuse Cabinet

1.2 REFERENCES

A. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Types
B. UL 198E - Class R Fuses
C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)
D. NEMA FU 1 - Low Voltage Cartridge Fuses
E. NFPA 70 – National Electrical Code

1.3 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

1.4 EXTRA MATERIALS

A. Provide two fuse pullers.

B. Provide three of each size and type of fuse installed.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – FUSES

A. Bussman, Division of Eaton
B. Edison Fuse, Division of Cooper Industries
C. Mersen
D. Littelfuse Inc

2.2 FUSES

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Fuses with ratings larger than 600 amperes: Class L (time delay), unless otherwise noted on the drawings.

D. Fuses with ratings larger than 200 amperes but equal to or less than 600 amperes: Class RK-1 (time delay), unless otherwise noted on the drawings.

E. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless otherwise noted on the drawings.

F. Control transformer fuses: Class CC (time delay).

G. Fuses for packaged equipment: Size and type as recommended by equipment manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses where indicated on the drawings and specifications.

B. Install fuses in accordance with manufacturer's instruction.

C. Install fuses in packaged equipment as required by equipment manufacturer.

D. Install fuse with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 26 28 13

SECTION 26 28 16 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fusible switches
B. Non-fusible switches
C. Motor disconnect switch
D. Enclosures

1.2 RELATED SECTIONS AND WORK

A. Refer to the Disconnect and Starter Schedule for rating and configuration.

1.3 REFERENCES

A. NEMA KS 1 - Enclosed Switches

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Product Data: For each type of enclosed switch, circuit breaker, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.

C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 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.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

A. [FDS-#]: Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.

B. [DS-#]: Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosures: Type as indicated on the disconnect schedule.

D. Accessories: As indicated on the disconnect schedule.

2.2 MOTOR DISCONNECT SWITCH

A. [DS-#]: Rotary Switch Assemblies: Rated for making and breaking loads, rotary type enclosed switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

B. Enclosures: Type as indicated on the Disconnect Schedule.

C. Ground lug connection provided in enclosure.

D. Accessories: As indicated on the Disconnect Schedule.

E. Listed UL 508 suitable for motor control.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated on the drawings.

B. Install fuses in fusible disconnect switches.

C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

END OF SECTION 26 28 16