PROJECT MANUAL

FOR

SAUK VALLEY COMMUNITY COLLEGE

2017 Abatement Project
Contract 3

Project Location:

173 Illinois Route 2
Dixon, Illinois
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**OWNER:**
SAUK VALLEY COMMUNITY COLLEGE  
173 IL Route 2  
Dixon, Illinois 61021

**PROJECT ENGINEER:**
WILLETT, HOFMANN & ASSOCIATES, INC.  
809 E. Second Street  
Dixon, Illinois 61021-0367  
Phone: (815) 284-3381  
www.WillettHofmann.com

**PROJECT MANUAL FOR:**
2017 Abatement Project – Contract 3

**DATE:** January 25, 2017

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INVITATION FOR BIDS

Sauk Valley Community College will receive bids for a project entitled **2017 Abatement Project – Contract 3** until 3:00 o’clock PM local time on the 13th day of February 2017, at the Business Office of Sauk Valley Community College, located at 173 IL Route 2, Dixon, Illinois 61021, at which time and place all bids will be publicly opened and read aloud.

The proposed work for which Sauk Valley Community College is soliciting bids consists of, but is not limited to, the following:

General construction of approximately 11,700 SF of interior walls, doors, windows, ceilings and finishes and HVAC, Plumbing, Fire Protection and Electrical work and other associated work.

Contract documents, including drawings and Technical Specifications, are on file at the Building and Grounds Office at Sauk Valley Community College, 173 IL Route 2, Dixon, Illinois 61021, and at the office of the Project Engineer, Willett, Hofmann & Associates, Inc., 809 East 2nd St., Dixon, Illinois 61021.

Bid and Contract Documents may be obtained after January 25, 2017. Copies of the Bid and Contract Documents including Project Manual and the Construction Drawings shall be obtained electronically in PDF format from the Willett, Hofmann & Associates, Inc. website at [www.WillettHofmann.com](http://www.WillettHofmann.com). Bidders shall click on “Bid Login” on the homepage of the website and follow instructions. The eBidDoc# (project number) is 4797357 for this project. The Contract Documents can be downloaded in PDF format from the website by depositing Ten Dollars ($10.00) by credit card. Bidders can also obtain the Contract Documents in PDF format on a DVD by depositing Fifty Dollars ($50.00) cash or check with Willett, Hofmann & Associates, Inc., 809 East 2nd Street, Dixon, Illinois. All said deposits are non-refundable.

A certified check or bank draft, payable to the order of the Sauk Valley Community College, negotiable U.S. Government Bonds (at par value) or a satisfactory Bid Bond executed by the Bidder and an acceptable surety in an amount equal to five percent (5%) of the total bid shall be submitted with each bid.

A pre-bid conference has been set for February 3, 2017 at 2:00 PM at the Building and Grounds Office at Sauk Valley Community College.

Attention is called to the fact that not less than the minimum salaries and wages as set forth in the Contract Documents must be paid on this project, and that the CONTRACTOR must ensure that employees and applicants for employment are not discriminated against because of their race, color, religion, sex or national origin.

Sauk Valley Community College is an equal opportunity employer. Sauk Valley Community College does not discriminate on the basis of handicapped status in the admission or access to, or treatment or employment in, its programs or activities.

Sauk Valley Community College reserves the right to reject any or all bids or to waive any informalities in the bidding.

Bids may be held by Sauk Valley Community College for a period not to exceed sixty (60) days from the date of the opening of bids for the purpose of reviewing the bids and investigating the qualifications of bidders, prior to awarding the Contract.

**BY ORDER OF**

**SAUK VALLEY COMMUNITY COLLEGE**

**Date:** January 25, 2017
INSTRUCTIONS TO BIDDERS

1. USE OF SEPARATE BID FORMS

These Contract Documents include a complete set of bidding and contract forms which are for the convenience of Bidders and are not to be detached from the Contract Documents, filled out, or executed. Separate copies of Bid Forms are furnished for that purpose.

2. INTERPRETATIONS OF ADDENDA

No oral interpretation will be made to any Bidder as to the meaning of the Contract Documents or any part thereof. Every request for such an interpretation shall be made in writing to the Project Engineer on behalf of the Owner. Any inquiry received seven (7) or more days prior to the date fixed for opening of Bids will be given consideration and any inquiry received after said date may not receive consideration. Every interpretation made to any Bidder will be in the form of an Addendum to the Contract Documents, and when issued, will be on file in the office of the Owner and the office of the Project Engineer at least five (5) days before bids are opened. In addition, all Addenda will be mailed to each person holding Contract Documents, but it shall be the Bidder's responsibility to make inquiry as to the Addenda issued. All such Addenda shall become part of the Contract and all Bidders shall be bound by such Addenda, whether or not received or acknowledged by the Bidders.

3. INSPECTION OF SITE

Each Bidder shall visit the site of the proposed work and become fully acquainted with the existing conditions relating to the required construction and labor, and shall become fully informed as to the facilities involved, the difficulties and restrictions in attending to the performance of the Contract. The Bidder should thoroughly examine the Drawings, Technical Specifications, and all other Contract Documents. The Contractor, by the execution of the Contract, shall in no way be relieved of any obligation under it due to his/her failure to receive or examine any form or legal instrument or to visit the site and become acquainted with the existing conditions and the Owner will be justified in rejecting any claim based on facts regarding which the Bidder should have been on notice as a result thereof.

4. PREBID CONFERENCE

A pre-bid conference has been set for February 3, 2017 at 2:00 PM at the Building and Grounds Office at Sauk Valley Community College.

5. ALTERNATE BIDS

No alternate bids will be considered unless alternate bids are specifically requested by the technical specifications.

6. BIDS

a. All bids must be submitted on forms supplied and included with this Project Manual and shall be subject to all requirements of the Contract Documents, including the Drawings, and these INSTRUCTIONS TO BIDDERS. All bids must be regular in every respect.
and no interlineations, excisions or special conditions shall be made or included in the Bid Form by the Bidder.

b. Bid Documents including the Bid Form, the Bid Security/Bid Guaranty shall be enclosed in an opaque envelope and shall be sealed and clearly labeled with the words "Bid Documents", project number, name of Bidder, and date and time of bid opening in order to guard against premature opening of the Bid.

c. The Owner may consider as irregular any Bid on which there is an alteration of or departure from the Bid Form hereto attached and at its option may reject the same.

d. If the Contract is awarded, it will be awarded by the Owner to a responsible Bidder on the basis of the lowest Bid, which may be comprised of the Base Bid and any selected Alternate Bid items specifically requested by the technical specifications, in any combination that best suits the interests of the Owner. The Contract will require the completion of the work according to the Contract Documents.

7. BID GUARANTY

a. The Bid must be accompanied by a Bid guaranty that shall not be less than five percent (5%) of the amount of the Bid. At the option of the Bidder, the guaranty may be a certified check, bank draft, negotiable U.S. Government Bonds (at par value), or a Bid Bond on a form acceptable to the Owner. The Bid Bond shall be secured by a guaranty or a surety company listed in the latest issue of U.S. Treasury Circular 570. The amount of such Bid Bond shall be within the maximum amount specified for such company in said Circular 570. No Bid will be considered unless it is accompanied by the required guaranty. Certified check or bank draft must be made payable to the order of Sauk Valley Community College. Cash deposits will not be accepted. The Bid guaranty shall insure the execution of the Agreement and the furnishing of the performance and payment bonds by the successful Bidder, all as required by the Contract Documents.

b. Revised Bids submitted before the opening of Bids, whether forwarded by mail or telegram, if representing an increase in excess of two percent (2%) of the original Bid, must have the Bid guaranty adjusted accordingly; otherwise the Bid will not be considered.

c. Certified checks or bank drafts, or the amount thereof, Bid bonds and negotiable U.S. Government bonds of unsuccessful Bidders will be returned as soon as practical after the opening of the Bids.

8. COLLUSIVE AGREEMENTS

Attention of Bidders is particularly called to the requirement that collusive agreements amongst bidders are strictly prohibited. Submission of a bid proposal shall be considered certification that the Bidder has not entered into a collusive agreement with any other person, firm, or corporation in regard to any Bid submitted.
9. STATEMENT OF BIDDER'S QUALIFICATIONS

Each Bidder shall upon request of the Owner submit on the form furnished for that purpose (a copy of which is included in the Contract Documents), a statement of the Bidder's qualifications, his/her experience record in constructing the type of improvements embraced in the Contract, his/her organization and equipment available for the work contemplated, and, when specifically requested by the Owner, a detailed financial statement. The Owner shall have the right to take such steps as it deems necessary to determine the ability of the Bidder to perform his/her obligations under the Contract and the Bidder shall furnish the Owner all such information and data for this purpose as it may request. The right is reserved to reject any Bid where an investigation of the available evidence or information does not satisfy the Owner that the Bidder is qualified to carry out properly the terms of the Contract.

10. CORRECTIONS

Erasures or other changes in the Bids must be explained or noted over the signature of the Bidder.

11. TIME FOR RECEIVING BIDS

a. Bids received prior to the advertised hour of opening will be securely kept sealed. The officer whose duty it is to open them will decide when the specified time has arrived, and no Bid received thereafter will be considered; except that when a Bid arrives by mail after the time fixed for opening, but before the reading of all other Bids is completed, and it is shown to the satisfaction of the Owner that the non-arrival on time was due solely to delay in the mails for which the Bidder was not responsible, such Bid will be received and considered.

b. Bidders are cautioned that, while telegraphic modifications of Bids may be received as provided above, such modifications, if not explicit and if in any sense subject to misinterpretation, shall make the Bid so modified or amended, subject to rejection.

12. OPENING OF BIDS

At the time and place fixed for the opening of Bids, the Owner will cause to be opened and publicly read aloud every Bid received within the time set for receiving Bids, irrespective of any irregularities therein. Bidders and other persons properly interested may be present, in person or by representative.

13. WITHDRAWAL OF BIDS

Bids may be withdrawn on written or telegraphic request dispatched by the Bidder in time for delivery in the normal course of business to the time fixed for opening; provided, that written confirmation of any telegraphic withdrawal over the signature of the Bidder is placed in the mail and postmarked prior to the time set for bid opening. The Bid guaranty of any Bidder withdrawing his Bid in accordance with the foregoing conditions will be returned promptly.
14. AWARD OF CONTRACT: REJECTION OF BIDS
   a. The Contract will be awarded to the responsible Bidder submitting the lowest Bid (as described in paragraph 6.d. of this section) complying with the conditions of the Invitation for Bids and these Instructions To Bidders. The Bidder to whom the award is made will be notified at the earliest possible date. The Owner, however, reserves the right to reject any and all Bids and to waive any informality in Bids received whenever such rejection or waiver is in its interest.
   b. The Owner reserves the right to consider as unqualified to do the work any Bidder who does not habitually perform with his/her own forces the major portions of the work involved in the construction of the Project embraced in this Contract.

15. EXECUTION OF AGREEMENT: PERFORMANCE AND PAYMENT BONDS
   a. Subsequent to the award and within fifteen (15) calendar days after the prescribed forms are presented for signature, the successful Bidder shall execute and deliver to the Owner, an agreement in the form included in the Contract Documents in such number of copies as the Owner may require.
   b. Having satisfied all conditions of award as set forth elsewhere in these documents, the successful bidder shall, within the period specified in paragraph "a" above, furnish performance and payment bonds, each in a penal sum not less than the amount of the Contract as awarded, as security for the faithful performance of the Contract, and for the payment of all persons, firms or corporations to whom the Contractor may become legally indebted for labor, materials, tools, equipment, or services of any nature including utility and transportation services, employed or used by the Bidder in performing the work. Such bonds shall be in the on a form that is acceptable to the Owner and shall bear the same date as, or a date subsequent to that of the Agreement. The current power of attorney for the person who signs for any surety company shall be attached to such bonds. These bonds shall be signed by a guaranty or surety company listed in the latest issue of the U.S. Treasury Circular 570, and the penal sum shall be within the maximum specified for such company in said Circular 570.
   c. The failure of the successful Bidder to execute such Agreement and to supply the required bonds within fifteen (15) calendar days after the prescribed forms are presented for signature, or within such extended period as the Owner may grant, based upon reasons determined sufficient by the Owner, shall constitute a default, and the Owner may either award the Contract to the next lowest responsible Bidder or re-advertise for Bids, and may charge against the Bidder the difference between the amount of the Bid and the amount for which a Contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the Bid Bond. If a more favorable Bid is received by re-advertising, the defaulting Bidder shall have no claim against the Owner for a refund.
16. **WAGES AND SALARIES**

   a. Attention of Bidders is particularly called to the requirements concerning the payment of not less than the prevailing wage and salary rates specified in the Contract Documents and the conditions of employment with respect to certain categories and classifications of employees.

   b. **ILLINOIS PREFERENCE ACT:** Whenever there is a period of excessive unemployment in Illinois, which is defined herein as any month immediately following two (2) consecutive calendar months during which the level of unemployment in the State of Illinois has exceeded five (5) percent as measured by the United States Bureau of Labor Statistics in its monthly publication of employment and unemployment figures, the CONTRACTOR shall employ only Illinois laborers. "Illinois laborer" means any person who has resided in Illinois for at least thirty (30) days and intends to become or remain an Illinois resident.

   Other laborers may be used when Illinois laborers, as defined herein, are not available, or are incapable of performing the particular type of work involved, if so certified by the CONTRACTOR and approved by the ENGINEER. The CONTRACTOR may place no more than three (3) of his regularly employed non-resident executive and technical experts, who do not qualify as Illinois laborers, to do work encompassed by this contract during periods of excessive unemployment.

17. **EQUAL EMPLOYMENT OPPORTUNITY**

   Attention of Bidders is particularly called to the requirement for ensuring that employees and applicants for employment are not discriminated against because of their race, color, religion, sex or national origin.

18. **TAX CERTIFICATION**

   Attention of Bidders is particularly called to the requirement that the Bidder must not be delinquent in the payment of any tax administered by the Illinois Department of Revenue and his/her submission of a Bid Proposal shall be certification to that effect.
BID FORM FOR LUMP SUM CONTRACT

Date __________________________

Proposal of ________________________________
(hereinafter called "Bidder"), organized and existing under the laws of the State of __________________________
doing business as ____________________________________________________________
(insert: "a corporation", "a partnership", or "an individual", as applicable)
to Sauk Valley Community College (hereinafter railed "Owner").

Sauk Valley Community College:
The Bidder, in compliance with your invitation for bids for the construction of the Project entitled:

2017 Abatement Project – Contract 3

Having examined the plans and specifications with related documents and the site of the proposed work,
and being familiar with all of the conditions surrounding the construction of the proposed project
including the availability of materials and labor, hereby proposes to furnish all labor, materials, and
supplies, and to construct the project in accordance with the contract documents, within the time set forth
therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the
work required under the contract documents including payment of prevailing wages in accordance with
the Illinois Prevailing Wage Act, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on or before a date to be specified in the
written "Notice to Proceed" of the Owner and to fully complete all work within ___________________(____)
consecutive calendar days thereafter, unless so modified by Change Order, but by no later than
September 2, 2017.

Bidder acknowledges receipt of the following addenda:
Number_____ Dated _________________; Number_____ Dated _________________;
Number_____ Dated _________________; Number_____ Dated _________________;

PROPOSAL:
Bidder agrees to perform the 2017 Abatement Project – Contract 3 Work described on the Drawings
and in the Specifications for the sum of:

BASE BID: All work as indicated on Drawings and Specifications.

__________________________________________________________

($________________________) $(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)
ALTERNATE BID #1: ADD work indicated as Alternate Bid #1 on Drawings and Specifications, namely the Northwest Classroom and Lab. This will be an ADD to the BASE BID.

ADD

($ ________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #2: ADD work indicated as Alternate Bid #2 on Drawings and Specifications, namely the Southwest Classroom and corridor. This will be an ADD to the BASE BID.

ADD:

($ ________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #3A: ADD work indicated as Alternate Bid #3A on Drawings and Specifications, namely the in floor electrical receptacles in the BASE BID. This will be an ADD to the BASE BID.

ADD:

($ ________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #3B: ADD work indicated as Alternate Bid #3B on Drawings and Specifications, namely the in floor electrical receptacles in the ALTERNATE BID #1. This will be an ADD to the ALTERNATE BID #1.

ADD:

($ ________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #3C: ADD work indicated as Alternate Bid #3C on Drawings and Specifications, namely the in floor electrical receptacles in the ALTERNATE BID #2. This will be an ADD to the ALTERNATE BID #2.

ADD:

($ ________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)
ALTERNATE BID #4A: ADD work indicated as Alternate Bid #4A on Drawings and Specifications, namely connecting the reheat heating water piping in the BASE BID. This will be an ADD to the BASE BID.

ADD: ____________________________

($_________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #4B: ADD work indicated as Alternate Bid #4B on Drawings and Specifications, namely connecting the reheat heating water piping in the ALTERNATE BID #1. This will be an ADD to the ALTERNATE BID #1.

ADD: ____________________________

($_________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #4C: ADD work indicated as Alternate Bid #4C on Drawings and Specifications, namely connecting the reheat heating water piping in the ALTERNATE BID #2. This will be an ADD to the ALTERNATE BID #2.

ADD: ____________________________

($_________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #5A: ADD work indicated as Alternate Bid #5A on Drawings and Specifications, namely installation of solid surface countertops and sills in lieu of plastic laminate countertops and sills in the BASE BID. This will be an ADD to the BASE BID.

ADD: ____________________________

($_________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #5B: ADD work indicated as Alternate Bid #5B on Drawings and Specifications, namely installation of solid surface countertops and sills in lieu of plastic laminate countertops and sills in the ALTERNATE BID #1. This will be an ADD to the ALTERNATE BID #1.

ADD: ____________________________

($_________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)
ALTERNATE BID #5C: ADD work indicated as Alternate Bid #5C on Drawings and Specifications, namely installation of solid surface countertops and sills in lieu of plastic laminate countertops and sills in the ALTERNATE BID #2. This will be an ADD to the ALTERNATE BID #2.

ADD:

($_________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #6A: DEDUCT work indicated as Alternate Bid #6A on Drawings and Specifications, namely the purchase and installation of IT cabling in the BASE BID. This will be a DEDUCT to the BASE BID.

DEDUCT:

($_________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #6B: DEDUCT work indicated as Alternate Bid #6B on Drawings and Specifications, namely the purchase and installation of IT cabling in the ALTERNATE BID #1. This will be a DEDUCT to the ALTERNATE BID #1.

DEDUCT:

($_________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #6C: DEDUCT work indicated as Alternate Bid #6C on Drawings and Specifications, namely the purchase and installation of IT cabling in the ALTERNATE BID #2. This will be a DEDUCT to the ALTERNATE BID #2.

DEDUCT:

($_________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #7A: DEDUCT work indicated as Alternate Bid #7A on Drawings and Specifications, namely all the painting in the BASE BID. This will be a DEDUCT to the BASE BID.

DEDUCT:

($_________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)
ALTERNATE BID #7B: DEDUCT work indicated as Alternate Bid #7B on Drawings and Specifications, namely all the painting in ALTERNATE BID #1. This will be a DEDUCT to Alternate Bid #1.

DEDUCT:

($______)  
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #7C: DEDUCT work indicated as Alternate Bid #7C on Drawings and Specifications, namely all the painting in ALTERNATE BID #2. This will be a DEDUCT to Alternate Bid #2.

DEDUCT:

($______)  
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #8A: ADD work indicated as Alternate Bid #8A on Drawings and Specifications, namely new carpet in lieu of carpet called to remain to the BASE BID. This will be an ADD to the BASE BID.

ADD:

($______)  
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #8B: ADD work indicated as Alternate Bid #8B on Drawings and Specifications, namely new carpet in lieu of carpet called to remain to ALTERNATE BID #1. This will be an ADD to ALTERNATE BID #1.

ADD:

($______)  
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #8C: ADD work indicated as Alternate Bid #8B on Drawings and Specifications, namely new carpet in lieu of carpet called to remain to ALTERNATE BID #2. This will be an ADD to ALTERNATE BID #2.

ADD:

($______)  
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)
ALTERNATE BID #9: ADD work indicated as Alternate Bid #9 on Drawings and Project Manual, namely the installation of a glass wall system between Rooms 238 and 237 in ALTERNATE BID #1. This will be an ADD to ALTERNATE BID #1.

ADD:

($__________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #10A: DEDUCT all work indicated as Alternate Bid #10A on Drawings and Specifications, namely the installation of new radiators in the BASE BID. This will be a DEDUCT to the BASE BID.

DEDUCT:

($__________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #10B: DEDUCT all work indicated as Alternate Bid #10B on Drawings and Specifications, namely the installation of new radiators in the ALTERNATE BID #1. This will be a DEDUCT to the ALTERNATE BID #1.

DEDUCT:

($__________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #10C: DEDUCT all work indicated as Alternate Bid #10C on Drawings and Specifications, namely the installation of new radiators in the ALTERNATE BID #2. This will be a DEDUCT to the ALTERNATE BID #2.

DEDUCT:

($__________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #11A: DEDUCT all work indicated as Alternate Bid #11A on Drawings and Specifications, namely the purchase and installation of all new Carpet and Base within the BASE BID. This will be a DEDUCT to the BASE BID. The purchase and installation of Resilient Flooring and Base shall remain in the BASE BID.

DEDUCT:

($__________)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)
ALTERNATE BID #11B: DEDUCT all work indicated as Alternate Bid #11B on Drawings and Specifications, namely the purchase and installation of all new Carpet and Base within the ALTERNATE BID #1. This will be a DEDUCT to the ALTERNATE BID #1. The purchase and installation of Resilient Flooring and Base shall remain in the ALTERNATE BID #1.

DEDUCT:

($__________________________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

ALTERNATE BID #11C: DEDUCT all work indicated as Alternate Bid #11C on Drawings and Specifications, namely the purchase and installation of all new Carpet and Base within the ALTERNATE BID #2. This will be a DEDUCT to the ALTERNATE BID #2. The purchase and installation of Resilient Flooring and Base shall remain in the ALTERNATE BID #2.

DEDUCT:

($__________________________)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

The above prices includes all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for in the Contract Documents. Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The Bidder agrees that this bid shall be good and may not be withdrawn for a period of sixty (60) calendar days after the scheduled closing time for receiving bids. Upon receipt of written notice of the acceptance of this bid, Bidder will execute the formal contract attached within fifteen (15) calendar days and deliver the required bonds and an acceptable Certificate of Insurance as required by the contract documents.

The bid security attached in the sum of ______________________________ ($__________________________ ) is to become the property of the Owner in the event the contract and bond are not executed within the time above set forth.

Respectfully submitted:

Bidder’s Officer Name, Title: ________________________________________________
(Print or type)

By: ____________________________________________
(Signature)

Address, Zip Code: ________________________________________________________

________________________________________________________
(SEAL - if by Corporation) Telephone Number: ________________________________
STATEMENT OF BIDDER’S QUALIFICATIONS

Bidder shall submit upon request of Owner the following. All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he or she desires.

1. Name of the Bidder.

2. Permanent main office address.

3. When were you organized?

4. If a corporation, in what state were you incorporated?

5. Provide Certificate of Good Standing to do business in Illinois from the Secretary of State.

6. How many years have you been engaged in the contracting business under your present firm or trade name?

7. Contracts on hand: (Please schedule these, showing amount of each contract and the appropriate anticipated dates of completion.)

8. Describe the general character of work performed by your company.

9. Have you ever failed to complete work awarded to you?

10. Have you ever defaulted on a contract?

11. List the more important projects recently completed by your company, stating the approximate cost for each, and the month and year the project was completed.

12. List your major equipment that will be made available for this contract.

13. State your experience in construction work similar in importance to this project.

14. List the background and experience of the principal members of your organization, including the officers.

15. Indicate the present amount of credit available to you: _______________________.

16. Please provide a bank credit reference: _______________________.

17. Will you, upon request, fill out a detailed financial statement and furnish any other information that may be required by Sauk Valley Community College?

18. The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by Sauk Valley Community College in verification of the recitals comprising the Statement of Bidder’s Qualifications.
Dated at ________________, this _____ day of ________________, 20____.

________________________________________
(Name of Bidder)

By ________________________________

Title ________________________________

State of __________________________ )
County of __________________________ ) ss.

________________________________________, being first duly sworn, deposes and says that he is
_____________ of __________________________ and that the answers to the foregoing
questions and all statements therein contained are true and correct.

Subscribed and sworn to before me

this _____ day of ____________, 20____.

________________________________________
(Notary Public)

My commission expires ____________.
CONTRACT

THIS AGREEMENT, made and concluded this ________ day of ________, 20____, by and between

__________________________________________________________ (a corporation organized

and existing under the laws of the State of __________________________ ) (a partnership consisting

of __________________________ ) (an individual trading as __________________________ )

hereinafter called the “CONTRACTOR”, and __________Sauck Valley Community College___, hereinafter
called the “OWNER”.

WITNESSETH: that the CONTRACTOR and the OWNER for the considerations stated herein mutually
agree as follows:

ARTICLE 1. STATEMENT OF WORK. The CONTRACTOR shall furnish all supervision, technical
personnel, labor, materials, machinery, tools, equipment and services, including utility and transportation
services, and perform and complete all work required for the construction of the proposed Improvements
embraced in the Project; namely

General construction of approximately 11,700 SF of interior walls, doors, windows, ceilings and
finishes and HVAC, Plumbing, Fire Protection and Electrical work and other associated work

and required supplemental work for the __2017 Abatement Project – Contract 3__, all in strict accordance
with the Contract Documents including all addenda thereto, number ____, dated ________, prepared by
Willett, Hofmann & Associates, Inc., acting and in these Contract Documents Preparation, referred to as
the “ENGINEER”.

ARTICLE 2. CONTRACT PRICE. The OWNER will pay the CONTRACTOR for the complete and
proper performance of the Contract in current funds, for the work performed, the sum of:

or an amount not to exceed the Base Bid plus accepted Alternate Bids and adjusted by all approved
change orders.

ARTICLE 3. CONTRACT. The executed contract documents shall consist of the following:

a. This Agreement  
   b. Addenda
   c. Invitation for Bids
   d. Instructions to Bidders
   e. Signed Copy of Bid
   f. Performance Bond
   g. Payment Bond
   h. General Conditions
   i. Specifications/Special Provisions
   j. Drawings
This Agreement, together with other documents enumerated in this ARTICLE 3, which said other documents are as fully a part of the Contract as if hereto attached or herein repeated, forms the Contract between the parties hereto.

Attention is called to the fact that not less than the minimum salaries and wages as set forth in the Contract Documents must be paid on this project, and that the CONTRACTOR must ensure that employees and applicants for employment are not discriminated against because of their race, color, religion, sex or national origin.

In the event that any provision in any component part of the Contract conflicts with any provision of any other component part, the provision of the component part first enumerated in this ARTICLE 3 shall govern, except as otherwise specifically stated.

IN WITNESS WHEREOF, the parties hereto have caused this AGREEMENT to be executed in 3 original copies on the day and year first above written.

CONTRACTOR:

________________________________________________________________________

BY: _________________________________________________________________

TITLE: __________________________________________________________________

ATTEST BY: __________________________________________________________________

TITLE: __________________________________________________________________

OWNER: ______________________ Sauk Valley Community College

BY: _________________________________________________________________

TITLE: __________________________________________________________________

ATTEST BY: __________________________________________________________________

TITLE: __________________________________________________________________
CERTIFICATION

I, _____________________________, certify that I am the _____________________________ of the Corporation named as CONTRACTOR herein; that __________________________ who signed this Agreement on behalf of the CONTRACTOR, was then __________________________ of said Corporation; that said Agreement was duly signed for and in behalf of said Corporation by authority of its governing body, and is within the scope of its corporate powers.

______________________________

BY: ______________________________

TITLE: ______________________________

(CORPORATE SEAL)
HOLD HARMLESS AGREEMENT

The CONTRACTOR shall indemnify and hold harmless the OWNER and its Agents and its Employees from and against all claims of personal injury or property damage, including claims against the OWNER, its Agents or servants, arising out of the Illinois Structural Work Act, and all losses and expenses, including attorneys fees that may be incurred by the OWNER defending such work and caused in whole or in part by any negligent act or omission of the CONTRACTOR, and Sub-Contractor, anyone directly or indirectly employed by any of them or anyone for whose acts caused in part by a party indemnified hereunder. In any and all claims against the OWNER or any of its agents or servants by an employee of a CONTRACTOR, any Sub-Contractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or Sub-Contractor under Workers’ Compensation Acts, Disability Acts, or their Employee Benefit Acts.

________________________________________
BY: ________________________________

Title: ________________________________

Attest:

BY: ________________________________

Date: ________________________________

Title: ________________________________
NOTICE OF AWARD

To:  

Project Description: Sauk Valley Community College  
2017 Abatement Project - Contract 3

The OWNER has considered the Lump Sum Proposal (Bid) submitted by you for the above described WORK in response to its Invitation for Bids dated ________________________

You are hereby notified that your Lump Sum Proposal has been accepted in the amount of: ________________________

You are required by the Invitation for Bids to execute the CONTRACT and furnish the required CONTRACTOR’S PERFORMANCE AND PAYMENT Bonds and certificates of insurance within fifteen (15) calendar days from the date of this Notice to you.

If you fail to execute said CONTRACT and to furnish said Bonds within fifteen (15) calendar days from receipt of this notice, said OWNER will be entitled to consider all your rights arising out of the OWNER’S acceptance of your Proposal (Bid) as abandoned and as a forfeiture of your Bid Bond. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award.

Dated this _____ day of __________, 2017.

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged by

this the ______ day of ____________ , 20 ___

By _______________________________

Title _______________________________
NOTICE TO PROCEED

To: ___________________________  Date: ___________________________
    ___________________________  Project: Sauk Valley Community College
    ___________________________  2017 Abatement Project – Contract 3
    ___________________________  WHA#1445D16

You are hereby notified to commence WORK in accordance with the Contract Documents, on _____ and you are to complete the WORK by no later than _________.

________________________________________
   Sauk Valley Community College
         OWNER

ACCEPTANCE OF NOTICE

Receipt of the above Notice to Proceed is hereby acknowledged by

________________________________________

this the _______ day of _____________, 20 ___

By ________________________________

Title _______________________________
CHANGE ORDER

Order No. ____________________________

Date: ________________________________

Agreement Date: ____________________________

NAME OF PROJECT: 2017 Abatement Project – Contract 3

OWNER: ____________________________ Sauk Valley Community College

CONTRACTOR: ____________________________

The following changes are hereby made to the CONTRACT DOCUMENTS:

Justification:

Change to CONTRACT PRICE:

Original CONTRACT PRICE:

Current CONTRACT PRICE adjusted by previous CHANGE ORDER:

The CONTRACT PRICE due to this CHANGE ORDER will be (increased) (decreased) by:

$____________________

The new CONTRACT PRICE including this CHANGE ORDER will be $____________________

Change to CONTRACT TIME:

The CONTRACT TIME will be (increased) (decreased) by _________ Calendar days.

APPROVALS REQUIRED:

OWNER: ____________________________

CONTRACTOR: ____________________________

ENGINEER: ____________________________
1.1 DEFINITIONS

A. Whenever used in any of the Contract documents the following meanings shall be given to the terms herein defined:

1. The term “Contract” or “Agreement” means the Contract executed by the OWNER and the CONTRACTOR, of which these GENERAL CONDITIONS form a part.
2. The term “OWNER” means Sauk Valley Community College.
3. The term “CONTRACTOR” means the person, firm or corporation entering into the Contract with the OWNER to construct and install the improvements embraced in this Contract.
4. The term “Project Area” means the area or areas within which are the specified Improvements contemplated to be constructed in whole or in part under this contract.
5. The term "ENGINEER" means either Willett, Hofmann & Associates, Inc, the ENGINEER in charge serving the OWNER with architectural and/or engineering services, his successor, or any other person or persons, employed by said OWNER for the purpose of directing or having in charge the work embraced in this Contract, the said ENGINEER acting directly or having in charge the work embraced in this Contract, the said ENGINEER having general charge of the work or through any assistant having immediate charge of a portion thereof limited by the particular duties entrusted to him.
6. The term “Local Government” means the town, village, city, county(ies) or other political subdivision of the State of Illinois within which the Project Area is situated.
7. The term “Contract Documents” means and shall include, but not be limited to, the following: Executed Contract, Addenda (if any), Invitation for Bids, Instructions to Bidders, Signed Copy of Bid, General Conditions, Specifications and Construction Drawings.
8. The term “Subcontractor” means any individual, firm, or corporation having a contractual responsibility with the CONTRACTOR or with any other subcontractor for the performance of a part of the work at the site.
9. The term “Drawings” means the Construction Drawings prepared by the ENGINEER.
10. The term “Specification” means that part of the Contract Documents which describes, outlines and stipulates: the quality of the materials to be furnished, the quality of workmanship required and the methods to be used in carrying out the construction work to be performed under this Contract.
11. The term “Addendum” or “Addenda” means any changes revisions or clarifications of the Contract Documents, which have been duly issued by the OWNER to prospective Bidders prior to the time of receiving Bids.

1.2 SUPERINTENDENCE BY CONTRACTOR

A. Except where the CONTRACTOR is an individual and gives his personal superintendence to the work, the CONTRACTOR shall provide a competent superintendent satisfactory to the OWNER and the ENGINEER on the work at all times during working hours with full authority to act for him. The CONTRACTOR shall also provide an adequate staff for the proper coordination and expediting of his work.
B. The CONTRACTOR shall be responsible for all work executed by him under the Contract. He shall verify all figures and elevations before proceeding with the work and will be held responsible for any error resulting from his failure to do so.

1.3 SUBCONTRACTS

A. The CONTRACTOR shall be as fully responsible to the OWNER for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

B. The CONTRACTOR shall cause appropriate provision to be inserted in all subcontracts relative to the work to require compliance by each subcontractor with the applicable provisions of the Contract.

C. Nothing contained in the Contract shall create any contractual relation between any subcontractor and the OWNER.

D. The CONTRACTOR shall not award work to Subcontractor in excess of 50% of the contract price without prior written approval of the OWNER.

1.4 OTHER CONTRACTS

A. The OWNER may award, or may have awarded other contracts for additional work, and the CONTRACTOR shall cooperate fully with such other Contractors, by scheduling his own work with that to be performed under other Contracts as may be directed by the OWNER. The CONTRACTOR shall not commit or permit any act, which will interfere with the performance of work by any other Contractor as scheduled.

1.5 FITTING AND COORDINATION OF WORK

A. The CONTRACTOR shall be responsible for the proper fitting of all work and for the coordination of the operations of all trades, subcontractors or materialmen engaged upon this Contract. He shall be prepared to guarantee to each of his subcontractors the locations and measurements that they may require for the fitting of their work to all surrounding work.

1.6 MUTUAL RESPONSIBILITY OF CONTRACTORS

A. If, through acts or neglect on the part of the CONTRACTOR, any other Contractor or any subcontractor shall suffer loss or damage on the work, the CONTRACTOR shall settle with such other Contractor or subcontractor by agreement or arbitration if such other Contractor or subcontractor will so settle. If such other Contractor or subcontractor shall assert any claim against the OWNER on account of any damage alleged to have been so sustained the OWNER will notify this CONTRACTOR, who shall defend at his own expense any suit based upon such claim, and, if any judgment or claims against the OWNER shall be allowed, the CONTRACTOR shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith.

1.7 ASSIGNMENT OR NOVATION

A. The CONTRACTOR shall not assign or transfer, whether by an assignment or novation, any of its rights, duties, benefits, obligations, liabilities or responsibilities under this Contract
without the written consent of the OWNER provided, however, that assignments to banks, trust companies, or other financial institutions may be made without the consent of the OWNER. No assignment or novation of this Contract shall be valid unless the assignment or novation expressly provides that the assignment of any of the CONTRACTORS rights or benefits under the Contract is subject to a prior lien for labor performed, services rendered and materials, tools, and equipment supplied for the performance of the work under this Contract in favor of all persons, firms, or corporations rendering such labor or services or supplying such materials, tools, or equipment.

1.8 TECHNICAL SPECIFICATIONS AND DRAWINGS

A. Anything mentioned in the Specifications and not shown on the Drawings or shown on the Drawings and not mentioned in the Specifications shall be of like effect as if shown on or mentioned in both. In case of difference between Drawings and Specifications, the Specifications shall govern. In case of any discrepancy in Drawings, or Specifications, the matter shall be immediately submitted to the OWNER without whose decision, said discrepancy shall not be adjusted by the CONTRACTOR, save only at his own risk and expense.

1.9 REQUESTS FOR SUPPLEMENTARY INFORMATION

A. It shall be the responsibility of the CONTRACTOR to make timely requests of the OWNER for any additional information not already in his possession which should be furnished by the OWNER under the terms of this Contract and which he will require in the planning and execution of the work. Such requests may be submitted from time to time as the need is approached, but each shall be filed in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay. Each request shall be in writing and list the various items and the latest date by which each will be required by the CONTRACTOR. The first list shall be submitted within two weeks after improper submission of samples or certificates for approval shall not be considered just cause for an extension of the contract time.

1.10 PERMITS AND CODES

A. The CONTRACTOR shall give all notices required by and comply with all applicable laws, ordinances, and codes of the Local Government. All construction work and/or utility installations shall comply with all applicable ordinances, and codes including all written waivers. Before installing any work, the CONTRACTOR shall examine the Drawings and Specifications for compliance with applicable ordinances and codes and shall immediately report any discrepancy to the OWNER. Where the requirements of the Drawings and Technical Specifications fail to comply with such applicable ordinances or codes, the OWNER will adjust the Contract by Change Order to conform to such ordinances or codes (unless waivers in writing covering the difference have been granted by the governing body or department) and make appropriate adjustment in the Contract Price or stipulated unit prices. Should the CONTRACTOR fail to observe the foregoing provisions and proceed with the construction and/or install any utility at variance with any applicable ordinance or code, including any written waivers (notwithstanding the fact that such installation is in compliance with the Drawings and Specifications), the CONTRACTOR shall remove such work without cost to the OWNER, or a Change Order will be issued to cover only the excess
cost the CONTRACTOR would have been entitled to receive if the change had been made before the CONTRACTOR commenced work on the items involved.

B. The CONTRACTOR shall, at his own expense, secure and pay to the appropriate department of the Local Government the fees or charges for all permits for street pavement, sidewalks, sheds, removal of abandoned water taps, sealing of house connection drains, pavement cuts, buildings, electrical, plumbing, water, gas and sewer permits required by the local regulatory body or any of its agencies.

C. The CONTRACTOR shall comply with applicable local laws and ordinances governing the disposal of surplus excavation, materials, debris and rubbish on or off the Project Area and commit no trespass on any public or private property in any operation due to or connected with the improvements embraced in this Contract.

1.11 CARE OF WORK

A. The CONTRACTOR shall be responsible for all damages to person or property that occur as a result of his fault or negligence in connection with the prosecution of the work and shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance, whether or not the same has been covered in whole or in part by payments made by the OWNER.

B. The CONTRACTOR shall provide sufficient competent watchmen, both day and night, including Saturdays, Sundays, and holidays, as may be necessary from the time the work is commenced until final completion and acceptance.

C. In an emergency affecting the safety of life, limb or property, including adjoining property, the CONTRACTOR, without special instructions or authorization from the OWNER, is authorized to act at his discretion to prevent such threatened loss or injury, and he shall so act. He shall likewise act if instructed to do so by the OWNER. The OWNER will determine any compensation claimed by the CONTRACTOR on account of such emergency work.

D. The CONTRACTOR shall avoid damage as a result of his operations to existing sidewalks, streets, curbs and pavements, utilities (except those which are to be replaced or removed), adjoining property, etc., and he shall, at his own expense, completely repair the damage thereto caused by his operations.

E. The CONTRACTOR shall shore up, brace, underpin, secure and protect as may be necessary, all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be in any way affected by the excavations or other operations connected with the construction of the improvements embraced in this Contract. The CONTRACTOR shall be responsible for the giving of any and all required notices to any adjoining or adjacent property owner or other party before the commencement of any work. The CONTRACTOR shall indemnify and save harmless the OWNER from any damages on account of settlements or the loss of lateral support of adjoining property and from all loss or expense and all damages for which the OWNER may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

1.12 ACCIDENT PREVENTION

A. No laborer or mechanic employed in the performance of this Contract shall be required to work in surroundings or under working conditions, which are unsanitary, hazardous, or
dangerous to his health or safety as determined under construction safety and health standards promulgated by the Secretary of Labor.

B. The CONTRACTOR shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the site, which occur as a result of his prosecution of the work. The safety provisions of applicable laws and building and construction codes shall be observed and the CONTRACTOR shall take or cause to be taken such additional safety and health measures as the OWNER may determine to be reasonably necessary. Machinery, equipment and all hazards shall be guarded in accordance with the safety provisions of the “Manual of Accident Prevention in Construction” published by the Associated General Contractors of America, Inc., to the extent that such provisions are not in conflict with applicable laws.

C. The CONTRACTOR shall maintain an accurate record of all cases of death, occupational disease, or injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the Contract. The CONTRACTOR shall promptly furnish the OWNER with reports concerning these matters.

D. The CONTRACTOR shall indemnify and save harmless the OWNER and ENGINEER from any claims for damages resulting from property damage, personal injury and/or death suffered or alleged to have been suffered by any person as a result of any work conducted under this contract.

1.13 SANITARY FACILITIES

A. The CONTRACTOR shall furnish, install and maintain ample sanitary facilities for the workmen. As the needs arise, a sufficient number of enclosed temporary toilets shall be conveniently placed as required by the sanitary codes of the State and Local Government. Drinking water shall be provided from an approved source, so piped or transported as to keep it safe and fresh and served from single service containers or satisfactory types of sanitary drinking stands or fountains. All such facilities and services shall be furnished in strict accordance with existing and governing health regulations.

1.14 REVIEW BY OWNER

A. The OWNER, its authorized representatives and agents shall, at all times have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this Contract, provided, however that all instructions and approval with respect to the work will be given to the CONTRACTOR only by the OWNER and/or its authorized representatives or agents.

1.15 PATENTS

A. The CONTRACTOR shall hold and save the OWNER, its officers, and employees harmless from liability of any nature or kind, including costs and expenses, for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, specifically stipulated in the Specifications.
1.16 WARRANTY OF TITLE

A. No material, supplies, or equipment to be installed or furnished under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale, lease-purchase or other agreement by which an interest therein or any part thereof is retained by the seller or supplier. The CONTRACTOR shall warrant good title to all materials, supplies, and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed thereon by him to the OWNER free from any claims, liens, or charges. Neither the CONTRACTOR nor any person, firm, or corporation furnishing any material or labor for any work covered by this Contract shall have any right to a lien upon any improvement or appurtenance thereon. Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any bond given by the CONTRACTOR for their protection or any rights under any law permitting such persons to look to funds due the CONTRACTOR in the hands of the OWNER. The provisions of this paragraph shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

1.17 GENERAL GUARANTY

A. Neither the final certificate of payment nor any provision in the Contract nor partial or entire use of the improvements embraced in this Contract by the OWNER or the public shall constitute an acceptance of work not done in accordance with the Contract or relieve the CONTRACTOR of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The CONTRACTOR shall promptly remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of twelve (12) months, or that specified in the technical specifications, from the date of final acceptance of the work.

B. The OWNER will give notice of defective materials and work with reasonable promptness.

1.18 COMMUNICATIONS

A. All notices, demands, requests, instructions, approvals, proposals, and claims must be in writing.

B. Any notice to or demand upon the CONTRACTOR shall be sufficiently stated on the signature page of the Agreement (or at such other office as the CONTRACTOR may from time to time designate in writing to the OWNER), or if deposited in the United States mail in a sealed, postage-prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission, in each case addressed to such office.

C. All papers required to be delivered to the OWNER shall, unless otherwise specified in writing to the CONTRACTOR, be delivered to the Business Office, and any notice to or demand upon the OWNER shall be sufficiently given if so delivered, or if deposited in the United States mail in a sealed, postage-prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission to said OWNER at such address, or to such other representatives of the OWNER or to such other address as the OWNER may subsequently specify in writing to the CONTRACTOR for such purposes.
D. Any such notice shall be deemed to have been given as of the time of actual delivery or (in the case of mailing) when the same should have been received in due course of post or (in the case of telegrams) at the time of actual receipt as the case may be.

1.19 PARTIAL USE OF SITE IMPROVEMENTS

A. The OWNER, at its election, may give notice to the CONTRACTOR and place in use those sections of the improvements which have been completed, inspected and can be accepted as complying with the Specifications and if in its opinion, each such section is reasonably safe, fit, and convenient for the use and accommodation for which it was intended, provided;
1. The use of such sections of the improvements shall in no way impede the completion of the remainder of the work by the CONTRACTOR.
2. The CONTRACTOR shall not be responsible for any damages or maintenance costs due directly to the use of such sections.
3. The use of such sections shall in no way relieve the CONTRACTOR of his liability due to having used defective materials or to poor workmanship.
4. The period of guarantee shall not begin to run until the date of the final acceptance of all work, which the CONTRACTOR is required to construct under this Contract.

1.20 TERMINATION AND DELAYS

A. Right of OWNER to Terminate Contract - In the event that any of the provisions of this contract are violated by the CONTRACTOR, or by any of his subcontractors, the OWNER may serve written notice upon the CONTRACTOR and the surety of its intention to terminate the contract, such notices to contain the reasons for such intention to terminate the contract, and unless within ten (10) days after the serving of such notice upon the CONTRACTOR, such violation or delay shall cease and satisfactory arrangement of correction be made, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the OWNER shall immediately serve notice thereof upon the surety and the CONTRACTOR and the surety shall have the right to take over and perform the contract; provided, however, that if the surety does not commence performance thereof within ten (10) days from the date of the mailing to such surety of notice of termination, the OWNER may take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the CONTRACTOR and the CONTRACTOR and his surety shall be liable to the OWNER for any excess cost occasioned the OWNER thereby, and in such event the OWNER may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefore.

B. Excusable delays - The right of the CONTRACTOR to proceed shall not be terminated nor shall the CONTRACTOR be charged damages for any delays in the completion of the work due:
1. To any acts of the Government, including controls or restrictions upon or requisitioning of materials, equipment, tools, or labor by reason of war, National Defense, or any other national emergency;
2. To any acts of the OWNER.
3. To causes not reasonably foreseeable by the parties to this contract at the time of the execution of the contract which are beyond the control and without the fault or negligence of the CONTRACTOR, including, but not limited to, acts of God or of the
public enemy, acts of another Contractor in the performance of some other contract with the OWNER, fires, floods, epidemics, quarantine, restrictions, strikes, freight embargoes, an weather of unusual severity such as hurricanes, tornadoes, cyclones and other extreme weather conditions; and

4. To any delay of any subcontractor occasioned by any of the causes specified in subparagraphs (1),(2), and (3) of this paragraph “b”.

Provided, however, that the CONTRACTOR promptly notifies the OWNER within ten (10) days in writing of the cause of the delay. Upon receipt of such notification the OWNER shall ascertain the facts and the cause and extent of delay. If upon the basis of the facts and the terms of this contract, the delay is properly excusable, the OWNER shall extend the time for completing the work for a period of time commensurate with the period of excusable delay.

1.21 DISPUTES

A. All claims, disputes and other matters in question arising under this contract or its interpretation, whether involving law or fact or both, or extra work, and all claims for alleged breach of contract shall within ten (10) days of commencement of the dispute be presented by the CONTRACTOR to the OWNER for decision. All papers pertaining to claims shall be filed in quadruplicate. Such notice need not detail the amount of the claim, but shall state the facts surrounding the claim in sufficient detail to identify the claim, together with its character and scope. In the meantime the contractor shall proceed with the work as directed. Any claim not presented within the time limit specified in this paragraph shall be deemed to have been waived, except that if the claim is of a continuing character and notice of the claim is not given within ten (10) days of its commencement, the claim will be considered only for a period commencing ten (10) days prior to the receipt by the OWNER of notice thereof.

B. The CONTRACTOR shall submit in detail his claim and his proof thereof. Each decision by the OWNER will be in writing and will be mailed to the CONTRACTOR by registered or certified mail, return receipt requested, directed to his last known address.

C. If the CONTRACTOR does not agree with any decision of the OWNER he shall in no case allow the dispute to delay the work but shall notify the OWNER promptly that he is proceeding with the work under protest and he may then except the matter in question from final release.

D. All legal recourse sought by the CONTRACTOR, shall be filed with the County Circuit Court System, in the County where the work has taken place.

1.22 DEDUCTION FOR UNCORRECTED WORK

A. If the OWNER deems it not expedient to require the CONTRACTOR to correct work not done in accordance with the contract documents, an equitable deduction from the contract price will be made by agreement between the CONTRACTOR and the OWNER and subject to settlement, in case of dispute as herein provided.

1.23 INSURANCE

The CONTRACTOR shall not commence work under the contract until all insurance has been obtained. Certificates of insurance showing coverage as required to be in effect will be filed with the OWNER at
the time of entering into the contract. Certificates of insurance will be on Accord Forms and shall provide thirty (30) days notice of cancellation. The certificates will be signed by the insurance companies or their authorized agents. The insurance companies must be authorized to do business in the State of Illinois, and carry an “A.M. Best” rating of AX or better.

The CONTRACTOR shall maintain in force the coverage’s required in this section for the term of the contract. Also, the CONTRACTOR shall not allow any SUBCONTRACTOR to commence work on any portion of the project without evidence that the SUBCONTRACTOR has insurance coverage equal to the coverage’s required in this section.

The minimum amounts of insurance shall be as follows:

**AUTOMOBILE**
Including coverage for owned, non-owned, and hired automobiles.

1. $1,000,000 Bodily Injury per Person
2. $1,000,000 Bodily Injury per Occurrence
3. $1,000,000 Property Damage per Occurrence
4. OR $1,000,000 Combined Single Limit

**WORKER’S COMPENSATION – STATUTORY EMPLOYER’S LIABILITY**

1. $500,000 Disease - each employee
2. $500,000 Disease - policy limit
3. $500,000 Each Accident

**COMMERCIAL GENERAL LIABILITY**
Policy shall include coverage for bodily injury and property damage arising out of an occurrence and shall include:
- Premises and Operations
- Products/Completed Operations
- Personal and Advertising Injury
- Contractual Liability
- X,C,U Coverage
- Per Project Aggregate Endorsement

**Additional Insureds – OWNER and ENGINEER**

1. $2,000,000 General Aggregate
2. $1,000,000 Products/Completed Operations Aggregate
3. $1,000,000 Personal & Advertising Injury
4. $1,000,000 Each Occurrence

**BUILDER’S RISK**
Builder’s Risk Insurance is NOT provided by the OWNER. The CONTRACTOR is responsible for any loss that would be insured by such coverage.

1.24 PAYMENT OF PREVAILING WAGE

A. The Illinois Prevailing Wage Act, 820 ILCS section 130/0.01, *et seq* requires that all laborers, workers, and mechanics employed by or on behalf of a public body in the construction of public works be paid the general prevailing rate of hourly wages (including allotments for training and approved apprenticeship programs, health and welfare,
insurance, vacation, and pension benefits) for work of a similar character in the locality in which the work is performed.

B. The Illinois Department of Labor publishes the current prevailing wage rate at [http://www.state.il.us/agency/idol/rates/rates.htm](http://www.state.il.us/agency/idol/rates/rates.htm). The rate is revised regularly and such revisions take effect immediately. It is the CONTRACTOR’S responsibility to ascertain and implement such changes.

C. Contractor must post the relevant prevailing wage rate(s) at a location on the project site that is easily accessible by workers.

D. Contractors and Sub-contractors must insert a provision or stipulation regarding the payment of the prevailing wage rate into every public works project and bid specification, subcontract, and contractor’s bond.

E. RECORD KEEPING RESPONSIBILITIES

1. All contractors and sub-contractors must create and keep for at least three (3) years records of all laborers, mechanics, and other workers employed by them on a public works project.

2. These records must include each worker’s name, address, telephone number, social security number, classification, hourly wages paid in each pay period, number of hours worked each day, and the starting and ending times of each work day. Each contractor and subcontractor is required to make these records available for inspection by the public body’s agents or Illinois Department of Labor officials at a reasonable time and place upon seven business days notice.

F. CERTIFIED PAYROLL RECORDS

1. Contractor must also submit a certified payroll to the public body for every month. This certified payroll must consist of a complete copy of the records required to be kept under Section 5(a)(1) of the Act.

2. The certified payroll shall also include a statement signed by the contractor or subcontractor submitting that: (1) the records are true and accurate; (2) the hourly rate paid to each worker is not less than the general prevailing wage rate required; and (3) the contractor or subcontractor is aware that filling a certified payroll that he or she knows to be false is a class B misdemeanor.

END OF SECTION
SUMMARY OF PROJECT

1.1 SECTION INCLUDES

A. Contract Description.
B. Work by OWNER.
C. CONTRACTOR use of site.

1.2 CONTRACT DESCRIPTION

A. The CONTRACTOR shall furnish all labor, equipment and materials necessary to construct the proposed improvements as shown on the construction drawings and described in the following specifications. In general, the major components of the proposed Work under this Contract will include, but not be limited to, the following items:

1. General construction of approximately 11,700 SF of interior walls, doors, windows, ceilings and finishes and HVAC, Plumbing, Fire Protection and Electrical work and other associated work

1.3 WORK BY OWNER

A. The Owner may be performing miscellaneous incidental and other project related work in the project area during the course of the project. Contractor shall coordinate and accommodate any Owner work.

1.4 CONTRACTOR USE OF SITE

A. Construction activities should be confined to the general areas where construction is being proposed as shown on the construction drawings. The normal operations of the Owner and building users must be maintained at all times during construction of the project.

1.5 CONTRACT TIME

A. Work on the PHASE 1 portion of the Project may begin upon receipt of Notice to Proceed (anticipated March 13, 2017) and shall be substantially complete by no later than May 26, 2017.

B. Work on the PHASE 2 portion shall begin upon the completion of Contract 2 which is anticipated to be June 5, 2017, and shall be substantially complete by no later than August 7, 2017.
APPLICATIONS FOR PAYMENT

1.1 SECTION INCLUDES

A. Procedures for the preparation and submittal of applications for payment.

1.2 FORMAT

A. Payment request must be submitted on a pay request form acceptable to the Owner.

B. CONTRACTOR shall provide the ENGINEER with the following for the review of progress payments applications:

1. Percentage of Completion or Quantity Installed for Each Work Item.
2. Detailed Scheduled Values for all Work Items.
3. Stored Materials under each Application.
4. Authorized Change Orders.
5. Certified Payrolls

1.3 PREPARATION OF APPLICATIONS

A. CONTRACTOR shall prepare each pay request for the ENGINEER’S review.

B. Use approved Schedule of Values of lump sum bid items. Provide a percentage of completion or quantity installed and a dollar value in each column for each work item performed.

C. OWNER will pay for materials stored on site. CONTRACTOR must have the materials at the construction site and provide an invoice identifying the cost of the materials stored. At the next pay request submission, the CONTRACTOR must provide a waiver of lien showing payment for stored materials.

D. Provide ENGINEER with list of all Change Order items for the ENGINEER’S preparation of the Change Order.

E. Provide ENGINEER with Partial Waivers of Lien for materials and sub-contractors work from previous months Periodic Payment Request.

F. Provide the ENGINEER with Certified Payrolls for all personnel who had worked on the project during the period the pay application covers.

1.4 SUBMITTAL PROCEDURES

A. CONTRACTOR signs three (3) copies of Periodic Pay Request and Change Orders and submits to ENGINEER for review.

B. ENGINEER reviews and signs three (3) copies of Periodic Pay Request and Change Orders.

C. ENGINEER submits three (3) copies of each Periodic Pay Request and Change Orders to OWNER.

D. Periodic Payment Request will be made once (1) per month.

E. Submit partial waivers of liens for all materials and sub-contractors work from previous month’s Periodic Payment Request.

F. Submit Final waivers of liens and Contractors Affidavit for all material suppliers (over $500) and sub-contractors for release of the Final Pay Request.

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G. Final Waivers of lien shall show total contract dollar amounts of each supplier and subcontractors work.
H. CONTRACTOR shall provide waivers of lien with first pay request if the amount of the first pay request is greater than 40% of the total contract price.
I. Submit Certified Payrolls for all personnel who had worked on the project during the period the pay application covers.

1.5 PARTIAL PAYMENT

A. The Contractor shall prepare a draft of the requisition for partial payment and submit it, with required number of copies, to the ENGINEER for approval. The amount of the payment due the CONTRACTOR shall be determined by adding to the total value of work completed to date, the value of materials properly stored on site deducting (1) ten percent (10%) of the total amount, to be retained until final payment and (2) the amount of all previous payments. The total value of work completed to date shall be based upon the estimated quantities of work completed to date on each item and the price established in the cost breakdown and adjusted in accordance with the value of work completed to date on approved change orders. The value of materials properly stored on site shall be based upon the quantities of materials and the invoice prices. Copies of all invoices shall be provided to the ENGINEER to receive credit for stored materials. Payment shall be made to the CONTRACTOR within 60 days of the OWNERS approval of a partial pay request.
B. Monthly or partial payments made by the OWNER to the CONTRACTOR are moneys advanced for the purpose of assisting the CONTRACTOR to expedite the work of construction. The CONTRACTOR shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the OWNER. Such payments shall not constitute a waiver of the right of the OWNER to require the fulfillment of all terms of the contract and the delivery of all improvements embraced in this contract complete and satisfactory to the OWNER in all details.

1.6 FINAL PAYMENT

A. After final inspection and acceptance by the OWNER of all work under the contract, the CONTRACTOR shall prepare his requisition for final payment.
B. The amount of the final payment due the contractor shall be the lump sum shown on his agreement or the sum as adjusted by approved change orders.
C. The OWNER, before paying the final payment to the CONTRACTOR, shall receive from the CONTRACTOR, his final waiver of lien and supporting final waivers of lien from all material suppliers and subcontractors, properly executed, showing total monetary amounts as listed on the schedule of values and matching the waivers as received from the material suppliers and subcontractors.

1.7 WITHHOLDING PAYMENTS

A. The OWNER may withhold from any payment otherwise due the CONTRACTOR so much as may be necessary to protect the OWNER and if it so elects may also withhold any amounts due from the CONTRACTOR to any subcontractors or material dealers, for work performed or material furnished by them. The foregoing provisions shall be construed solely
for the benefit of the OWNER and will not require the OWNER to determine or adjust any claims or disputes between the CONTRACTOR and his subcontractors or material dealers, or to withhold any moneys for their protection unless the OWNER elects to do so. The failure or refusal of the OWNER to withhold moneys from the CONTRACTOR shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this contract.

1.8 PAYMENTS SUBJECT TO SUBMISSION OF CERTIFICATES

A. Each payment to the CONTRACTOR by the OWNER shall be made subject to the submission by the CONTRACTOR of all written certifications required of him and his subcontractors.

END OF SECTION
MODIFICATION REQUIREMENTS

1.1 SECTION INCLUDES

A. Procedures for the preparation and submittal of change orders.

1.2 FORMAT

A. Change Order requests may be submitted by Contractor or Engineer.
B. CONTRACTOR shall provide the ENGINEER with the following for preparing change orders:
   1. Item.
   2. Description of Work Item.
   3. Scheduled Values for Each Work Item (material and labor).
   4. Reason and justification of change order request.

1.3 PREPARATION OF CHANGE ORDER

A. ENGINEER shall prepare each final change order for the CONTRACTOR’S review and signature.
B. Change Order will be submitted on the ENGINEER’S standard change order form.
C. Use work items from approved Schedule of Values, where applicable.

1.4 SUBMITTAL PROCEDURES

A. CONTRACTOR signs three (3) copies of Change Orders.
B. ENGINEER signs three (3) copies of Change Orders.
C. ENGINEER submits three (3) copies of each Change Orders to OWNER.
D. Upon OWNERS approval of change order, the work shall commence expeditiously.
E. Approved Change Order amount will be reflected on following months payment estimate.

1.5 CHANGES IN WORK

A. The OWNER may make changes in the scope of work required to be performed by the CONTRACTOR under the contract or making the contract, and without relieving or releasing the CONTRACTOR from any of his obligations under the contract or any guarantee given by him pursuant to the contract provisions, and without affecting the validity of the guaranty bonds, and without relieving or releasing the surety or sureties of said bonds. All such work shall be executed under the terms of the original contract unless it is expressly provided otherwise.
B. Except for the purpose of affording protection against any emergency endangering health life, limb or property, the CONTRACTOR shall make no change in the materials used or in the specified manner of constructing and/or installing the improvements or supply additional labor, services or materials beyond that actually required for the execution of the contract, unless on pursuance of a written order from the OWNER authorizing the CONTRACTOR to proceed with the change. No claim for an adjustment of the contract price will be valid unless so ordered.
C. If applicable unit prices are contained in the agreement (established as a result of either a unit price bid or a supplemental schedule of unit prices) the OWNER may order the CONTRACTOR to proceed with desired unit prices specified in the contract, provided that in case of a unit price contract the net value of all changes does not increase or decrease the original total amount shown in the agreement by more than 25 percent (25%) in accordance with the section entitled unit prices, under instruction to bidders.

D. If applicable unit prices are not contained in the agreement or if the total net change increases or decreases the total contract price more than 25 percent (25%), the OWNER shall, before ordering the CONTRACTOR to proceed with desired changes, request an itemized proposal from him covering the work involved in the change after which the procedure shall be as follows:

1. If the proposal is acceptable the OWNER will prepare the change order in accordance therewith for acceptance by the CONTRACTOR and
2. If the proposal is not acceptable and prompt agreement between the two parties cannot be reached, the OWNER may order the CONTRACTOR to proceed with the work on a cost-plus-limited basis. A cost-plus-limited basis is defined as the net cost of the CONTRACTOR’S labor, materials and insurance plus 15 percent (15%) of said net cost to cover overhead and profit, the total cost not to exceed a specified limit.

E. The procedure as outline in this section for a unit price contract also applies in the case of a lump sum contract.

1.6 CLAIMS FOR EXTRA WORK

A. If a CONTRACTOR claims that any instructions by drawings or otherwise involve extra cost or extension of time, he shall, within ten (10) days after receipt of such instructions, and in any event before proceeding to execute the work, submit his protest thereto, in writing to the OWNER, stating clearly and in detail the basis of his objections. No such claim will be considered unless so made.

B. Claims for additional compensation for extra work, due to alleged errors on ground elevations, contour lines, or bench marks, will not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more work, than would reasonably estimated form the drawing and maps issued.

C. Any discrepancies which may be discovered between actual conditions and those represented by the drawings and maps shall at once be reported to the OWNER and work shall not proceed except at the CONTRACTORS risk, until written instructions have been received by him from the OWNER.

D. If, in the basis of the available evidence, the OWNER determines that an adjustment of the contract price and/or time is justifiable, the procedure shall be as provided in 1.5 above.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Identification and description of Alternate Work.

1.2 RELATED REQUIREMENTS

A. Bid Form: Quotation of cost of each Alternate.
B. Sections of the Specifications applicable to each Alternate.

1.3 PROCEDURES

A. Alternatives quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted alternatives will be identified in the Owner-Contractor Agreement.
B. Coordinate related work and modify surrounding work as required to complete the work, including changes under each Alternate, when acceptance is designated in Owner-Contractor Agreement. Fully integrate the Work of each alternative with all other work.

1.4 SCHEDULE OF ALTERNATIVES

Alternative No. 1: ADD work indicated as Alternate Bid #1 on Drawings and Specifications, namely the Northwest Classroom and Lab. This will be an ADD to the BASE BID.

Alternative No. 2: ADD work indicated as Alternate Bid #2 on Drawings and Specifications, namely the Southwest Classroom and corridor. This will be an ADD to the BASE BID.

Alternative No. 3A: ADD work indicated as Alternate Bid #3A on Drawings and Specifications, namely the in floor electrical receptacles in the BASE BID. This will be an ADD to the BASE BID.

Alternative No. 3B: ADD work indicated as Alternate Bid #3B on Drawings and Specifications, namely the in floor electrical receptacles in the ALTERNATE BID #1. This will be an ADD to the ALTERNATE BID #1.

Alternative No. 3C: ADD work indicated as Alternate Bid #3C on Drawings and Specifications, namely the in floor electrical receptacles in the ALTERNATE BID #2. This will be an ADD to the ALTERNATE BID #2.

Alternative No. 4A: ADD work indicated as Alternate Bid #4A on Drawings and Specifications, namely connecting the reheat heating water piping in the BASE BID. This will be an ADD to the BASE BID.

Alternative No. 4B: ADD work indicated as Alternate Bid #4B on Drawings and Specifications, namely connecting the reheat heating water piping in the ALTERNATE BID #1. This will be an ADD to the ALTERNATE BID #1.

Alternative No. 4C: ADD work indicated as Alternate Bid #4C on Drawings and Specifications, namely connecting the reheat heating water piping in the ALTERNATE BID #2. This will be an ADD to the ALTERNATE BID #2.
Alternative No. 5A: ADD work indicated as Alternate Bid #5A on Drawings and Specifications, namely installation of solid surface countertops and sills in lieu of plastic laminate countertops and sills in the BASE BID. This will be an ADD to the BASE BID.

Alternative No. 5B: ADD work indicated as Alternate Bid #5B on Drawings and Specifications, namely installation of solid surface countertops and sills in lieu of plastic laminate countertops and sills in the ALTERNATE BID #1. This will be an ADD to the ALTERNATE BID #1.

Alternative No. 5C: ADD work indicated as Alternate Bid #5C on Drawings and Specifications, namely installation of solid surface countertops and sills in lieu of plastic laminate countertops and sills in the ALTERNATE BID #2. This will be an ADD to the ALTERNATE BID #2.

Alternative No. 6A: DEDUCT work indicated as Alternate Bid #6A on Drawings and Specifications, namely the purchase and installation of IT cabling in the BASE BID. This will be a DEDUCT to the BASE BID.

Alternative No. 6B: DEDUCT work indicated as Alternate Bid #6B on Drawings and Specifications, namely the purchase and installation of IT cabling in the ALTERNATE BID #1. This will be a DEDUCT to the ALTERNATE BID #1.

Alternative No. 6C: DEDUCT work indicated as Alternate Bid #6C on Drawings and Specifications, namely the purchase and installation of IT cabling in the ALTERNATE BID #2. This will be a DEDUCT to the ALTERNATE BID #2.

Alternative No. 7A: DEDUCT work indicated as Alternate Bid #7A on Drawings and Specifications, namely all the painting in the BASE BID. This will be a DEDUCT to the BASE BID.

Alternative No. 7B: DEDUCT work indicated as Alternate Bid #7B on Drawings and Specifications, namely all the painting in ALTERNATE BID #1. This will be a DEDUCT to Alternate Bid #1.

Alternative No. 7C: DEDUCT work indicated as Alternate Bid #7C on Drawings and Specifications, namely all the painting in ALTERNATE BID #2. This will be a DEDUCT to Alternate Bid #2.

Alternative No. 8A: ADD work indicated as Alternate Bid #8A on Drawings and Specifications, namely new carpet in lieu of carpet called to remain to the BASE BID. This will be an ADD to the BASE BID.

Alternative No. 8B: ADD work indicated as Alternate Bid #8B on Drawings and Specifications, namely new carpet in lieu of carpet called to remain to ALTERNATE BID #1. This will be an ADD to ALTERNATE BID #1.

Alternative No. 8C: ADD work indicated as Alternate Bid #8B on Drawings and Specifications, namely new carpet in lieu of carpet called to remain to ALTERNATE BID #2. This will be an ADD to ALTERNATE BID #2.

Alternative No. 9: ADD work indicated as Alternate Bid #9 on Drawings and Project Manual, namely the installation of a glass wall system between Rooms 238 and 237 in ALTERNATE BID #1. This will be an ADD to ALTERNATE BID #1.

Alternate No. 10A: DEDUCT all work indicated as Alternate Bid #10A on Drawings and Specifications, namely the installation of new radiators in the BASE BID. This will be a DEDUCT to the BASE BID.

Alternate No. 10B: DEDUCT all work indicated as Alternate Bid #10B on Drawings and Specifications, namely the installation of new radiators in the ALTERNATE BID #1. This will be a DEDUCT to the ALTERNATE BID #1.
Alternate No. 10C: DEDUCT all work indicated as Alternate Bid #10C on Drawings and Specifications, namely the installation of new radiators in the ALTERNATE BID #2. This will be a DEDUCT to the ALTERNATE BID #2.

Alternate No. 11A: DEDUCT all work indicated as Alternate Bid #11A on Drawings and Specifications, namely the purchase and installation of all new Carpet and Base within the BASE BID. This will be a DEDUCT to the BASE BID. The purchase and installation of Resilient Flooring and Base shall remain in the BASE BID.

Alternate No. 11B: DEDUCT all work indicated as Alternate Bid #11B on Drawings and Specifications, namely the purchase and installation of all new Carpet and Base within the ALTERNATE BID #1. This will be a DEDUCT to the ALTERNATE BID #1. The purchase and installation of Resilient Flooring and Base shall remain in the ALTERNATE BID #1.

Alternate No. 11C: DEDUCT all work indicated as Alternate Bid #11C on Drawings and Specifications, namely the purchase and installation of all new Carpet and Base within the ALTERNATE BID #2. This will be a DEDUCT to the ALTERNATE BID #2. The purchase and installation of Resilient Flooring and Base shall remain in the ALTERNATE BID #2.

END OF SECTION
COORDINATION AND MEETINGS

1.1 SECTION INCLUDES
A. Coordination and project conditions.
B. Pre-construction meeting.
C. Progress meetings.

1.2 COORDINATION AND PROJECT CONDITIONS
A. Coordinate scheduling, submittals and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
B. Verify utility requirements and characteristics of operating equipment are compatible. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing into service, such equipment.
C. Coordinate completion and cleanup of Work of separate sections in preparation for Substantial Completion.
D. After completion of work, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of OWNER'S activities.

1.3 PRECONSTRUCTION MEETING
A. ENGINEER will schedule a meeting after Notice of Award and CONTRACTOR completion of Contract Documents.
B. Attendance Required: OWNER, ENGINEER, CONTRACTOR and any representatives of the CONTRACTOR.
C. Agenda:
1. Execution of OWNER-CONTRACTOR Agreement.
2. Submission of executed bonds and insurance certificates.
3. Submission of list of Subcontractors, list of Products, Schedule of Values, and progress schedule.
4. Designation of personnel representing the parties in Contract and the ENGINEER.
5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Security and site housekeeping procedures.
8. Wages and Verification Requirements

1.4 PROGRESS MEETINGS
A. Progress meetings may be scheduled at request of the OWNER, CONTRACTOR or ENGINEER as required throughout the Project. Additional compensation in any form shall not be awarded for attendance at progress meetings.

END OF SECTION
REFERENCE STANDARDS

1.1 SECTION INCLUDES

A. Quality assurance.

1.2 QUALITY ASSURANCE

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
B. Conform to reference standard by date of issue current on date for receiving bids.
C. Obtain copies of standards when required by the Contract Documents.
D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
E. Should specified reference standards conflict with Contract Documents, request clarification from the ENGINEER before proceeding.
F. The Contract Documents shall alter neither the contractual relationship, duties and responsibilities of the parties in Contract nor those of the ENGINEER by mention or inference otherwise in any reference document.

END OF SECTION
1.1 SECTION INCLUDES

A. Submittal procedures.
B. Construction progress schedules.
C. Product Data.
D. Shop Drawings.
E. Samples.
F. Design data.
G. Certificates.
H. Manufacturer's instructions.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal to:

Willett, Hofmann & Associates, Inc.
Attn: Thomas W. Houck, AIA, PE, LEED AP BD+C
809 East Second Street, P.O. Box 367
Dixon, Illinois, 61021-0367

B. Identify Project, CONTRACTOR, Subcontractor and Supplier, pertinent drawing and detail number, and specification section number, as appropriate.

C. Apply CONTRACTOR’s stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

D. Identify variations from Contract Documents and Product or system limitations, which may be detrimental to the successful performance of the completed Work.

E. Provide space for CONTRACTOR and ENGINEER review stamps.

F. When revised for resubmission, identify all changes made since previous submission.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedule within 15 days after date established in Notice to Proceed.
B. Revise and resubmit as necessary at progress meetings.
C. Show complete sequence of construction by activity. Indicate the start and finish dates and duration.

1.4 PRODUCT DATA

A. Product Data For Review: Submit to ENGINEER for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

B. Submit one (1) ELECTRONIC submittal, UNLOCKED AND EDITABLE.

C. Submit one copy of a complete Product Reference and Engineering Technical Design Manual from all manufacturers supplying materials and equipment.
D. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers’ standard data to provide information specific to this Project.
E. Indicate Product utility and electrical characteristics, utility connection requirements and location of utility outlets for service for functional equipment and appliances.

1.5 SHOP DRAWINGS

A. Shop Drawings For Review: Submit to ENGINEER for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
C. Submit one copy of a complete Product Reference and Engineering Technical Design Manual from all manufacturers supplying materials and equipment.
D. Submit one (1) ELECTRONIC submittal, UNLOCKED AND EDITABLE.

1.6 SAMPLES

A. Samples For Review:
   1. Submit to ENGINEER for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
B. Samples For Selection:
   1. Submit to ENGINEER for aesthetic, color, or finish selection.
   2. Submit samples of finishes from the full range of manufacturers’ standard colors, textures and patterns to ENGINEER for OWNER’s selection.
C. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices.
D. Include identification on each sample, with full Project information.
E. Submit the number of samples specified in individual specification sections; one of which will be retained by ENGINEER.
F. Submit one (1) ELECTRONIC submittal, UNLOCKED AND EDITABLE.

1.7 DESIGN DATA

A. Submit for the ENGINEER’s knowledge as contract administrator.
B. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.8 CERTIFICATES

A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the CONTRACTOR to ENGINEER, in quantities specified for Product Data.
B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
C. Certificates may be recent or previous test results on material or Product, but must be acceptable to ENGINEER.
1.9 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to ENGINEER for delivery to OWNER in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

C. Submit one (1) ELECTRONIC submittal, UNLOCKED AND EDITABLE.

END OF SECTION
DIVISION 1 - GENERAL REQUIREMENTS
Section 01510 - Temporary Utilities

TEMPORARY UTILITIES

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, water and sanitary facilities.

1.2 TEMPORARY ELECTRICITY

A. Owner to provide temporary electricity for construction operations as required. Contractor to exercise measures to conserve energy. Contractor shall be responsible for the delivery method and the maintenance of temporary electricity to the locations required.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Contractor to provide, pay for, and maintain lighting for construction operations as needed beyond existing building lighting provided.

1.4 TEMPORARY HEATING

A. Contractor to provide, maintain and pay for heating devices and heat as needed beyond existing building heating provided.

1.5 TEMPORARY COOLING

A. Contractor to provide, maintain and pay for cooling devices and cooling as needed beyond existing building cooling provided.

1.6 TEMPORARY VENTILATION

A. Contractor to ventilate enclosed areas as required to assist cure of materials, to dissipate humidity and to prevent accumulation of dust, fumes, vapors, or gases.

1.7 TELEPHONE SERVICE

A. Contractor to provide, maintain, and pay for telephone service as needed for the project. Use of Owner’s phone system by Contractor will not be allowed except in case of emergency.

1.8 TEMPORARY WATER SERVICE

A. Owner to provide temporary water for construction operations as required. Contractor to exercise measures to conserve energy. Contractor shall be responsible for the delivery method and the maintenance of temporary water to the locations required.

1.9 TEMPORARY SANITARY FACILITIES

A. Owner will allow Contractor to use existing building sanitary facilities. Contractor to take care in use of facilities and shall be responsible for clean up of any debris or soiling of facilities caused by Contractor’s employees or sub-contractors. Failure to comply will result in Contractor providing all required sanitary facilities.

END OF SECTION
CONSTRUCTION FACILITIES

1.1 SECTION INCLUDES


1.2 PARKING

A. Park in designated parking areas as directed by Owner to accommodate construction personnel.
B. Do not allow vehicle parking on existing roadway pavement, which will impede traffic flow.

1.3 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Collect and remove waste materials, debris, and rubbish from site periodically or as directed by the OWNER or ENGINEER and dispose of off-site in location determined by CONTRACTOR.

1.4 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials prior to final inspection.
B. Clean and repair damage caused by installation or use of temporary work.
C. Restore facilities used during construction to original condition.

END OF SECTION
TEMPORARY CONTROLS

1.1 SECTION INCLUDES

A. Temporary Controls: Barriers, protection of installed Work, security, noise control and pollution control.

1.2 BARRIERS

A. Provide barriers as required to prevent unauthorized entry to construction areas and to protect existing facilities from damage from construction operations.
B. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.3 PROTECTION OF INSTALLED WORK

A. Protect installed Work.
B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.

1.4 SECURITY

A. Provide security and facilities as required to protect Work, and existing facilities and OWNER's operations from unauthorized entry, vandalism, or theft.

1.5 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.6 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

END OF SECTION
PRODUCT REQUIREMENTS

1.1 SECTION INCLUDES

A. Products.
B. Product delivery requirements.
C. Product storage and handling requirements.
D. Product options.
E. Product substitution procedures.

1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.
B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.
B. Store with seals and labels intact and legible.
C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
D. For exterior storage of fabricated products, place on sloped supports above ground.
E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
B. Products Specified by Naming One or More Manufacturers: products of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

01600-1
1.6 PRODUCT SUBSTITUTION PROCEDURES

A. ENGINEER will consider requests for Substitutions for items as allowed under Section 1.5C only within 30 days after date of OWNER-CONTRACTOR Agreement.

B. Substitutions may be considered when a product becomes unavailable through no fault of CONTRACTOR.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that CONTRACTOR:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse OWNER for review or redesign services associated with re-approval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
   2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
   3. ENGINEER will notify CONTRACTOR in writing of decision to accept or reject request.

END OF SECTION
DIVISION 1 - GENERAL REQUIREMENTS  
Section 01700 - Contract Closeout

CONTRACT CLOSEOUT

1.1 SECTION INCLUDES

A. Closeout procedures.
B. Final cleaning.
C. Project record documents.
D. Spare parts and maintenance Products.
E. Maintenance service.
F. Final Waiver’s of Lien

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected and that Work is complete in accordance with Contract Documents and ready for ENGINEER's review.
B. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
B. Clean adjacent equipment and fixtures as necessary to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
C. Clean site; sweep paved areas, rake clean landscaped surfaces.
D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain one set of record documents on site; record revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.
B. Ensure entries are complete and accurate, enabling future reference by OWNER.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress.
E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.
F. Record Drawings: Legibly mark each item to record actual construction including:
   1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   2. Field changes of dimension and detail.
3. Details not on original Contract drawings.

G. Submit documents to ENGINEER.

1.5 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra Products in quantities specified in individual specification sections.
B. Deliver to Project site; obtain receipt prior to final payment.

1.6 FINAL WAIVER’S OF LIEN

A. CONTRACTOR will be required to submit individual Final Waiver’s of Lien from all suppliers and subcontractors for amounts exceeding Five Hundred dollars ($500) prior to Final Payment.
B. CONTRACTOR will be required to submit a Contractor’s Final Waiver of Lien for the full contract amount prior to Final Payment.

END OF SECTION
WARRANTIES

1.1 SECTION INCLUDES

A. Preparation and submittal of warranties.
B. Time of submittals.

1.2 PREPARATION OF SUBMITTALS

A. Obtain warranties executed in duplicate by responsible Subcontractors, suppliers, and manufacturers. Except for items put into use with OWNER's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
B. Verify that documents are in proper form, contain full information, and are notarized.
C. Co-execute submittals when required.
D. Retain warranties until time specified for submittal.

1.3 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with OWNER's permission, submit documents within ten days after acceptance.
B. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
C. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

END OF SECTION
1.1 SECTION INCLUDES

A. Form of submittals.
B. Preparation and time of submittals.
C. Schedule of submittals.

1.2 FORM OF SUBMITTALS

A. CONTRACTOR shall furnish with his bid proposal a Bid Bond in the amount of 5% of the total bid price. The Bid Bond form is bound into the Project Booklet in Section 00410 or on a form acceptable to the OWNER.
B. After Notice of Award, CONTRACTOR shall furnish Payment and Performance bonds. The Payment Bond form is in Section 00510 and the Performance Bond form is in Section 00520 or on forms acceptable to the OWNER.

1.3 PREPARATION AND TIME OF SUBMITTALS

A. CONTRACTOR shall furnish one (1) executed Bid Bond with his Proposal. If a Proposal is not accompanied with a Bid Bond, it may be rejected.
B. CONTRACTOR shall furnish one (1) executed Payment and Performance bond. The Payment and Performance bonds must be executed and returned to the OWNER within fifteen (15) days after receiving the Notice of Award.

1.4 SCHEDULE OF SUBMITTALS

A. Section 00410: Bid Bond - 5% of total bid price.
B. Section 00520: Payment Bond - 100% of total contract price.
C. Section 00530: Performance Bond - 100% of total contract price.

END OF SECTION
SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolishing designated building equipment and fixtures.
   2. Demolishing designated construction.
   3. Cutting and alterations for completion of the Work.
   4. Protecting items designated to remain.
   5. Removing demolished materials.

1.2 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, subsurface obstructions.

1.3 SCHEDULING

A. Schedule Work to coincide with new construction.

B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation and events and classes in adjoining spaces.

C. Coordinate utility and building service interruptions with Owner.
   1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
   2. Schedule tie-ins to existing systems to minimize disruption.
   3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.4 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 - PRODUCTS

2.1 Not Used.
PART 3 - EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Maintain existing temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.

D. Erect and maintain weatherproof closures for exterior openings.

E. Maintain existing temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.

F. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.

G. Provide appropriate temporary signage including signage for exit or building egress.

H. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

3.2 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.

C. Demolish in orderly and careful manner. Protect existing improvements, supporting structural members and portions detailed to remain.

D. Carefully remove building components indicated to be reused.
   1. Disassemble components as required to permit removal.
   2. Package small and loose parts to avoid loss.
   3. Mark components and packaged parts to permit reinstallation.
   4. Store components, protected from construction operations, until reinstalled.

E. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

F. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

END OF SECTION
WOOD CASEWORK AND COUNTERTOP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Cabinet Units
   2. Countertops
   3. Cabinet Hardware
   4. Preparation for installing utilities in cabinets
   5. Shop finishing
   6. Accessories

B. Related Sections
   1. Section 09 21 16 - Gypsum Board Systems

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A156.9 - Cabinet Hardware.
   2. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. Architectural Woodwork Institute:
   1. AWI - Quality Standards Illustrated.

C. American Society For Testing And Materials (ASTM)

1.3 SUBMITTALS

A. Section 01300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Submit data for hardware accessories.

D. Samples:
   1. Submit two (2) sets of samples, illustrating cabinet finish and texture.
   2. Submit two (2) sets of samples, illustrating countertop finish and texture.
   3. Submit two (2) sets of samples, illustrating cabinet hardware finish and texture.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Custom Grade.
1.5 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.
B. Protect units from moisture damage.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.
B. During and after installation of Work of this section, maintain same temperature and humidity conditions in building spaces as will occur after occupancy.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Provide minimum 5 year warranty on total system installed.

PART 2 - PRODUCTS

2.1 WOOD CASEWORK

A. Manufacturers
   1. Techline USA, LLC
   2. Diversified Casework
   3. Substitutions: Section 01600 - Product Requirements

B. Materials
   1. Hardwood shall be kiln-dried, clear and free of defects and shall meet surface requirements as specified below.
   2. Plywood shall be of balanced construction and ¾” 7-ply veneer core hardwood plywood for shelves, cabinet ends and bottoms of base and tall cabinets; 1” 9-ply veneer core hardwood plywood for shelves over 36”, bottoms of wall and upper cabinets, and tops of wall, upper and tall cabinets; nominal ½” 9-ply veneer core plywood for drawer body; ¾” 3-ply particleboard core plywood for cabinet doors and drawer heads. Plywood shall meet the standards of ANSI/HPVA HP-1-2009.
   4. Exposed surfaces shall be of plain-sliced, HPVA grade A Red Oak veneers and compatible Grade I Red Oak hardwood lumber.
   5. Semi-exposed surfaces shall be plain sliced, HPVA grade 1 Red Oak veneers and compatible Grade II hardwood lumber.
6. Concealed surfaces shall be no less than HPVA grade D face or grade 3 back veneers and compatible mill option hardwood lumber.

7. Edging for cabinet parts shall be 3 mm hardwood edging of compatible hardwood Red Oak.

8. Hardboard shall be ¼” thick 55 lb. density hardwood chip fiberboard formed with heat and pressure into sheets providing a hard, smooth surface.

9. Glass used for framed sliding and swinging doors shall be 3/16” tempered glass. Glass used for unframed sliding doors, shall be 1/4” tempered glass.

10. Drawer and door pulls shall be satin finish, zinc coated wire type, 96 mm centers, offering a comfortable hand grip, and be securely fastened to doors and drawers. Two pulls shall be required on all drawers over 24” long.

11. Hinges shall be BHMA Grade 1 of stainless steel, five (5) knuckle institutional, .083” thick, offset type for all swinging doors. Hinges shall be 2-½” long, one (1) pair for doors under 4 ft. in height and 1-1/2 pair on doors over 4 ft. in height. Hinges are mounted with flathead screws, so applied to door and cabinet to withstand a weight load of 150 lbs. minimum.

12. Locks when shown or called for shall be a National Lock, 5-disc tumbler with heavy duty interchangeable cylinder. Exposed lock noses shall be dull nickel (satin). Locks shall have capacity for 200 primary key changes. Master key one level with the potential of 200 different, non-interchangeable master key groups.

13. Roller catches shall be used on swinging doors. Catches shall have two spring-loaded polyethylene rollers and metal catch to secure doors. Double doors without locks shall have a catch on each door. Full height cases shall have 3-point latching devices. Magnetic catches are not allowed.

14. Leg shoes shall be provided on all table legs, unless otherwise specified, to conceal leveling device. Shoes shall be 2-1/2” high and made of pliable, black rubber material. Use of a leg shoe, which does not conceal leveling device, will not be acceptable.

15. Floor glides, where specified for movable open-leg tables, shall be a non-skid material at least 1” diameter to prevent indenting composition flooring and shall have at least a 5/8” height adjustment. Use of metal buttons will not be acceptable.

16. Dowels used to join frames and panels shall be fluted hardwood not less than 8 mm in diameter.

17. Shelf support clips shall be “seismic” twin pin type for mounting on interior of cabinet work. Clips shall be corrosion resistant and shall retain shelves from accidental removal. Shelves in all cabinets are adjustable on 32mm centers. Single pin support clips and surface mounted metal support strips and clips subject to corrosion are not acceptable.

18. Base molding and stainless steel corner clips shall be provided by others.

19. Upright rods, cross rods and ring support rods, where specified, shall be aluminum (1/2” or 3/4” dia., as required). Rod sockets shall be aluminum, secured through table tops with lock nut and washer. Rod clamps shall be heavy duty, designed to securely hold rod assembly in any position. Use of wood rod assemblies will not be accepted.

20. Label holders, where shown or called for, shall be a zinc-plated steel, brad-attached type with satin finish and designed for 2” x 1” cards.

21. Number plates, where shown or called for, shall be aluminum brad-attached type with satin finish and indented black lettering.

22. Sink supports, where required, shall be of a cradle type consisting of two 1-1/2” x 3/4” horizontal cleats and adjustable leveling bolts or glides. The horizontal cleats shall be supported by two 1/8” x 1-1/2” angle irons attached to the cabinet end panels.
C. Construction

1. Base Cabinets shall consist of the following minimum construction:
   a. Joinery must meet AWI Premium Grade requirements.
   b. End panels shall be multiple doweled and glued to top frame members, intermediate rails and bottoms.
   c. Cabinet bottoms shall be multiple doweled and glued to end panels.
   d. Toe space shall be 4” high and fully enclosed.
   e. Edging shall be provided on the front edges of ends, bottoms and shelves, and on all four edges of door and drawer fronts.
   f. Cabinet top shall be composed of a single full sub-top composed of a ¾” veneer core plywood that has been doweled and glued to all end panels.
   g. Intermediate rails (3/4” x 2-½” hardwood per parts definition) shall be multiple doweled and glued to end panels at the front of the cabinet between drawers and between drawers and doors.
   h. Screw strips (3/4” by 3” veneer core hardwood plywood) shall be located at the top and bottom behind the cabinet back and multiple doweled to the cabinet ends.
   i. Hardboard cabinet backs shall be fully captured and dadoed into end panels and bottoms, with full perimeter gluing around the rear of the back. Where a removable back is indicated, it shall be an additional piece applied to cover an opening that is added to the fully captured back. (Backs are to meet the visual requirement of cabinet parts.)
   j. Shelves shall be ¾” thick in cabinets up to 36” wide, 1” thick in all cabinets over 36” wide. (Front edges of shelves are to meet the visual requirement of cabinet parts.)
   k. Drawer box shall be four-sided (sub-front, sides and back), each panel made of nominal ½” thick, 9-ply Baltic Birch plywood and joined to adjacent panels by full glue and multiple dovetail joinery all four corners.
   l. Drawer bottom (1/4” on drawers under 42” wide, ½” on larger drawers) shall be melamine faced hardboard (appearance to meet visual appearance of drawer box), dadoed into all four drawer box sides with full perimeter gluing on the underside.
   m. Door and drawer heads shall be 3/4” thick plywood with edging as specified to resist warping. Reveals shall be 1/4” between door and drawer heads and ½” on end panels. Face veneers shall be vertically grain matched.
   n. Drawer slides shall be easily removable with a 100 lb. dynamic load rating and nylon roller bearings, powder coated surfaces, self-closing and with hold-open feature. Slides shall be attached to the drawer box both from below and the side. File drawers shall be full extension, 150 lb. dynamic load rating mounted to the drawer sides.

2. Full Height Swinging Door Cases:
   a. Shall be designed and constructed for full enclosure to assure dust proofing of the interior.
   b. Tops shall be 1” thick plywood, multiple doweled into end panels, secured with glue.
   c. A double extruded aluminum track shall be attached to the case top for suspension system when sliding doors are called for. Doors shall be suspended from an adjustable hanger and glide on nylon roller wheels. An aluminum U-channel is located on the case bottom to guide the bottom of the doors.
   d. Solid panel doors shall be 3/4” thick plywood with edging as specified.
   e. Doors shall be removable without use of tools, and so designed to prevent by-passing.
f. Shelves shall be ¾” thick in cabinets up to 36” wide, 1” thick in all cabinets over 36” wide.
g. To assure a rigid case, the center shelf is structurally joined to the end panels and glued.
h. Case bottoms shall be 3/4” thick plywood, multiple doweled and glued securely to end panels.
i. Fastening cleats, top and bottom, ¾” x 3” plywood, shall support and strengthen all joints.
j. Toe space, 2-¼” deep x 4” high, shall be totally enclosed by a ¾” x 4” plywood rail.
k. Backs in open cases shall be 1/4” plywood; backs not exposed to view shall be 1/4” high-density fiberboard.
l. Case interior shall be flush.

3. Wall-Hung Swinging Door Cases: General construction features shall be the same as for full height type cases with the following exception:
   a. Case bottoms shall be 1” thick plywood, multiple doweled and glued securely to end panels.
   b. Panel framed doors shall be hung on 1 pair of offset, institutional type hinges under 48” in height. Doors on cases 48” high shall have 1-1/2 pair of offset, institutional type hinges.

D. Finish and Performance Requirements
   1. Wood Surface Preparation: Prior to application of the wood finish, case and cabinet surfaces shall be smoothly sanded to remove loose fibers, scratch marks and abrasions, with all dust thoroughly removed by compressed air. Finish shall be applied to cabinet parts prior to assembly in order to assure uniform coverage.
   2. Wood Stain Color: Selected from Manufacturer’s standard selection
   3. Wood Finish Application: Finishes shall be applied and cured under controlled atmospheric conditions, aided by infrared radiant heaters. Finish must be VOC-free. Finish shall be applied via a flat line system prior to cabinet assembly in order to assure uniform coverage.
   4. Interior Wood Casework Finish: Interior surfaces shall receive a double-pass of an acid, alkali, solvent, water and abrasion resistant finish meeting AWI requirements.
   5. Exterior Wood Casework Finish: Exposed exterior surfaces, including interiors of glazed cases and open shelving, shall be provided with an acid, alkali, solvent, water and abrasion resistant finish meeting both AWI section 1500 and SEFA 8 requirements. Finish shall be applied to cabinet parts prior to assembly in order to assure uniform coverage.

2.2 COUNTERTOP – BASE BID

A. Manufacturers
   1. Formica
   2. KML Corp
   3. Wilsonart
   4. Substitutions: Section 01600 - Product Requirements

B. High-pressure decorative laminate, NEMA LD 3, Grade CLS
   1. Substrate Particleboard: 100% recycled fiber, 3/4” thick, CARB certified.
2.3 COUNTERTOP – ALTERNATE BID #5

A. Manufacturers
   1. Dupont - Corian
   2. Formica
   3. Wilsonart
   4. Substitutions: Section 01600 - Product Requirements

B. Solid surface Countertop
   1. Proprietary type, with integral coloring, stain resistant to domestic chemicals and cleaners.

C. Fabrication
   1. Fabricate all components, including counter to achieve shape and configuration.
   2. Gel coat exposed finish surfaces smooth and polish to gloss sheen.
   3. Radius corners and edges.
   4. Cure components prior to shipment.

2.4 FINISHES

A. Color: as selected by owner from manufacturer’s standard range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify adequacy of backing and support framing.

C. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Install materials and systems in accordance with manufacturer published instructions and requirements. Install materials with uniform appearance and in proper relation with adjacent construction.

B. Accurately set all cabinets plumb, square level, and permanently secure in position as indicated on the drawings. Install casework to a tolerance of 1/8-inch in 96-inches for plumb and level.

C. Install casework without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operations.

D. Exercise extreme care to avoid damaging casework finish during the handling and erecting of all members.
E. Field fabrications and modifications of casework required for completion of units shall be performed with extreme care to avoid damage to casework finish. Scribe casework and fillers as required for a tight fit.

F. Wall cabinets shall be securely fastened to studs or blocking in the wall.

G. All exposed cabinetry surfaces shall be of vertical grade high-pressure decorative laminate. Exposed cabinetry sides shall be covered with an end panel of vertical grade high-pressure decorative laminate.

H. Install countertops on base cabinets and other support systems as recommended by manufacturer. Secure backsplashes to tops with concealed fastening methods.

3.3 ADJUSTING

A. Section 01700 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean all materials provided under this section and all adjacent materials, which may have become soiled from this work.

B. Wipe out casework interiors and empty drawers of dirt and debris. Remove pencil marks and other blemishes from casework surfaces.

C. Remove foreign matter that could affect operation or appearance of hardware.

D. Make final adjustments to drawers and doors. Doors shall swing freely. All doors shall be aligned both vertically and horizontally. Drawers shall open and close smoothly, without binding or excessive slide and play.

E. Remove from the site all debris resulting from the work of this section.

END OF SECTION
BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Batt insulation in interior wall and ceiling construction.
   2. Batt insulation for filling perimeter window and door shim spaces.

B. Related Requirements:
   1. Section 09 21 16 - Gypsum Board Assemblies.
   2. Section 09 51 13 - Acoustical Panel Ceilings

1.2 REFERENCE STANDARDS

A. ASTM International:

1.3 SUBMITTALS

A. Section 01300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer data on product characteristics, performance criteria, limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Remove insulation that becomes wet or damp.
   3. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 BATT INSULATION

A. Manufacturers:
   1. CertainTeed Corporation
2. Johns Manville
3. Owens Corning
4. Substitutions: As specified in Section 01600 - Product Requirements.

2.2 MATERIALS

A. Batt Insulation:
   1. Description: Preformed glass-fiber batt or roll, friction fit.
   2. Comply with ASTM C665, Type I.
   3. Size: As required for full contact with gypsum wall board and metal studs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01700 - Execution and Closeout Requirements: Requirements for application examination.
   B. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

A. Install in interior wall and ceiling spaces without gaps or voids.
   B. Do not compress insulation.
   C. Trim insulation neatly to fit spaces.
   D. Insulate miscellaneous gaps and voids.
   E. Fit insulation tight in spaces and tight to mechanical and electrical services within plane of insulation.

3.3 SCHEDULE

A. Ceiling Insulation above the following rooms ONLY:
   1. 204, 205A, 205B, 206, 207
   2. Portions of corridors 203 and 208 as detailed on plans.
   B. Wall Insulation all interior walls.

END OF SECTION
JOINT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sealants and joint backing.
   2. Precompressed foam sealers.
   3. Accessories.

B. Related Requirements:
   1. Section 07 95 00 - Expansion Control: Expansion joint assemblies.
   2. Section 09 21 16 - Gypsum Board Assemblies: Acoustic sealant.

1.2 REFERENCE STANDARDS

A. ASTM International:

1.3 SUBMITTALS

A. Section 01300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, illustrating sealant colors for selection.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer’s original packaging and inspect for damage.

C. Store products according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.
1.5 AMBIENT CONDITIONS

A. Maintain temperature and humidity as recommended by sealant manufacturer during and after installation.

1.6 WARRANTY

A. Section 01700 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish two-year installer's warranty for all sealants.

C. Include coverage for:
   1. Installed sealants and accessories failing to achieve airtight or watertight seal.
   2. Installed sealants and accessories exhibiting loss of adhesion or cohesion.

PART 2 - PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
   1. BASF Corporation
   2. Bostik, Inc
   3. Dow Corning Corporation
   4. Sika Corporation
   5. Tremco Incorporated
   6. Substitutions: As specified in Section 01600 - Product Requirements.

2.2 JOINT SEALERS BY APPLICATION

A. General-Purpose Sealant:
   1. Material: Silicone.
   2. Comply with ASTM C-920, Type S, Grade NS, Class 100/50, Uses NT, M, G, A, O.
   3. Type: Single-component.
   4. Color: As selected.
   5. WS-290, as manufactured by Sika Corporation.
   6. Applications:
      a. Joints between concrete and other materials.
      b. Joints between metal frames and other materials.
      c. Other exterior joints for which no other sealant is indicated.

B. Interior Glazing Sealant:
   1. Description: As recommended by glazing system manufacturer.
   2. Type: Single-component.
   4. Applications:
      a. Between units of glazing

C. Exterior Metal Lap Joint Sealant:
   1. Material: Butyl or polyisobutylene.
2. Type: Non-drying, non-skinning, non-curing.
3. Applications: Concealed sealant bead in sheet metalwork.

2.3 ACCESSORIES

A. Primer:
   1. Type: Non-staining.
   2. As recommended by sealant manufacturer to suit application.

B. Joint Cleaner:
   1. Type: Non-corrosive and non-staining.
   2. As recommended by sealant manufacturer.
   3. Compatible with joint forming materials.

C. Joint Backing:
   1. Description: Round foam rod, compatible with sealant.
   2. Comply with ASTM D1056, sponge or expanded rubber.
   3. Size: Oversized 30 to 50 percent larger than joint width.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01700 - Execution and Closeout Requirements: Requirements for application examination.

B. Verify that substrate surfaces and joint openings are ready to receive Work of this Section.

C. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Section 01700 - Execution and Closeout Requirements: Requirements for application preparation.

B. Comply with ASTM C1193.

C. Remove loose materials and foreign matter that could impair adhesion of sealant.

D. Clean and prime joints.

E. Protect elements surrounding Work of this Section from damage or disfiguration.

3.3 APPLICATION

A. Comply with ASTM C1193.

B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
C. Apply sealant free of air pockets, foreign embedded matter, ridges, and sags.

D. Joint Tooling: Concave.

E. Precompressed Foam Sealant:
   1. Do not stretch.
   2. Avoid joints except at corners, ends, and intersections.
   3. Apply with face 1/8 to 1/4 inch below adjoining surface.

3.4 CLEANING

A. Section 01700 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION

A. Section 01700 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect sealants until cured.

END OF SECTION
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flush wood doors.

B. Related Requirements:
   1. Section 08 71 00 – Door Hardware

1.2REFERENCE STANDARDS

A. ASTM International:
   1. ASTM E413 - Classification for Rating Sound Insulation.

B. Architectural Woodwork Institute:
   1. AWI AWS - Architectural Woodwork Standards.

C. Wood Window and Door Manufacturers Association:
   1. WDMA I.S 1A - Architectural Wood Flush Doors.

1.3SUBMITTALS

A. Section 01300 - Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Submit data for door core materials and construction.
   2. Submit data for veneer species, type and characteristics.
   3. Submit data for factory finishes.

C. Shop Drawings:
   1. Indicate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, and factory machining criteria.

D. Samples:
   1. Submit two samples of door veneer, 4x4 inch in size illustrating wood grain, stain color, and sheen.

E. Manufacturers’ Instructions: Submit special installation instructions.

F. Qualification Statements:
   1. Submit manufacturer experience qualifications.

1.4QUALITY ASSURANCE

A. Perform Work in accordance with AWI AWS Section 9, grades identified in section.
B. Finish doors in accordance with AWI AWS Section 5, grades identified in section.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer when stored more than one week.

C. Accept doors on site in manufacturer’s packaging. Inspect for damage.
   1. Break seal on site to permit ventilation.

1.7 WARRANTY

A. Section 01700 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Interior Doors:
   1. Factory Finished Doors: Furnish manufacturer’s life of installation warranty.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS

A. Manufacturers:
   1. Algoma Hardwoods
   2. Eggers Industries
   3. Graham Wood Doors
   4. Mohawk Flush Doors
   5. Substitutions: Section 01600 - Product Requirements.

B. Flush Interior Doors: Solid core.
   1. Thickness: 1-3/4 inches
   2. Core: PC.
   3. Face Construction: Seven ply.
   5. Quality Grade: Premium.

C. Performance / Design Criteria:
   1. Performance Duty Level: WDMA I.S. 1A.
2. Sound Transmission Resistance: ASTM E413; minimum STC 35 for door and frame assemblies indicated as acoustically rated.

2.2 MATERIALS

A. Door Cores: AWI AWS Section 9.
   1. Solid Core, Non-Fire Rated:
      a. Type: PC; particleboard.

B. Interior Door Faces:
   1. Transparent Finished Faces: Wood veneer.
      a. Species: Red oak.
      b. Veneer Cut: Quarter sliced or match existing doors
      c. Veneer Matching: Slip matched or match existing doors
      d. Face Matching: Balanced.

C. Facing Adhesive: Type II - water resistant.

2.3 FABRICATION

A. Fabricate doors in accordance with AWI AWS Section 9 requirements.

B. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement.

C. Vertical Exposed Edge of Stiles: Wood veneer matching door facing.

D. Fit door edge trim to edge of stiles after applying veneer facing.

E. Bond edge banding to cores.

F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions specified. Do not machine for surface hardware. Furnish solid blocking for through bolted hardware.

G. Factory fit doors for frame opening dimensions identified on shop drawings.

H. Provide edge clearances in accordance with AWI AWS Section 9.

2.4 FINISHES

A. Finish work in accordance with AWI AWS Section 5; Premium Grade.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with sealer.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01700 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with AWI AWS Section 9 and manufacturer’s instructions.

B. Field Fitting and Trimming:
   1. Trim door height by cutting bottom edges to maximum of 3/4 inch.

C. Coordinate installation of doors with installation of frames specified in Section 08 44 13 and hardware specified in Section 08 71 00.

3.3 TOLERANCES

A. Conform to AWI AWS Section 9 requirements for the following:
   1. Fit and clearance tolerances.
   2. Gaps.
   3. Flushness.
   4. Flatness.
   5. Squareness.

END OF SECTION
SLIDING GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Section includes glazed aluminum-framed sliding doors, inactive leaves, and frames.

1.2 REFERENCE STANDARDS

A. AAMA 611: Anodized Architectural Aluminum.
B. ASTM B308: Aluminum-Alloy 6061-T6 Standard Structural Profiles

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures specifies requirements for submittals.
B. Shop Drawings:
   1. Include plans, elevations, details, hardware, operational clearances and accessories. Include
      keying schedule for locksets.
   2. Delegated Design Submittals: For installations not supported from above, provide drawings
      and calculations signed by an engineer, indicating components and connections,
      demonstrating compliance with applicable regulations.
C. Product Data: Include fabrication details, aluminum finishes, glass types, installation and
   operating instructions for each type of sliding door.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements specifies requirements for transporting, handling,
   storing, and protecting products.
B. Deliver materials in manufacturer’s packaging including application instructions.
C. Deliver door system to job site in manufacturer’s packaging.
   1. Remove panels from packaging and carefully transfer panels to a secure jobsite area.
D. Protect stored product from damage.
   1. Store product flat in dry, well ventilated area out of direct sunlight, under cover, protected
      from weather and construction activities.

1.5 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls specifies ambient condition control facilities
   for product storage and installation.
B. Condition wood components to average prevailing relative humidity before installation.

C. Do not expose wood components to extreme or rapid changes in heat or humidity.

1.6 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.7 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements specifies requirements for warranties.

B. Warranty: Manufacturer’s warranty agreeing to repair or replace components used in interior installations, excluding glass, that fail in materials or workmanship within three years from date of substantial completion.

PART 2 - PRODUCTS

2.1 FOLDING DOOR SYSTEM

A. Manufacturer List:
   1. The Sliding Door Company, Inc
   2. Substitutions: Specified in Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Framing, General:
   1. Material: Aluminum extrusions, 6061 alloy.
   2. Finish: Clear Anodized Aluminum: AAMA 611, Class II.

B. Beams and Columns: 2 by 4 inches, 0.102 inch minimum thickness.

C. Top Tracks: 0.064 inch minimum thickness, with number of channels required for door operation indicated.

D. Bottom Tracks:
   1. Aluminum 6061 extrusions, 0.057 inch minimum metal thickness, 0.325 inch high, barrier-free per ADA.
   2. Installation: Surface-mounted (to include ramp).
   3. Channels: Interlocking tracks with number of channels required for door operation indicated.
   4. Finish: Clear Anodized Aluminum: AAMA 611, Class II.

E. Doors: divided into two horizontally
   1. Stiles and Rails: 3 inch sight line, 0.051 inch minimum thickness.
   2. Mullions: Built-In Mullions: 1.5 inch sight line.
2.3 HARDWARE

A. Handle: Standard Handle (Brushed Silver - Aluminum) Double.

B. Upper Roller Carriages: Vinyl rollers with steel bearings.

C. Lower Carriages: Sliding wheel-to-track with locking mechanism and polyoxymethylene (POM) copolymer wheels with steel bearings.

D. Handles:
   1. Square Designer Handle (Stainless Steel)

E. Door Stop: For head or bottom track, as indicated in shop drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings and substrates are acceptable for installation of work of this section.

3.2 INSTALLATION

A. Install systems according to shop drawings and manufacturer’s installation instructions.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Adjust doors for smooth operation.

B. Comply with manufacturer’s written recommendations for cleaning and maintenance.

C. Clean aluminum and glass surfaces immediately after installing sliding doors.

D. Protect surfaces from impact and from contact with contaminating substances resulting from other construction operations.

E. Clean immediately before substantial completion.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood folding door system with fingertip operation, including wood frame, wood panels, folding system and locking hardware.

1.2 REFERENCE STANDARDS


B. AAMA 1303.5, Voluntary Specifications for Forced Entry Resistant Aluminum Sliding Glass Doors.


D. ASTM E 283, Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.


F. ASTM E 547, Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.


1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures specifies requirements for submittals.

B. Detail Order Documentation: Indicate outside net frame dimensioning, direction of swing, number of panels folding, configuration of panels left or right, identify main door swing panel, typical head, side jambs, sill and panel details and elevation view drawings.

C. Product Data: Manufacturer's literature including independently certified testing results, installation instructions with warranty and care and maintenance instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements specifies requirements for transporting, handling, storing, and protecting products.

B. Deliver materials in manufacturer's packaging including application instructions.
C. Deliver door system to job site in manufacturer’s packaging.
   1. Remove panels from packaging and carefully transfer panels to a secure jobsite area.

D. Protect stored product from damage.
   1. Store product flat in dry, well ventilated area out of direct sunlight, under cover, protected from weather and construction activities.

E. Wood items must be finished within seven (7) days of jobsite delivery.

1.5 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls specifies ambient condition control facilities for product storage and installation.

B. Condition wood components to average prevailing relative humidity before installation.

C. Do not expose wood components to extreme or rapid changes in heat or humidity.

1.6 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.7 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements specifies requirements for warranties.

B. Provide manufacturer's standard limited warranty for defects in materials and workmanship.

C. Warranty Period: Shall begin at date of substantial completion.
   1. Five (5) years for operating and locking hardware.
   2. One (1) year for wood components.

PART 2 - PRODUCTS

2.1 FOLDING DOOR SYSTEM

A. Manufacturer List:
   1. LaCantina Doors, Inc.
   2. Jeld-Wen, Inc.
   3. Substitutions: Specified in Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Frame and Panels: From manufacturer's standard profiles, provide complete folding door system with all hardware and consisting of head, side jambs, thresholds and wood panels with dimensions shown on drawings.
B. Provide wood panels in pattern as shown on drawings with manufacturer’s standard profile. Panel thickness to be 1 3/4”. Horizontal mullion in panel construction is not required.

C. Provide standard 3 5/8” stile and rail profile.

D. Type of Wood: Vertical grain Douglas Fir.

E. Wood Finish: Unfinished, ready for paint or stain.

F. Frame: Side jambs to be 1 1/4” thick. Frame width to be 5 5/8” overall, head, jamb.

G. Locking Hardware and Handles: Provide manufacturer’s standard rebated flush bolts at top and bottom of panel between each pair of folding panels and on any secondary swing panel.
   1. Handles shall be lever operators with key lock. Storeroom function, match building keying system.

H. On the main entry panel for configurations with a swing panel, provide manufacturer’s standard trimset and lever handle on the outside, and compatible lock set with lockable latch. Depressing of handles withdraws latch.

I. Rebated flush bolts to lock into the frame’s top and bottom locking channels.

J. Provide main entry panel handle height centered at 36” from bottom of panel.

K. Folding Hardware: Provide manufacturer’s standard folding hardware, head track, side jambs and threshold frame system. Weight of panels to be borne by the bottom of the track will not be allowed. Hardware system carrying capacity to be 220 lbs. per panel.

L. Hardware system to operate with an upper wheel carrier that rolls on the aluminum head track. A lower track incorporated into the threshold to guide the door panels. Upper carrier and lower guide are attached to door panel hinges. Jamb panels are attached with top and bottom pivots. Panels are connected with hinges including top and bottom hinges attached to top carrier and lower guide. Handles to assist with opening and close of door included. Carrier pins at the top pivots, intermediate and end carrier support the full door weight and this is where panels are adjusted. A pin locking system is used to lock vertical adjustment once heights are set. Pivots at the jamb allow simple screwdriver adjustment of the system horizontally up to 3/8” (10mm). All screws fully concealed for external security. Architectural grade stainless steel used for hinge pins, carrier pins and carrier bogeys.

M. Hardware sets: Provide three (3) hinges on panels 96” or less and four (4) hinges on panels taller than 96”. Optional wall pivots available for jamb side pivot panels for taller doors or high-wind environments.

N. Hardware finish: Stainless steel.

O. Threshold: Provide guide track only for interior

P. Adjustment: Provide system capable adjustments without removing panels from tracks, 3/8” (7 mm) both vertically and horizontally with flat head and Phillips head screwdriver.
Q. Provide screws for connecting panels and frame components.

R. Provide magnetic door stop for main entry swing panel and for stacking of folding panels

2.3 FABRICATION

A. Use solid LVL core wood panels, fitted interior wood components, hinges, folding hardware, locking hardware and handles, threshold and track as specified herein to make a folding door system. Factory pre-assemble as is standard for manufacturer and ship with all components and Installation Instructions.

B. Sizes and Configurations: See drawings for selected custom dimensions within maximum frame sizes possible as shown in manufacturer's literature. See drawings for selected number of panels and configuration.

PART 3 - EXECUTION

3.1 ERECTION

A. Due to the size, weight and movement of the panels, verify the structural header requirements. Specifically the maximum deflection of the header with the live loads shall not exceed the lesser of \( \frac{L}{720} \) of the span and 1/4".

B. Verify that dimensions of rough opening will fit the net frame dimensions of door system; verify that rough openings are level, plumb, and square, with no unevenness in the floor

C. Installation of folding door system constitutes acceptance of existing conditions.

3.2 INSTALLATION

A. Install the door system frame and panels in accordance with manufacturer's installation instructions.

B. Installer to provide adequate anchorage devices and to securely fit frame in place, absolutely level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work. Head section of frame must be installed with a 1/8" upward crown at the center of the opening.

C. Ensure doors are adjusted at time of installation for proper operation.

D. Protect installed product from construction activities, particularly thresholds and floor channels.

E. Finishing: Field finish under Section 099000 - Painting; seal and finish promptly after installation no more than seven (7) days and prior to exposure to weather.

END OF SECTION
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hardware for wood and aluminum doors.
   1. Provide door gaskets, including weatherstripping and seals, and thresholds.

B. Related Sections:
   1. Section 08 14 16 - Flush Wood Doors.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A156.3 - Exit Devices.
   2. ANSI A156.4 - Door Controls - Closures.
   3. ANSI A156.13 - Mortise Locks and Latches.
   4. ANSI A156.18 - Materials and Finishes
   5. ANSI A156.24 - Delayed Egress Locks.
   6. ANSI A156.26 - Continuous Geared Hinges
   7. ANSI A156 - Complete Set of BHMA Standards (A156 Series) with Binder.

B. Builders Hardware Manufacturers Association:
   1. BHMA Directory of Certified Products.

1.3 SUBMITTALS

A. Section 01300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts.

C. Manufacturer’s Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of installed cylinders and their master key code.

C. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
D. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.5 QUALITY ASSURANCE
   A. Perform Work in accordance with the following requirements:
      1. ANSI A156 series.
   B. Furnish hardware marked and listed in BHMA Directory of Certified Products.

1.6 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   B. Hardware Supplier: Company specializing in supplying commercial door hardware with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
   A. Section 01600 - Product Requirements: Product storage and handling requirements.
   B. Package hardware items individually with necessary fasteners, instructions, and installation templates, when necessary; label and identify each package with door opening code to match hardware schedule.

1.8 COORDINATION
   A. Section 01300 - Administrative Requirements: Coordination and project conditions.
   B. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
      1. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.
   C. Sequence installation to accommodate required utility connections.
   D. Coordinate Owner's keying requirements during course of Work.

1.9 WARRANTY
   A. Section 01700 - Execution and Closeout Requirements: Product warranties and product bonds.
   B. Furnish five year manufacturer warranty for locksets and door closers.

1.10 MAINTENANCE MATERIALS
   A. Section 01700 - Execution and Closeout Requirements: Maintenance materials.
B. Furnish special wrenches and tools applicable for each different and for each special hardware component.

C. Furnish maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 - PRODUCTS

2.1 DOOR HARDWARE

A. General Hardware Requirements: Where not specifically indicated, comply with applicable ANSI A156 standard for type of hardware required. Furnish each type of hardware with accessories as required for applications indicated and for complete, finished, operational doors.
   1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently in advance to avoid delay in Work.
   2. Reinforcing Units: Furnished by door and frame manufacturers; coordinated by hardware supplier or hardware manufacturer.
   3. Fasteners: Furnish as recommended by hardware manufacturer and as required to secure hardware.
      a. Finish: Match hardware item being fastened.

B. Hinges: ANSI/BHMA A156.26 Continuous Geared, extruded tempered aluminum 6063-T6 alloy,
   1. Configuration: Three interlocking extrusions in pinless assembly, installed to full height of door frame, Full mortise type, flush short leaf.
   2. Strength: Heavy Duty
   3. Fasteners: As recommended by Manufacturer.
   4. Acceptable Manufacturers:
      a. Bommer Industries, Inc. FM83HD-SLF
      b. Design Hardware FMHD83
      c. McKinney Products Company MCK-12HD
      d. Roton 780-112HD
      e. Stanley Hardware 661HD

   1. Bored type: ANSI A156.2, Series 4000, Grade 1 unless otherwise indicated.
   2. Acceptable Manufacturers:
      a. Best Access Systems 9K series
      b. Design Hardware Z Series
      c. DORMA Architectural Hardware CL800 series
      d. Schlage Locks ND series
      e. Sargent Lock Co. 10 series

D. Exit Devices: ANSI A156.3, Grade 1, rim, heavy duty, with push pad. Furnish top and bottom strikes.
   1. Types: Suitable for doors requiring exit devices.
   2. Acceptable Manufacturers:
a. Design Hardware 1000R Series
b. DORMA Architectural Hardware 9000 Series
c. Precision Hardware 2000 Series
d. Sargent Lock Co. 8800 series
e. Von Duprin Inc. 98 Series

E. Cylinders: TO BE PROVIDED BY OWNER to match existing key system.

F. Wall stop:
   1. Acceptable Manufacturers:
      a. Design Hardware WS-CC
      b. Ives WS407CCV

2.2 ACCESSORIES

A. Lock Trim: Furnish levers with escutcheon plate as selected from manufacturers full range of levers and roses.
   1. Do not permit through bolts on solid wood core doors.

B. Through Bolts: Do not permit through bolts and grommet nuts on door faces in occupied areas unless no alternative is possible.
   1. Do not use through bolts on solid wood core doors.

2.3 FINISHING

A. Finishes: ANSI A156.18; furnish following finishes:
   a. BHMA 630 and 626, satin finish.
   b. BHMA 630, satin finished stainless steel.
   c. BHMA 626, satin chromium plated brass or bronze.
   d. BHMA 628, satin aluminum, clear anodized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify doors and frames are ready to receive door hardware and dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.

3.3 ADJUSTING

A. Section 01700 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
B. Adjust hardware for smooth operation.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit adjacent work to damage hardware or hardware finish.

3.5 SCHEDULES

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END OF SECTION
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass glazing for metal frames, and doors.
   2. Glass glazing materials and installation requirements are included in this section for other sections referencing this section.

B. Related Sections:
   1. Section 08 14 16 - Flush Wood Doors: Glazed doors.
   2. Section 08 32 13 - Sliding Aluminum-Framed Glass Doors: Glazed doors.

1.2 REFERENCES

A. ASTM International:

B. Consumer Products Safety Commission:

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
   1. Indicate sizes, layout, thicknesses, and loading conditions for glass.

C. Product Data:
   1. Glass: Provide physical, solar optical performance characteristics, and special handling or installation requirements.
   2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.

D. Samples:
   1. Glass: Submit two samples 12x12 inch in size, illustrating each glass, coloration and design.
PART 2 - PRODUCTS

2.1 FLOAT GLASS MATERIALS

A. Tempered Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering.
   1. Furnish tempered glass conforming to CPSC 16 CFR 1201 Category II at locations where safety glass is required by code.

2.2 FLOAT GLASS PRODUCTS

A. Float Glass
   1. Manufacturers:
      a. AGC Glass Company North A...
      b. Guardian Glass;
      c. Old Castle
      d. Pilkington North America
      e. Substitutions: Section 01 60 00 - Product Requirements.

B. Clear Glass: Annealed, and Tempered float glass as required; Class 1 clear.
   1. Minimum Thickness: 1/4 inch.

C. One-Way Mirror Glass: Annealed float glass as specified except Quality Q2.
   1. Minimum Thickness: 1/4 inch.

2.3 GLAZING ACCESSORIES

A. Setting Blocks: Elastomeric material recommended by glass manufacturer, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Elastomeric material recommended by glass manufacturer, 50 to 60 Shore A durometer hardness, minimum 3 inch long x one half the height of glazing stop x thickness to suit application, self adhesive on one face.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings for glazing are correctly sized and within acceptable tolerance.

C. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear, and ready to receive glazing.
3.2 INSTALLATION

A. Interior Dry Method (Tape and Tape) Installation:
   1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
   2. Place setting blocks at 1/3 points with edge block no more than 6 inches from corners.
   3. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
   4. Place glazing tape on free perimeter of glazing in same manner described above.
   5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
B. Remove glazing materials from finish surfaces.
C. Remove labels after Work is complete.
D. Clean glass and adjacent surfaces.

3.4 SCHEDULE

A. Interior Wood Doors: Clear glass, tempered.
B. View/Control Windows: One-Way Mirror Glass, reflective side out to labs, tempered.
C. Existing side lights: Clear glass, tempered.

END OF SECTION
GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal stud wall framing.
   2. Metal channel framing.

B. Related Requirements:
   1. Section 07 21 16 - Blanket Insulation

1.2 REFERENCE STANDARDS

A. ASTM International:
   5. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

B. Gypsum Association:
   1. GA 214 - Recommended Levels of Gypsum Board Finish.
   2. GA 216 - Application and Finishing of Gypsum Board.

1.3 SUBMITTALS

A. Section 01300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on metal framing, gypsum board, joint tape, joint compound.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840.
1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Manufacturers:
   1. CertainTeed Corporation
   2. Georgia-Pacific Building Products
   3. National Gypsum Company
   4. United States Gypsum Company
   5. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Framing Materials:
   1. Studs and Tracks: ASTM C645; galvanized sheet steel, 0.036 inch thick, C shape.
      a. Size: 3 5/8” unless noted otherwise.
   2. Furring, Framing, and Accessories: ASTM C645.
      a. Size: 3/4”
   3. Fasteners: ASTM C1002; length to suit application.
   4. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

B. Gypsum Board Materials: ASTM C1396/C1396M.
   1. Standard Gypsum Board: 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.

2.3 ACCESSORIES

A. Gypsum Board Accessories: ASTM C1047; metal and paper combination; corner beads, edge trim, and expansion joints.
   1. Metal Accessories: Galvanized steel.
   2. Edge Trim: Type L bead.

B. Joint Materials: ASTM C475; reinforcing tape, joint compound, and water.

C. Gypsum Board Screws: ASTM C954; length to suit application.
   1. Screws for Steel Framing: Type S.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01700 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings and as instructed by manufacturer.

3.2 INSTALLATION

A. Metal Stud Installation:
1. Install studs in accordance with ASTM C754.
2. Metal Stud Spacing: 16” OC.
3. Extend stud framing to above ceiling.
4. Brace all walls from structure. Walls shall not move, sag, or sway.
5. Door Opening Framing: Install double studs at door frame jambs.
6. Blocking: Bolt or screw steel channels to studs. Install blocking for support of wall cabinets, movable partition, soffits, and other items mounted to walls.

B. Wall Furring Installation:
1. Erect wall furring for direct attachment to concrete masonry walls.
2. Erect furring channels vertically; space maximum 16 inches oc, not more than 4 inches from floor and ceiling lines. Secure in place on alternate channel flanges at maximum 24 inches on center.

C. Ceiling Framing Installation:
1. Install in accordance with ASTM C754.
2. Coordinate location of hangers with other work.
3. Install ceiling framing independent of walls, columns, and above ceiling work.
4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
5. Laterally brace entire suspension system.

D. Gypsum Board Installation:
1. Install gypsum board in accordance with ASTM C840.
2. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.
3. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
4. Use screws when fastening gypsum board to metal furring or framing.
5. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
6. Place control joints consistent with lines of building spaces as indicated on Drawings.
7. Place corner beads at external corners Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
8. Apply gypsum board to curved walls in accordance with GA-216.

E. Joint Treatment:
   1. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   2. Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.

3.3 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

END OF SECTION
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustic panels.
   2. Suspended metal grid ceiling system and perimeter trim.
   3. Supplementary acoustic insulation over system units.

B. Related Requirements:
   1. Section 07 21 16 - Blanket Insulation.
   2. Section 07 90 00 - Joint Protection.

1.2 REFERENCE STANDARDS

A. ASTM International:
   3. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.3 SEQUENCING

A. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustic units after interior wet work is dry.

1.4 SUBMITTALS

A. Section 01300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on metal grid system components and acoustic units.

C. Samples:
   1. Submit two samples illustrating material and finish of acoustic units.
   2. Submit two samples of suspension system main runner, cross runner, perimeter molding.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.6 AMBIENT CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

PART 2 - PRODUCTS

2.1 SUSPENDED ACOUSTICAL CEILINGS

A. Manufacturers:
   1. Armstrong World Industries
   2. CertainTeed Corporation
   3. Chicago Metallic Corporation
   4. United States Gypsum Comp.
   5. Substitutions: Section 01600 - Product Requirements.

B. Performance / Design Criteria:
   1. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1/360 of span.

2.2 COMPONENTS

A. Acoustic Panels: ASTM E1264, conforming to the following:
   1. Basis of Design: USG Frost - 414
      a. Size: 24 x 24 inches.
      b. Thickness: 3/4 inches.
      c. Composition: Mineral fiber.
      d. Light Reflectance: 0.84
      e. NRC: 0.70
      f. CAC: 38 to 40.
      g. Edge: SLB
      h. Surface Color: White.
      i. Surface Finish: Non-directional fine fissured.

B. Grid:
   1. Non-fire Rated Grid: ASTM C635, heavy duty; exposed T; components die cut and interlocking.
   2. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
   3. Exposed Grid Surface Width: 15/16 inch .
   5. Grid Finish: White
   6. Accessories: Stabilizer bars, clips, splices, perimeter moldings, and others required for suspended grid system.
   7. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
2.3 ACCESSORIES

A. Acoustic Batt Insulation: Specified in Section 07 21 16.

B. Touch-up Paint: Type and color to match acoustic and grid units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01700 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify layout of hangers will not interfere with other work.

3.2 INSTALLATION

A. Lay-In Grid Suspension System:
   1. Install suspension system in accordance with ASTM C635, ASTM C636 and as supplemented in this section.
   2. Locate system on room axis according to reflected plan.
   3. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
   4. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   5. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
   6. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability.
   7. Do not eccentrically load system, or produce rotation of runners.
   8. Perimeter Molding:
      a. Install edge molding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.
      b. Use longest practical lengths.
      c. Miter corners.
      d. Install at junctions with other interruptions.
   9. Form expansion joints. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

B. Acoustic Units:
   1. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
   2. Lay directional patterned units one way with pattern parallel to longest room axis. Fit border trim neatly against abutting surfaces.
   3. Install units after above ceiling work is complete.
   4. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
   5. Cutting Acoustic Units:
      a. Cut to fit irregular grid and perimeter edge trim.
b. Cut bevel edges to field cut units.
c. Double cut and field paint exposed edges of tegular units.

3.3 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes resilient sheet flooring.

1.2 REFERENCES

A. ASTM International:
2. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate seaming plan, custom patterns and inlay designs.

C. Product Data: Submit data describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

D. Samples:
1. Submit manufacturer's complete set of color samples for initial selection.
2. Submit two samples, 6x6 inch in size illustrating color and pattern for each resilient flooring product specified.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect roll materials from damage by storing on end.
C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.7 WARRANTY

A. Manufacturer’s standard form in which manufacturer agrees to repair or replace flooring that fails within specified warranty period.
   1. Material warranty must be direct from the product manufacturer.
   2. Material warranties from separate or third party insurance providers are not valid.
   3. Material warranties from private label distributors are not valid.

B. Failures include, but are not limited to, the following:
   1. Material manufacturing defects.
   2. Surface wear and deterioration to the point of wear-through.

C. Warranty Period:
   1. For materials: 2 years from date of Substantial Completion.
   2. For surface wear: 10 years from date of Substantial Completion.
   3. For moisture vapor tolerance: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET FLOORING

A. Manufacturers:
   1. Armstrong World Industries
   2. Gerflor
   3. Johnsonite; a Tarkett company
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Homogeneous Vinyl Sheet: Meet performance requirements of ASTM F1913 color and pattern through total thickness:
   1. Basis of Design: Gerflor – Mipolam symbioz
      a. Total Thickness: 0.080 inch nominal.
      b. Sheet Width: 72 inch minimum.
      c. Static Load Limit: 250 psi minimum.
      d. Heat welded seams.
      e. Wax free

2.2 RESILIENT BASE

A. Manufacturers:
   1. Armstrong World Industries
   2. Johnsonite; a Tarkett company
   3. Roppe
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Base: ASTM F1861 Type TV - Vinyl; coved style:
   1. Height: 4 inch.
   2. Thickness: 0.125 inch thick.
   3. Finish and color: As selected by owner from manufacturers standard range.
   4. Length: Roll.

2.3 ACCESSORIES

A. Subfloor Filler: Premix latex; type recommended by adhesive material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.


D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify floor and lower wall surfaces are free of substances capable of impairing adhesion of new adhesive and finish materials.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Clean substrate.

D. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances cannot be removed.

3.3 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.

B. Double cut sheet; provide heat welded seams.
C. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Secure metal strips after installation of flooring with stainless steel screws.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

### 3.4 INSTALLATION - BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, ‘V’ cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

### 3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean, seal, and maintain resilient flooring products.

### 3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION
TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Carpet tile, self-stick adhesive backed.
   2. Accessories.

1.2 SUBMITTALS

A. Section 01300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples:
   1. Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

1.3 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.5 AMBIENT CONDITIONS

A. Store materials in area of installation for 48 hours prior to installation.

1.6 WARRANTY

A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.
   1. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.
   2. The non-prorated lifetime limited warranty shall specifically warrant against:
   3. Excessive Surface Wear: More than 15% loss of pile fiber weight
   4. Excessive Static Electricity: More than 3.0 kV per AATCC 134
5. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
6. Delamination
7. Edge Ravel
8. Zippering
9. Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.

PART 2 - PRODUCTS

2.1 CARPET TILE
   A. Match Carpet Type and Size As Supplied By Owner
      1. Tarkett – Tandus Centiva – Aftermath II 03026
   B. Carpet Tile: 24 x 24 inch, nominal
   C. Backing:
      1. Primary: Synthetic non-woven
      2. Secondary: Closed Cell Cushion
   D. Total Product Thickness: min 0.375in
   E. Owner shall select up to 4 different colors/patterns.

2.2 RESILIENT BASE
   A. Manufacturers:
      1. Armstrong World Industries, Inc.
      2. Johnsonite; A Tarkett Company.
      3. Roppe Corporation, USA.
      4. Substitutions: Section 01 60 00 - Product Requirements.
   B. Base: ASTM F1861 Type TV - Vinyl; coved style:
      1. Height: 4 inch.
      2. Thickness: 0.125 inch thick.
      4. Length: Roll.
   C. Owner shall select up to 4 different colors.

2.3 ACCESSORIES
   A. Sub-Floor Filler: Type recommended by flooring material manufacturer.
   B. Moldings and Edge Strips: Rubber or Vinyl, color as selected.
   C. Contact Adhesive: Recommended by carpet manufacturer, releasable type.
PART 3 - EXECUTION

3.1 PREPARATION

A. Section 01700 - Execution and Closeout Requirements: Requirements for installation preparation.
B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
D. Clean substrate.

3.2 INSTALLATION

A. Install carpet tile in accordance with CRI Carpet Installation Standard.
B. Do not mix carpet from different cartons unless from same dye lot.
C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
D. Install carpet tile in square pattern, with pile direction alternating to next unit, set parallel to building lines.
E. Locate change of color or pattern between rooms under door centerline.
F. Adhere carpet tile with self-stick adhesive backing by removing protective membrane and pressing tile back onto clean and dry substrate.
G. Trim carpet tile neatly at walls and around interruptions.
H. Complete installation of edge strips, concealing exposed edges.

3.3 CLEANING

A. Section 01700 - Execution and Closeout Requirements: Requirements for cleaning.
B. Remove excess adhesive from floor, base, and wall surfaces without damage.
C. Clean and vacuum carpet surfaces.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and field application of paints and other coatings.

1.2 REFERENCES

A. American Standards for Testing Materials


1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

A. Product Data: Provide data on all finishing products.

B. Samples:
   1. Submit one paper chip sample in size sufficient to accurately illustrate range of available colors for each surface finishing product scheduled.

C. Manufacturer’s Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.
1.7 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior.

PART 2 - PRODUCTS

2.1 PAINTING AND COATING

A. Acceptable Manufacturers
   1. PPG Architectural Coatings
   2. Sherwin-Williams Company: Duration
   3. Substitutions permitted per Section 01600 – Product Requirements.

2.2 MATERIALS

A. Coatings: Ready mixed coatings.
   1. Prepare pigments: To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.
2.3 FINISHES

A. As recommended by coating manufacturer for condition and surface to be coated.
   1. See schedule for items to be coated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Surfaces: Correct defects and clean surfaces, which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

C. Marks: Seal with shellac those that may bleed through surface finishes.

D. Impervious Surfaces: Follow manufacturer’s instructions. Remove mildew by scrubbing with solution of tetra-sodium or tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

3.3 APPLICATION

A. Apply products in accordance with manufacturer’s instructions.

B. Paint equipment and piping accessories, supports, brackets, specialties, valves and similar items not specifically mentioned in the schedule the same color as the principal assembly with which each is associated.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Protect adjacent surfaces with protective coverings; mask name plates, hardware, valve stems and similar items; keep valve stems free from paint at all times; clean up spilled or spattered paint immediately.

F. Lay drop cloths to protect floors and other surfaces from splatter and droppings. Protect all fixed equipment and remove the canopies of light fixtures and cover and protect from injury.
G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. The use of any temporary heating or housing to obtain suitable temperatures for painting must be approved by the Engineer. Systems which result in excessive filmy deposits on metal surfaces will not be approved.

3.4 CLEANING

A. Collect waste material, which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 SCHEDULE

A. New GWB
   1. Primer: 1 coat
   2. Paint: 2 coats

B. Existing GWB
   1. Paint: 2 coats

END OF SECTION
OPERABLE PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Paired Panel Operable Partitions

1.2 REFERENCE STANDARDS

A. ASTM International:
   3. ASTM E 413 - Classification for Rating Sound Insulation.

1.3 SUBMITTALS

A. Section 01300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

C. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

D. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

E. Samples: Color samples demonstrating full range of finishes available. Verification samples shall be available in same thickness and material indicated for the work.

F. Manufacturer’s Certificates: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Provide manufacturer’s operating and maintenance instructions that include recommendations for periodic checking and adjustment and periodic cleaning and maintenance of all components.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: Experienced installer, certified by the operable partition manufacturer, as qualified to install the manufacturer’s partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in accordance with ASTM E 90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of Opening: Conform to ASTM E 557.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle and store products in accordance with manufacturer’s recommendations.

B. Store products indoors in manufacturer’s unopened packaging until ready for installation.

C. Protect from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

1.7 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s absolute limits.

1.9 WARRANTY

A. Manufacturers 2 year limited warranty for partition panels and 5 year limited warranty on mechanical components including track and carriers.

PART 2 - PRODUCTS

2.1 PAIRED PANEL OPERABLE PARTITION

A. Manufacturers:
   1. Moderco Inc.
   2. Modernfold, Inc
   3. Substitutions: Section 01600 - Product Requirements.
B. Product: Acousti-Seal Encore Paired Panel Operable Partition by Modernfold, Inc., manually operated, top supported with operable floor seals and automatic top seals

2.2 COMPONENTS

A. Panel Construction and STC Rating: Nominal 4-1/4 inch (108 mm) thick panels in manufacturer's standard 51 inch (1295 mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16 gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
   1. Panel Skin: Roll-formed steel wrapping around panel edge, with panel skins lock-formed and welded directly to the frame for unitized construction with minimum STC as follows:
      a. STC: 52.
   2. Panel Trim: No vertical trim required or allowed on vertical edges of panels; minimal groove appearance at panel joints.
   3. Panel Weight: Steel skin.
      a. 52 STC, 8.2 lbs./sq. ft.

B. Panel Finish and Exposed Trim: Factory applied as follows:

C. Sound Seals and Bottom Seals:
   1. Vertical Interlocking Sound Seals between panels: Aluminum astragals, with tongue and groove configuration in each panel edge. Rigid plastic astragals are not acceptable.
   2. Horizontal Top Seals shall be Modernfold SureSet automatic operable top seals, manually operated operable top seals not required or permitted.
   3. Horizontal Bottom Seals shall be Modernfold SureSet bottom seal:
      a. SA2 - Automatic bottom seals providing nominal 2 inch (51 mm) operating clearance with an operating range of plus 1/2 inch (13 mm) to 1-1/2 inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks. Extended seal exerts nominal 120 pounds (54 kg) downward force to the floor throughout operating range.

D. Suspension System:
   1. Suspension System: as detailed on drawings.

E. Special Components:
   1. Work Surfaces: Dry marker surfaces, white enamel on steel, bonded to the face of the panel, with trim without exposed fasteners. Trim is not acceptable on vertical edges to provide uninterrupted work surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01700 - Execution and Closeout Requirements: Requirements for installation examination.
B. Do not begin installation until supports and substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer’s instructions and ASTM E 557 installation procedures. Test for proper operation and make necessary adjustments until satisfactory results are obtained.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 21 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced in the 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.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor’s convenience and lists normal breakdown of the work.

D. Scope of Work:

1. **Plumbing Work** shall include, but is not necessarily limited to:
   a. Furnish and install all items listed in the Plumbing Material List.
   b. Extend existing domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
   c. Extend existing compressed air to headwalls provided by the Owner.
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

2. **Heating Work** shall include, but is not necessarily limited to:
   a. Extend existing heating water system including piping, insulation, terminal heating equipment, and specialties. Make final connections to all coils, including those furnished by others.
   b. Extend existing reheat water system including piping, insulation, and connections to terminal heating coils.
c. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

3. **Air Conditioning and Ventilating Work** shall include, but is not necessarily limited to:
   
a. Extend existing supply air ductwork systems including all fittings, insulation, and outlets.

b. Extend existing return air ductwork systems including all fittings, insulation, and inlets.

c. Furnish and install all terminal air boxes and reheat coils.

d. Furnish and install all temperature control systems.

e. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

4. **Temperature Control Work** shall include, but is not necessarily limited to:

a. Extend existing temperature control system as specified in Section 23 09 00.

b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.

c. Furnish automatic control valves for installation by others.

d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

5. **Fire Protection Work** shall include, but is not necessarily limited to:

a. Extend existing wet pipe sprinkler system for areas noted on the drawings.

b. Furnish and install all items listed on the Fire Protection Material List.

c. Furnish all hydraulic calculations and working sprinkler drawings.

d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.
6. **Testing, Adjusting, and Balancing Work** shall include, but is not necessarily limited to:
   a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.

1.3 ALTERNATES

A. Alternate 1 will be a portion of work in the northwest corner of the project area (current lab, storage, and office areas). This will be an ADDITIVE ALTERNATE.

   1. Refer to plan view drawing for Alternate #1 plan layout.

B. Alternate 2 will be the portion of work in the southwest corner of the project area (classroom). This will be an ADDITIVE ALTERNATE.

   1. Refer to plan view drawings for Alternate #2 plan layout.

C. Alternate 3: Electrical only; no mechanical as part of this alternate.

D. Alternate 4 will be the reheat heating water piping. This will be an ADDITIVE ALTERNATE.

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. 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.

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, 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 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. 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 all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.

2. 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 Contractor.

c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

3. 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 Contractor when so noted on the Electrical Drawings.

3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. 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.

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.

1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5” and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5” and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

d. Maintenance clearances and code-required dedicated space shall be included.

e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

   a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. KJWW 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 KJWW. KJWW will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

   a. Scale of drawings:

      1) General plans: 1/4 Inch = 1'-0" (minimum).

      2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).

      3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).

      4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).

      5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.

3. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.
D. General:

1. Coordination drawing files shall be made available to the A/E and Owner’s Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.

2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.

4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.

8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

   a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

   b. Potential layout changes shall be made to avoid additional access panels.

   c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.

   d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.

11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.

12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.7 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 City of Dixon, Illinois Codes, Laws, Ordinances and other regulations having jurisdiction.

2. Conform to all State Codes.
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. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.

3. Make application for and pay for fire protection water service connection.

F. Examination of Drawings:

1. The drawings for the fire protection 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 fire protection 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.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.
H. 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 KJWW.

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 KJWW 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 KJWW as to the accuracy or correctness of the information provided. KJWW accepts no responsibility or liability for the Contractor’s use of these documents.

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:

<table>
<thead>
<tr>
<th>Referenced Specification</th>
<th>Submittal Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 05 00</td>
<td>Owner Training Agenda</td>
</tr>
<tr>
<td>21 13 00</td>
<td>Sprinkler Systems</td>
</tr>
<tr>
<td>21 13 00</td>
<td>Fire Protection Equipment</td>
</tr>
</tbody>
</table>

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; 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, 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: 21 XX XX.description.YYYYMMDD
   b. Transmittal file name: 21 XX XX.description.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.9 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.

1.10 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.

1.11 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.

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 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.
2. 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 wall penetrations are sealed.
   b. Pipe identification is installed.
   c. Branch piping in the location of sprinklers shall be dropped to the ceiling.

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.

### 3.3 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. **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.

C. 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 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 report by the State Fire Marshal of the fire protection system.

5. 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.

3.4 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.div21.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as “1 of 2”, “2 of 2”, etc.
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. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.


7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

8. Dimensional drawings of equipment.

9. Capacities and utility consumption of equipment.

10. Detailed parts lists with lists of suppliers.

11. Operating procedures for each system.

12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.

13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.

15. Instruction books, cards, and manuals furnished with the equipment.

3.5 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. The instructions shall include:
   1. Maintenance of equipment.
   2. Description of emergency system operation.

D. 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.

E. Minimum hours of instruction for each item shall be:
   1. Sprinkler System(s) - One (1) hour.

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 fire protection 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.

3.6 RECORD DOCUMENTS

A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of fire protection drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the fire protection systems.
B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, 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; Change Orders; concealed control system devices.

C. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

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.

3.7 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 areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.8 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, 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.

END OF SECTION
READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

In order 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. Fire protection system operational.
3. Pipes labeled.

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.

* * * * *
DIVISION 21 - FIRE SUPPRESSION
21 05 29 - Fire Suppression Supports And Anchors

FIRE SUPPRESSION SUPPORTS AND ANCHORS

PART 1 - GENERAL
1.1 SECTION INCLUDES
A. Hangers, Supports, and Associated Anchors.
B. Sleeves and Seals.
C. Flashing and Sealing of Equipment and Pipe Stacks.
D. Cutting of Openings.
E. Escutcheon Plates and Trim.

1.2 QUALITY ASSURANCE
A. Support Sprinkler Piping in conformance with NFPA 13.

1.3 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:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Hanger Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; and smaller</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; through 3-1/2&quot;</td>
<td>1/2&quot;</td>
</tr>
</tbody>
</table>

Column #1: Steel 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.

2.2 PIPE HANGERS AND SUPPORTS
A. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58 and 127 (where applicable).
B. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required 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 without compromising fire barrier penetrations and other fixed takeoff locations.

Acceptable Products:

- Anvil: Fig. CT121
- Cooper/B-Line: Fig. B3373CT
- Erico: Model 510
- Nibco/Tolco: Fig. 82

C. Unless otherwise indicated, hangers shall be as follows:

1. **Clevis Type**:
   - Service: Bare Metal Pipe

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>Bare Steel, Plastic or Insulated Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 260</td>
<td>Fig. CT65</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. 3100</td>
<td>Fig. B3104CT</td>
</tr>
<tr>
<td>Erico</td>
<td>Model 400</td>
<td>Model 402</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 1</td>
<td>Fig. 81</td>
</tr>
</tbody>
</table>

2. **Adjustable Swivel Ring Type**:
   - Service: Bare Metal Pipe - 4 inches and Smaller

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>Bare Steel Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 69</td>
<td>Fig. CT69</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B3170NF</td>
<td>Fig. B170CT</td>
</tr>
<tr>
<td>Erico</td>
<td>Model FCN</td>
<td></td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 200</td>
<td>Fig. 202</td>
</tr>
</tbody>
</table>

D. 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.

1. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.
E. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

1. **Clamp Type:**
   Service: Bare Metal Pipe
   a. Clamps in direct contact with copper pipe shall be plastic coated.
   b. Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.

<table>
<thead>
<tr>
<th>Acceptable Products</th>
<th>Bare Steel, Plastic or Insulated Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut</td>
<td>Fig. P1100 or P2500</td>
<td></td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B2000 or B2400</td>
<td>Fig. BVT</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. A-14 or 2STR</td>
<td></td>
</tr>
</tbody>
</table>

F. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

1. **Concrete Inserts, Single Rod Galvanized:**

<table>
<thead>
<tr>
<th>Acceptable Products</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 282</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B3014</td>
</tr>
<tr>
<td>Erico</td>
<td>Model 355</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 310</td>
</tr>
</tbody>
</table>

2. **Concrete Inserts, Continuous Strip Galvanized:**

<table>
<thead>
<tr>
<th>Acceptable Products</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut Corp</td>
<td>P3200 Series</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B22-J</td>
</tr>
<tr>
<td>Erico</td>
<td>CONCT</td>
</tr>
</tbody>
</table>

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.

G. 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.
2.3 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.

2.4 PIPE SLEEVES AND LINTELS

A. Each Contractor shall provide pipe sleeves and lintels for all 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 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. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.5 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 duct and pipe openings.

2.6 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.

2.7 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 FIRE SUPPRESSION 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.

B. Supports Requirements:

1. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.

2. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
3. 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, 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. 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.

E. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof deck (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.

F. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
G. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Steel (Std. Weight or Heavier – Liquid Service):</td>
<td></td>
</tr>
<tr>
<td>1-1/4” &amp; under</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>1-1/2”</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>2”</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>2-1/2”</td>
<td>11'-0&quot;</td>
</tr>
<tr>
<td>3”</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>4” &amp; larger</td>
<td>12'-0&quot;</td>
</tr>
</tbody>
</table>

2. Installation of hangers shall conform to MSS SP-58 and applicable NFPA standards.

END OF SECTION
FIRE SUPPRESSION IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of products installed under Division 21.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS


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:

<table>
<thead>
<tr>
<th>O.D. of Pipe or Insulation</th>
<th>Marker Length</th>
<th>Size of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 1-1/4”</td>
<td>8”</td>
<td>1/2”</td>
</tr>
<tr>
<td>1-1/2” to 2”</td>
<td>8”</td>
<td>3/4”</td>
</tr>
<tr>
<td>2-1/2” to 6”</td>
<td>12”</td>
<td>1-1/4”</td>
</tr>
</tbody>
</table>

Plastic tags may be used for outside diameters under 3/4”.

B. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.

C. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

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. 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. 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.

4. Underground Pipe Markers: Install 8” to 10” below grade, directly above buried pipes.

3.2 SCHEDULE

A. Pipes to be marked:

<table>
<thead>
<tr>
<th>Pipe Service</th>
<th>Lettering Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Protection Water</td>
<td>White</td>
<td>Red</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

B. Wet-Pipe Sprinkler System.

1.2 QUALITY ASSURANCE

B. Equipment and Components: Bear UL label or marking.
C. Valves: Bear UL label or marking. Provide manufacturer’s name and pressure rating marked on valve body. Pressure rating shall match specified pipe system pressure rating. Remanufactured valves are not acceptable.
D. Specialist Firm: Company specializing in sprinkler systems with minimum three years experience.
E. Sprinkler design drawings submitted by the Contractor shall be prepared by a NICET Water-Based Fire Protection Systems Layout Level III or Level IV designer or PE, and signed and sealed by a Professional Engineer licensed in the state where the project is located.

1.3 SUBMITTALS

A. Submit shop drawings per Section 21 05 00. Indicate pipe materials, joining methods, supports, floor and wall penetration seals, sprinklers, equipment data and ratings, and hydraulic calculations.
B. Submit detailed pipe and sprinkler layout and other calculations and forms as described in NFPA 13.
C. Submit detailed working drawings and obtain review of them in the following order:

1. Engineer/Architect.
2. State Fire Marshal/Authority Having Jurisdiction
3. Owner’s Insurance Company
4. Architect/Engineer
5. Local Fire Department
6. Owner’s Insurance Company
7. Architect/Engineer

Begin construction after all approvals are received.
D. Working drawings shall include piping and sprinkler layout, sprinkler types and ratings, sections and elevations at critical points. Show coordination with lighting, ductwork, and diffusers, and indicate basic flow and hydraulic design information, including main location and date that the test was taken.


1.4 DELIVERY, STORAGE, AND HANDLING

A. Store valves and sprinklers in shipping containers, with labels in place.
B. Provide temporary protective coating on iron and steel valves.
C. Maintain temporary end caps and closures in place until installation.

1.5 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves to General Contractor for placement in walls and floors. Sleeve location to be determined by the Fire Protection Contractor prior to construction. If additional sleeves are required, they shall be core drilled by the Fire Protection Contractor.

1.6 SYSTEM DESCRIPTION

A. System shall cover building areas noted.
B. System shall interface with building fire alarm system. Provide all required wiring.
C. Provide wet pipe sprinkler system to NFPA 13 and building code requirements as required by Owner’s insurance company and as shown on the drawings.

1.7 REGULATORY REQUIREMENTS

A. All material, equipment, and installation shall be approved by the Authorities Having Jurisdiction and the Owner’s Insurance Company.
B. The Authorities Having Jurisdiction and the Owner’s Insurance Company shall have precedence over the drawings and specifications in case of discrepancies.
C. The entire installation shall comply with all applicable codes.

1.8 SYSTEM DESIGN

A. Design and install a complete, hydraulically calculated wet-pipe sprinkler system for the entire building.
B. Provide all required equipment and accessories.
C. System shall include a 5 psi allowance for future decrease in available pressure and an allowance for inside and outside hose streams.

D. Provide monitor switches on all shutoff valves.

E. Install sprinkler riser in location shown on drawings or as approved by the Architect/Engineer.

F. Provide pressure gauge with valve in the main riser.

1.9 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 21 05 00 for required fire protection systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit manufacturers’ operation and maintenance data. Include written maintenance data on components of system, servicing requirements, and record drawings.

1.11 JOB CONDITIONS

A. Fire Protection Contractor shall determine the flow and pressure available at the service connection. The Fire Protection Contractor is responsible to verify this information and make all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than 18 months.

B. Pipe sizing shown on drawings for service entrance and main risers is preliminary for coordination purposes only. Contractor is responsible for final sizing from hydraulic calculations.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Steel Pipe (Inside Building-Above Grade):

1. Pipe: 2” and Under - Schedule 40, black steel, ASTM A53. Threaded and coupled or flanged.

2. Joints: 2” and under - screwed or flanged.

B. Steel Pipe (Inside Building-Above Grade):

1. Pipe: 2-1/2” and Over - Schedule 10, black steel, grooved, ASTM A135.
2. Joints: Mechanically coupled grooved.
3. Fittings: 500 lb. WOG, black, malleable iron, ASTM A47.
4. Plain end fittings and couplings are not acceptable.

2.2 FLEXIBLE SPRINKLER HOSE WITH THREADED END FITTINGS

A. UL listed per UL 2443.
B. Construction:

1. Hose:
   a. Type 304 stainless steel.
   b. Straight or elbow hose - maximum six (6)-foot hose length.
   c. 1/2” or 3/4” outlet.
   d. 175 psi rated pressure.
   e. Leak-tested minimum 7/8”.
   f. Minimum 7/8” hose Braided hose.
   g. O-ring sealed joints are not acceptable.

2. Ceiling Bracket:
   a. Zinc plated or galvanized steel – 24” and 48” sizes.
   b. Flexible hose attachment: Open hub or set screw.

3. Unit may be prepackaged with sprinkler head.

C. Acceptable Manufacturers: FlexHead Industries, Victaulic Aquaflex.

2.3 UNIONS AND COUPLINGS

A. Unions: 175 psi malleable iron for threaded ferrous piping.
B. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular and longitudinal deflection; “C” shaped composition sealing gasket, steel bolts, nuts, and washers. 175 psi, ASTM A47. Plain end fittings and couplings are not acceptable. Rolled groove couplings for Schedule 10 pipe. Cut groove couplings for Schedule 40 pipe. Couplings shall be enamel coated for wet systems. Acceptable Manufacturers: Victaulic, ITT, Grinnell, Central, Star Fittings.
C. Coupling gaskets for wet systems shall be Grade “E” EDPM Type A.
2.4 EQUIPMENT

A. Equipment shall be as scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPING

A. General Installation Requirements:

1. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over sprinkler piping and sprinklers.

2. Ream pipe and tube ends to full inside diameter. Remove burrs. Remove scale and foreign material, inside and outside, before assembly.

3. Die cut screw joints with full cut standard taper pipe threads.

4. Coat threads with pipe joint compound or wrap with Teflon tape.

5. Locate piping to minimize obstruction of other work.

6. Route piping in concealed spaces above finished ceiling.

7. Use full and double lengths of pipe wherever possible.

8. Slope all piping for complete drainage. Install auxiliary drains for all trapped piping per NFPA 13.

9. 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.

10. Comply with manufacturer’s installation instructions.

B. Steel Piping:

1. In steel piping, main sized saddle branch connections or direct connection of branches to main is permitted if main is one pipe size larger than the branch for up to 6" mains and if main is two pipe sizes larger than branch for 8" and larger mains. Do not project branch pipes into main pipes.

C. Wall/Floor Penetration:

1. Provide sleeves when penetrating floors and walls.
2. Seal pipes passing through exterior walls with a wall seal per Section 21 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe. Sleeves through floors shall extend minimum 1.5” above finished floor.

3. Fire seal all pipe and sleeve penetrations (both wall and floor) to maintain fire separation required without restraining pipe.

D. 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. Fire protection equipment dedicated to the electrical equipment room or space may be installed above equipment if other alternatives are not available.

E. Hangers and Supports:

1. Provide hangers and supports as required by NFPA 13 and UL, with the following exceptions:
   a. Do not use powder driven devices, explosive devices, wooden plugs, or plastic inserts.
   b. Do not install fasteners to carry the load in tension, unless absolutely necessary.

F. Exposed Piping:

1. Install chrome plated steel escutcheons where exposed pipes penetrate walls or floors.

3.2 INSTALLATION - EQUIPMENT

A. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over system equipment and sprinklers.

B. Test Valves:

1. Install test valves where required. Pipe to outdoors or drain. Test connection shall have flow equivalent to the smallest K-factor sprinkler.

C. Sprinklers:

1. Locate sprinklers to clear lights, ducts and diffusers. Do not run sprinkler pipes through ducts. Ductwork has priority over sprinkler pipes. Offset pipes as needed.

2. Center sprinklers in two directions in ceiling tiles and provide offsets as required.
3. Do not allow concealed sprinkler cover plates to be painted. Sprinkler cover plates are to be factory painted only. Do not field paint.

4. Apply strippable or paper covers so concealed sprinkler cover plates do not receive field paint finish.

3.3 SYSTEMS CLEANING AND TESTING

A. General Requirement:
   1. All water used for testing and remaining in the piping system shall be obtained from a potable water source.

B. Interior Piping:
   1. Verify adequate water flow at the inspector's test connection.
   2. Flush all interior piping to remove scale and other foreign material before placing system into service.
   3. Hydrostatically test the entire interior piping system at a minimum of 200 psig or 50 psig in excess of the normal system working pressure for systems subjected to pressures in excess of 150 psig. Maintain test pressure for 2 hours without loss of pressure.

C. Fire Alarm System:
   1. Test the alarm system by operating the inspector's test connection or the alarm test valves. Verify that the building fire alarm system activates.
   2. Adjust all monitor switches for proper operation.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced in the 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.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Scope of Work:

1. **Plumbing Work** shall include, but is not necessarily limited to:
   
   a. Furnish and install all items listed in the Plumbing Material List.
   
   b. Extend existing domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
   
   c. Extend existing compressed air to headwalls provided by the Owner.
   
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

2. **Heating Work** shall include, but is not necessarily limited to:

   a. Extend existing heating water system including piping, insulation, terminal heating equipment, and specialties. Make final connections to all coils, including those furnished by others.

   b. Extend existing reheat water system including piping, insulation, and connections to terminal heating coils.
c. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

3. **Air Conditioning and Ventilating Work** shall include, but is not necessarily limited to:
   a. Extend existing supply air ductwork systems including all fittings, insulation, and outlets.
   b. Extend existing return air ductwork systems including all fittings, insulation, and inlets.
   c. Furnish and install all terminal air boxes and reheat coils.
   d. Furnish and install all temperature control systems.
   e. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

4. **Temperature Control Work** shall include, but is not necessarily limited to:
   a. Extend existing temperature control system as specified in Section 23 09 00.
   b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
   c. Furnish automatic control valves for installation by others.
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

5. **Fire Protection Work** shall include, but is not necessarily limited to:
   a. Extend existing wet pipe sprinkler system for areas noted on the drawings.
   b. Furnish and install all items listed on the Fire Protection Material List.
   c. Furnish all hydraulic calculations and working sprinkler drawings.
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.
6. **Testing, Adjusting, and Balancing Work** shall include, but is not necessarily limited to:

   a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.

1.3 **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. Itemize all work and list associated hours and pay scale for each item.

1.4 **ALTERNATES**

   A. Alternate 1 will be a portion of work in the northwest corner of the project area (current lab, storage, and office areas). This will be an ADDITIVE ALTERNATE.

      1. Refer to plan view drawing for Alternate #1 plan layout.

   B. Alternate 2 will be the portion of work in the southwest corner of the project area (classroom). This will be an ADDITIVE ALTERNATE.

      1. Refer to plan view drawings for Alternate #2 plan layout.

   C. Alternate 3: Electrical only; no mechanical as part of this alternate.

   D. Alternate 4 will be the reheat heating water piping. This will be an ADDITIVE ALTERNATE.

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.

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, 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 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. 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 all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.

2. 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 Contractor.
   c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

3. 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 Contractor when so noted on the Electrical Drawings.

3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. 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.

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.

1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

   a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, hydronic piping, and any item that may impact coordination with other disciplines.

   b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5” and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

   c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5” and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

   d. Maintenance clearances and code-required dedicated space shall be included.

   e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

   a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. KJWW 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 KJWW. KJWW will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

   a. Scale of drawings:

      1) General plans: 1/4 Inch = 1 '-0" (minimum).

      2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).

      3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).

      4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).

      5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.

3. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.
DIVISION 22 - PLUMBING
22.05.00 - Basic Plumbing Requirements

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner’s Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.

2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.

4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.

8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

   a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

   b. Potential layout changes shall be made to avoid additional access panels.

   c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.

   d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner’s Representative.
e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.

11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.

12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.7 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 City of Dixon, Illinois Codes, Laws, Ordinances and other regulations having jurisdiction.

2. Conform to all State Codes.
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. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.

F. Examination of Drawings:

1. The drawings for the plumbing 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.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.
H. 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 KJWW.

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 KJWW 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 KJWW as to the accuracy or correctness of the information provided. KJWW accepts no responsibility or liability for the Contractor’s use of these documents.

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:

<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Submittal Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 05 00</td>
<td>Owner Training Agenda</td>
</tr>
<tr>
<td>22 07 19</td>
<td>Plumbing Pipe Insulation</td>
</tr>
<tr>
<td>Refer to drawings</td>
<td>Items in Plumbing Material List</td>
</tr>
</tbody>
</table>
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; 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, 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: 22 XX XX.description.YYYYMMDD
b. Transmittal file name: 22 XX XX.description.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

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 the cost for each of the following:
   a. Overhead and profit.
   b. Bonds.
   c. Insurance.
   d. General Requirements: Itemize all requirements.

2. 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.
   a. Contractor’s own labor forces.
   b. All subcontractors.
   c. All major suppliers of products or equipment.

3. Break down all costs into:
   a. Material: Delivered cost of product with taxes paid.
   b. Labor: Labor cost, excluding overhead and profit.

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 aboveground piping system (sanitary, storm, domestic water, etc.). Break down the material and labor for each piping system based on geography (building, floor, wing and/or phase).

b. Pipe insulation with separate material and labor line items for each piping system listed above.

c. Each plumbing fixture (e.g., WC, lavatory, sink, etc.). Multiple units of the same type can be listed together, provided quantities are also listed so unit costs can be determined.

d. Water balancing

e. Record drawings

f. 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 & 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. 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, 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.

1.13 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.

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 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.
   2. 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 wall penetrations are sealed.
      c. Pipe identification and valve tags are installed.
   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.
3.3 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. 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.

C. 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 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; receipt by Architect/Engineer required prior to final payment approval.

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.div22.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as “1 of 2”, “2 of 2”, etc.

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. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.


7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

8. Dimensional drawings of equipment.

9. Capacities and utility consumption of equipment.

10. Detailed parts lists with lists of suppliers.

11. Operating procedures for each system.

12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.

13. Repair procedures for major components.

14. List of lubricants in all equipment and recommended frequency of lubrication.

15. Instruction books, cards, and manuals furnished with the equipment.

3.5 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. The instructions shall include:

1. Maintenance of equipment.
2. Explanation of seasonal system changes.

D. 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.
E. 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.

F. 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.

3.6 RECORD DOCUMENTS

A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of plumbing drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the plumbing systems.

B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, 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; Change Orders; concealed control system devices.

C. Before completion of the project, a set of reproducible plumbing 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.

D. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

E. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.
3.7 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 areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.8 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, 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.

END OF SECTION
READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

In order 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 plumbing fixtures installed and caulked.
3. Pipe insulation complete, pipes labeled and valves tagged.

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.

* * * * *
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 plumbing 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 Plumbing System: Maintain service to all plumbing fixtures until new piping is installed. Obtain permission from Owner at least 48 hours before shutting down system for any reason. Make changeover to new piping with minimum outage. Do not disconnect any roof drainage piping until new piping is in place and operational.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing plumbing work under provisions of Division 2 and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned piping to source of supply and/or main lines.

D. Remove exposed abandoned pipes, including abandoned pipes above accessible ceilings. 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. Extend existing installations using materials and methods compatible with existing installations, or as specified.

H. Remove unused sections of domestic water piping back to mains and cap. Capped pipe shall be less than 2 feet from main to prevent “dead legs”.

I. Temporarily cap all openings to the sanitary and vent system to prevent odor from entering the work area and building.

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 22 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. 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. PLUMBING 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.

END OF SECTION
PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.
B. Sleeves and Seals.
C. Flashing and Sealing of Equipment and Pipe Stacks.
D. Cutting of Openings.
E. Escutcheon Plates and Trim.

1.2 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:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Hanger Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” and smaller</td>
<td>3/8”</td>
</tr>
<tr>
<td>2-1/2” through 3-1/2”</td>
<td>1/2”</td>
</tr>
</tbody>
</table>

Column #1: Copper and plastic 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.

2.2 PIPE HANGERS AND SUPPORTS

A. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58 and 127 (where applicable).

B. 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.
C. Ferrous hot piping 2-1/2 inches and larger shall have steel saddles tack welded to the pipe at each support at a depth not less than the specified 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

D. On all insulated piping, provide a semi-cylindrical metallic shield and fire resistant vapor barrier jacket.

E. As an alternative to separate pipe insulation insert and saddle, properly sized integral rigid insulation sections may be used for this application.

Acceptable Products:

Cooper/B-Line - Fig. B3380 through B3384
Pipe Shields - A1000, A2000
Erico - Model 124, 127

F. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required by applicable codes (the Illinois Plumbing Code requires 10 foot maximum spacing for support of copper risers), but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings or lugs welded to the pipe. Provide sufficient flexibility to accommodate expansion and contraction without compromising fire barrier penetrations and other fixed takeoff locations.

Acceptable Products:

Anvil - Fig. CT121
Cooper/B-Line - Fig. B3373CT
Erico - Model 510
Nibco/Tolco - Fig. 82

G. Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Insulate over mounts.

Acceptable Products: Mason RBA, RCA, or BR.

H. Hangers in direct contact with copper pipe shall be coated with plastic with appropriate temperature range. HYDRA-ZORB clamps are permitted for this application for bare pipes within their temperature limits of -65°F to +275°F.
I. Unless otherwise indicated, hangers shall be as follows:

1. **Clevis Type:**
   - **Service:**
     - Bare Metal Pipe
     - Insulated Cold Pipe
     - Insulated Hot Pipe - 3 inches & Smaller

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>Bare Steel, Plastic or Insulated Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 260</td>
<td></td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. 3100</td>
<td>Fig. B3100C</td>
</tr>
<tr>
<td>Erico</td>
<td>Model 400</td>
<td></td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 1</td>
<td>Fig. 81PVC</td>
</tr>
</tbody>
</table>

J. 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.

1. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

K. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

1. **Clamp Type:**
   - **Service:**
     - Bare Metal Pipe
     - Insulated Cold Pipe
     - Insulated Hot Pipe - 3 inches and smaller

   a. Clamps in direct contact with copper pipe shall be plastic coated.

   b. Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>Bare Steel, Plastic or Insulated Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut</td>
<td>Fig. P1100 or P2500</td>
<td></td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B2000 or B2400</td>
<td>Fig. BVT</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. A-14 or 2STR</td>
<td></td>
</tr>
</tbody>
</table>
L. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

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.

M. Copper piping located in an exposed area, including indirect waste piping in janitors closets, shall use split ring standoff hangers for copper tubing. Support shall have copper electroplating for corrosion resistance. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

   **Acceptable Products:**
   - Erico/M-Co  
     Model #456
   - B-Line  
     Fig. 3198HCT
   - Anvil  
     Fig. CT138R
   - Nibco/Tolco  
     Fig. 301CT

N. 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.
2.3 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.

2.4 PIPE SLEEVES AND LINTELS

A. Each Contractor shall provide pipe sleeves and lintels for all 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. 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.

G. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
2.5 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.

2.6 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.

2.7 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 PLUMBING SUPPORTS

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.

B. Supports Requirements:

1. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.

2. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.
C. Pipe Requirements:

1. Support all piping and equipment, including valves, 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 cast iron soil pipe, grooved end steel pipe with mechanical couplings, and glass pipe.

D. 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.

E. 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.

F. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

G. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel (Std. Weight or Heavier – Liquid Service):</td>
<td></td>
</tr>
<tr>
<td>1-1/4&quot; &amp; under</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>Pipe Material</td>
<td>Maximum Spacing</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Hard Drawn Copper &amp; Brass (Liquid Service):</td>
<td></td>
</tr>
<tr>
<td>3/4” and under</td>
<td>5'-0”</td>
</tr>
<tr>
<td>1”</td>
<td>6'-0”</td>
</tr>
<tr>
<td>1-1/4”</td>
<td>7'-0”</td>
</tr>
<tr>
<td>1-1/2”</td>
<td>8'-0”</td>
</tr>
</tbody>
</table>

3. Installation of hangers shall conform to MSS SP-58 and the applicable Plumbing Code.

END OF SECTION
PLUMBING 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 SUBMITTALS

A. Submit shop drawings per Section 22 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 75°F; 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).

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.

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 new 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”/75 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.

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:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Shield Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2” to 3-1/2”</td>
<td>12” long x 18 gauge</td>
</tr>
</tbody>
</table>

7. All piping and insulation that does not meet 25/50 that is located 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.

8. On 1” and smaller piping routed through metal wall studs, provide a plastic grommet to protect the piping. The piping shall be insulated between the wall studs, and the insulation shall butt up to each stud.

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. 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 At or Above 140°F:

1. Insulate fittings, valves, flanges, and strainers.

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.

D. 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. On exposed piping serving plumbing fixtures, the piping does not need to be insulated if less than four feet in developed length. If piping is longer than four feet in developed length, the piping shall be insulated and have a plastic jacket.

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 60°F, seal fitting covers with vapor retarder mastic in addition to tape.
3.4 SCHEDULE

<table>
<thead>
<tr>
<th>Piping System</th>
<th>Insulation Type/Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Domestic Hot Water &amp; Circulating - Potable and Non-Potable - up to 140°F</td>
<td></td>
</tr>
<tr>
<td>Up to 1-1/2” Pipe Size</td>
<td>A / 1”</td>
</tr>
<tr>
<td>Above 1-1/2” Pipe Size</td>
<td>A / 1-1/2”</td>
</tr>
<tr>
<td>B. Domestic Cold Water - Potable and Non-Potable</td>
<td>A / 1”</td>
</tr>
</tbody>
</table>

END OF SECTION
PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings.
B. Valves.
C. Domestic Water Piping System.

1.2 QUALITY ASSURANCE

A. Valves: Manufacturer’s name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

1.4 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 22 05 00 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 COLD WATER - POTABLE AND NON-POTABLE

A. Design Pressure: 175 psi.
Maximum Design Temperature: 200°F.

B. Piping - All Sizes:

1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.
2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
C. Shutoff Valves:

1. Ball Valves:

   a. BA-1:

      1) 3" and under, 150 psi saturated steam, 600 psi CWP, 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-255-FB-P-UL BR1-R, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.

   NOTES:

      a) Provide extended shaft for all valves in insulated piping.

      b) 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.

D. Strainers:

1. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi CWP @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.

2.2 SANITARY DRAINAGE (ABOVE GROUND)

SANITARY INDIRECT DRAINAGE (ABOVE GROUND)

SANITARY VENT (ABOVE GROUND)

A. Design Pressure: Gravity
   Maximum Design Temperature: 180°F

B. Piping - All Sizes:

1. Pipe and Fittings: Standard weight cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.

2. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
3. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

2.3 UNIONS
A. Copper pipe - wrought copper fitting - ground joint.

2.4 AIR VENTS
A. Provide means for venting air at all high points in the piping system and at all other points where air may be trapped.
B. 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.

2.5 STRainers
A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>1/4&quot; - 2&quot; water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3/64&quot;</td>
</tr>
</tbody>
</table>

B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.
C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

2.6 DRAIN VALVES
A. Drain valves shall be shutoff valves as specified for the intended service with added 3/4" male hose thread outlet and cap.

2.7 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, and stainless steel are commonly used and require isolation from each other with the following exceptions:
   1. Iron, steel, and stainless steel connected to each other.
2. Brass, copper, and bronze connected to each other.

3. Brass or bronze valves and specialties connected to steel, iron, or stainless steel in closed systems. Where two brass or bronze items occur together, they shall be connected with brass nipples.

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.

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.

2.8 LOCK OUT TRIM

A. Provide lock out trim for all quarter turn shutoff valves opening to atmosphere and installed in domestic water piping over 120°F, in compressed air piping, and as indicated on the drawings.

2.9 VALVE OPERATORS

A. Provide handwheels for gate valves and gear operators for butterfly valves.
2.10 VALVE CONNECTIONS

A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install all products per manufacturer’s recommendations.
B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
C. Remove scale and dirt, on inside and outside, before assembly.

3.2 TESTING PIPING

A. Sanitary Drainage:
   Sanitary Vent:
   1. Test all piping with water to prove tight.
   2. Test piping before insulation is applied.
   3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
   4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
   5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
   6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
   7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.

B. Hot Water - Potable and Non-Potable:
   Cold Water - Potable and Non-Potable:
   1. Test pipes in chases and walls before piping is concealed.
   2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
   3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen.
4. Hold test pressure for at least 2 hours.

5. Test to be witnessed by the Architect/Engineer’s representative, if requested by the Architect/Engineer.

C. All Other Piping:
   1. Test piping at 150% of normal operating pressure.
   2. Piping shall hold this pressure for one hour with no drop in pressure.
   3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
   4. Drain and clean all piping after testing is complete.

3.3 CLEANING PIPING

A. Assembly:
   1. Before assembling pipe systems, 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’s representative. Blow chips and burrs from machinery or thread cutting operation 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.
   3. Notify the Architect/Engineer’s representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer’s representative with regard to specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
   4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

B. All Water Piping:
   1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
   2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
   3. If necessary, remove valves to clean out all foreign material.
3.4 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.

2. Route piping in orderly manner and maintain gradient. Install to conserve building space.

3. Group piping whenever practical at common elevations.

4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.

5. Slope water piping and arrange to drain at low points.

6. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.

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.

C. Valves/Fittings and Accessories:

1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.

2. Provide clearance for installation of insulation and access to valves and fittings.

3. Provide access doors for concealed valves and fittings.

4. Install valve stems upright or horizontal, not inverted.

5. Provide one plug valve wrench for every ten plug valves 2” and smaller, minimum of one. Provide each plug valve 2-1/2” and larger with a wrench with set screw.

6. Install balancing valves with straight, unobstructed pipe section both upstream and downstream as required, per manufacturer’s installation instructions.
7. Install corrugated, stainless steel tubing system according to manufacturer’s written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

3.5 PIPE ERECTION AND LAYING

A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.

B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data 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 install any item that is not clean.

D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.

E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.

F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.

G. Provide flanges or unions at all final connections to equipment, traps and valves.

H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.

I. Use full and double lengths of pipe wherever possible.

J. Unless otherwise indicated, install all 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 equipment.

K. 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.
L. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.

3.6 DRAINING AND VENTING

A. Unless otherwise indicated on the drawings, all horizontal water lines, including branches, shall pitch 1” in 40 feet to low points for complete drainage, removal of condensate and venting.

B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.

C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.

D. Provide drip legs at low points and at the base of all risers in compressed air pipes. Drip legs shall be full line size on pipes through 4” and at least 4”, but not less than half line size over 4”. Drip legs shall be 12” minimum length, capped with a reducer to a drain valve.

E. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install compressed air and gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.

F. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.

G. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8” pipe from the tapping location to an accessible location and terminate with a venting device.

H. All vent and drain piping shall be of same materials and construction for the service involved.

3.7 BRANCH CONNECTIONS

A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.

B. 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.
C. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:

1. Domestic water piping above grade.

D. Further limit use of mechanically formed fittings as follows:

1. Must have at least same pressure rating as the main.
2. Main must be type K or L copper tubing.
3. Permanent marking shall indicate insertion depth and orientation.
4. Branch pipe shall conform to the inner curve of the piping main.
5. Main must be 1" or larger.
6. Branch must be 3/4" or larger.

E. Branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.

F. Forged weld-on fittings are limited as follows:

1. Must have at least same pressure rating as the main.
2. Main must be 2-1/2" or larger.
3. Branch line is at least two pipe sizes under main size.

3.8 JOINING OF PIPE

A. Solder Joints:

1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are 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, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.

2. Flux shall be non-acid type.

3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.

B. Mechanical Joints:

1. Joints shall conform to ANSI A21.11 "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings". Gasket material shall be neoprene. The standard bolts and nuts of the pipe manufacturer shall be used and shall be coated at the factory with rust preventive lubricant after threading and tapping.
2. Final tightening of bolts shall be with a torque wrench to insure equal tension in all bolts.

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Provide necessary connections at the start of individual sections of mains for adding chlorine.

B. Before starting work, verify system is complete, flushed and clean.

C. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.

F. Verify initial chlorination levels by testing at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main.

G. Maintain disinfectant in system for 24 hours, after which test at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main. If final disinfectant residual tests less than 25 mg/L at any one of the tested outlets, flush the entire system and repeat disinfection and testing procedure.

H. After final disinfectant residuals test at or above 25 mg/L after a minimum 24-hour duration, flush disinfectant from system at a minimum velocity of 3.0 feet/second until residual is equal to that of incoming water or 1.0 mg/L.

I. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.

END OF SECTION
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Traps.

1.2 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 22 05 00.

B. Include sizes, rough-in requirements, service sizes, and finishes.

PART 2 - PRODUCTS

2.1 TRAPS

A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be:

1. Chromium plated cast brass when used with plumbing fixtures or when installed exposed in finished spaces.

2. Insulated at accessible lavatories.

3. Cast iron, deep-seal pattern where concealed above ceiling, below grade or in unfinished areas.

4. Deep-seal pattern of the same material and/or coating where drainage lines are of special materials or coatings such as polypropylene, PVDF, CPVC, etc.

B. All traps shall have accessible, removable cleanouts, except where installed on floor drains with removable strainers.

C. Each trap shall be completely filled with water at the end of construction but before building space turnover to the Owner.
PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Coordinate construction to receive drains at required invert elevations.

B. Install all items per manufacturer's instructions.

END OF SECTION
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 in the 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.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Scope of Work:

1. **Plumbing Work** shall include, but is not necessarily limited to:
   a. Furnish and install all items listed in the Plumbing Material List.
   
   b. Extend existing domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
   
   c. Extend existing compressed air to headwalls provided by the Owner.
   
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.

2. **Heating Work** shall include, but is not necessarily limited to:
   a. Extend existing heating water system including piping, insulation, terminal heating equipment, and specialties. Make final connections to all coils, including those furnished by others.
   
   b. Extend existing reheat water system including piping, insulation, and connections to terminal heating coils.
c. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

3. **Air Conditioning and Ventilating Work** shall include, but is not necessarily limited to:
   a. Extend existing supply air ductwork systems including all fittings, insulation, and outlets.
   b. Extend existing return air ductwork systems including all fittings, insulation, and inlets.
   c. Furnish and install all terminal air boxes and reheat coils.
   d. Furnish and install all temperature control systems.
   e. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

4. **Temperature Control Work** shall include, but is not necessarily limited to:
   a. Extend existing temperature control system as specified in Section 23 09 00.
   b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
   c. Furnish automatic control valves for installation by others.
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

5. **Fire Protection Work** shall include, but is not necessarily limited to:
   a. Extend existing wet pipe sprinkler system for areas noted on the drawings.
   b. Furnish and install all items listed on the Fire Protection Material List.
   c. Furnish all hydraulic calculations and working sprinkler drawings.
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

6. **Testing, Adjusting, and Balancing Work** shall include, but is not necessarily limited to:
   a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.
1.3 ALTERNATES

A. Alternate 1 will be a portion of work in the northwest corner of the project area (current lab, storage and office areas). This will be an ADDITIVE ALTERNATE.

1. Refer to plan view drawing for Alternate #1 plan layout.

B. Alternate 2 will be the portion of work in the southwest corner of the project area (classroom). This will be an ADDITIVE ALTERNATE.

1. Refer to plan view drawings for Alternate #2 plan layout.

C. Alternate 3: Electrical only; no mechanical as part of this alternate.

D. Alternate 4 will be the reheat heating water piping. This will be an ADDITIVE ALTERNATE.

1. This shall include all branch heating water supply, heating water return, and hydronic accessories up to both the new terminal air box reheat coil and the existing vertical main. Refer to terminal air box coil piping detail and control diagram for more details.

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. 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.

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, 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 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. 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 all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.

2. 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 Contractor.
   c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

3. 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 Contractor when so noted on the Electrical Drawings.

3. Provides motor control and temperature control wiring, where so noted on the drawings.

4. 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.

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.
1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

   a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, hydronic piping, and any item that may impact coordination with other disciplines.

   b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5” and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

   c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5” and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

   d. Maintenance clearances and code-required dedicated space shall be included.

   e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.

2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. KJWW 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 KJWW. KJWW will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

a. Scale of drawings:

   1) General plans: 1/4 Inch = 1 ’-0” (minimum).

   2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1’-0” (minimum).

   3) Shafts and risers: 1/2 Inch = 1’-0” (minimum).

   4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 ‘-0” (minimum).

   5) Sections of congested areas: 1/2 Inch = 1’-0” (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.

3. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner’s Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.

2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.

8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
   a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
   b. Potential layout changes shall be made to avoid additional access panels.
   c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
   d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
   e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.

11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.

12. Updated coordination drawings that reflect as-built conditions may be used as record documents.
1.7 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 City of Dixon, Illinois Codes, Laws, Ordinances and other regulations having jurisdiction.
   2. Conform to all State Codes.
   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. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.

2. Comply with all utility company requirements.

3. Make application for and pay for service connections, such as gas.

4. Make application for and pay for all meters and metering systems required by the utility company.

F. 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.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. 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 KJWW.

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 KJWW 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 KJWW as to the accuracy or correctness of the information provided. KJWW accepts no responsibility or liability for the Contractor’s use of these documents.

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:

<table>
<thead>
<tr>
<th>Referenced Specification Section</th>
<th>Submittal Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 05 00</td>
<td>Owner Training Agenda</td>
</tr>
<tr>
<td>23 05 93</td>
<td>Testing, Adjusting, and Balancing</td>
</tr>
<tr>
<td>23 09 00</td>
<td>Controls</td>
</tr>
<tr>
<td>23 09 13</td>
<td>Instrumentation</td>
</tr>
<tr>
<td>23 36 00</td>
<td>Terminal Air Boxes</td>
</tr>
<tr>
<td>23 37 00</td>
<td>Grilles, Registers, and Diffusers</td>
</tr>
</tbody>
</table>

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; 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, 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: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

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 the cost for each of the following:
   a. Overhead and profit.
   b. Bonds.
   c. Insurance.
   d. General Requirements: Itemize all requirements.

2. 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.
   a. Contractor’s own labor forces.
   b. All subcontractors.
   c. All major suppliers of products or equipment.

3. Break down all costs into:
   a. Material: Delivered cost of product with taxes paid.
   b. Labor: Labor cost, excluding overhead and profit.

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 type of small unitary equipment (e.g., FCUs, UHs, CABs, etc.). Multiple units of the same type can be listed together, provided quantities are also listed so unit costs can be determined.
   b. Each piping system (chilled water, heating water, steam, condensate, etc.). In addition, for larger projects, break down the material and labor for each piping system based on geography (building, floor, and/or wing).
   c. Each duct system (supply, return, relief, outside air, etc.) listed separately for each unit they serve (AHU-1 supply air ductwork, AHU-1 return air ductwork, etc.).
   d. Pipe insulation with separate material and labor line items for each piping system listed above.
   e. Duct insulation with separate material and labor line items for each duct system listed above.
   f. Temperature controls broken down into material and labor for the following:
      1) Engineering
      2) Controllers, devices, sensors, etc.
      3) Control valves
      4) Control dampers
      5) Conduit
      6) Wiring
7) Programming
8) Commissioning

g. Site utilities (5’ beyond building)
h. Air balancing
i. Water balancing
j. Commissioning
k. Record drawings
l. 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 & 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.

1.12 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.

1.13 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.

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 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.
2. 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.
3.3 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. 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.

C. 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 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.


5. 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.

3.4 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.div23.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as “1 of 2”, “2 of 2”, etc.

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.


8. Schematic 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.

3.5 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. The instructions shall include:

1. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.

2. Maintenance of equipment.
3. Explanation of seasonal system changes.

D. 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.

E. Minimum hours of instruction for each item shall be:

1. Temperature Controls - As defined in Section 23 09 00.

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.

3.6 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. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
E. Record changes daily and keep the marked drawings available for the
Architect/Engineer's examination at any normal work time.

F. Upon completing the job, and before final payment is made, give the marked-up
drawings to the Architect/Engineer.

3.7 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 rubbish, debris, etc., accumulated during construction from the premises.

3.8 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.

END OF SECTION
READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

In order 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 miscellaneous mechanical systems operating.
3. All temperature control systems operating, programmed and calibrated.
4. Pipe insulation complete, pipes labeled and valves tagged.

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.

* * * * *
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 draining system. Minimize outage duration.

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. 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.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.
B. Sleeves and Seals.
C. Flashing and Sealing of Equipment and Pipe Stacks.
D. Cutting of Openings.
E. Escutcheon Plates and Trim.

1.2 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:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Column #1</th>
<th>Column #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” and smaller</td>
<td>3/8”</td>
<td>3/8”</td>
</tr>
<tr>
<td>2-1/2” through 3-5/8”</td>
<td>1/2”</td>
<td>1/2”</td>
</tr>
</tbody>
</table>

Column #1: Steel pipe.
Column #2: Copper 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.

2.2 PIPE HANGERS AND SUPPORTS

A. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58 and 127 (where applicable).

B. 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.
C. Ferrous hot piping 2-1/2 inches and larger shall have steel saddles tack welded to the pipe at each support at a depth not less than the specified 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

D. On all insulated piping, provide a semi-cylindrical metallic shield and fire resistant vapor barrier jacket.

E. As an alternative to separate pipe insulation insert and saddle, properly sized integral rigid insulation sections may be used for this application.

Acceptable Products:
- Cooper/B-Line - Fig. B3380 through B3384
- Pipe Shields - A1000, A2000
- Erico - Model 124, 127

F. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required by applicable codes (the Illinois Plumbing Code requires 10 foot maximum spacing for support of copper risers), 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 without compromising fire barrier penetrations and other fixed take-off locations.

Acceptable Products:
- Anvil - Fig. CT121
- Cooper/B-Line - Fig. B3373CT
- Erico - Model 510
- Nibco/Tolco - Fig. 82

G. Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Insulate over mounts.

Acceptable Products: Mason RBA, RCA, or BR.

H. Hangers in direct contact with copper pipe shall be coated with plastic with appropriate temperature range. HYDRA-ZORB clamps are permitted for this application for bare pipes within their temperature limits of -65°F to +275°F.
I. Unless otherwise indicated, hangers shall be as follows:

1. **Clevis Type:**
   Service: Bare Metal Pipe
   Insulated Cold Pipe
   Insulated Hot Pipe - 3 inches & Smaller

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>Bare Steel, Plastic or Insulated Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 260</td>
<td></td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. 3100</td>
<td>Fig. B3100C</td>
</tr>
<tr>
<td>Erico</td>
<td>Model 400</td>
<td></td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 1</td>
<td>Fig. 81PVC</td>
</tr>
</tbody>
</table>

2. **Adjustable Swivel Ring Type:**
   Service: Bare Metal Pipe - 4 inches and Smaller

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>Bare Steel Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 69</td>
<td></td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B3170NF</td>
<td>Fig. B3170CTC</td>
</tr>
<tr>
<td>Erico</td>
<td>Model FCN</td>
<td>102A0 Series</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 200</td>
<td>Fig. 203</td>
</tr>
</tbody>
</table>

J. 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.

1. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

K. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

1. **Clamp Type:**
   Service: Bare Metal Pipe
   Insulated Cold Pipe
   Insulated Hot Pipe - 3 inches and smaller

   a. Clamps in direct contact with copper pipe shall be plastic coated.
b. Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.

<table>
<thead>
<tr>
<th>Acceptable Products</th>
<th>Bare Steel, Plastic or Insulated Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut</td>
<td>Fig. P1100 or P2500</td>
<td></td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B2000 or B2400</td>
<td>Fig. BVT</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. A-14 or 2STR</td>
<td></td>
</tr>
</tbody>
</table>

L. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

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.

M. 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.

2.3 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.

2.4 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. 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.

G. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.5 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.

2.6 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.

2.7 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.

B. Supports Requirements:

1. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.

2. 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. 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.

E. 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.

F. Do not exceed the manufacturer’s recommended maximum load for any hanger or support.

G. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Steel and Fiberglass (Std. Weight or Heavier – Liquid Service):</td>
<td></td>
</tr>
<tr>
<td>1-1/4” &amp; under</td>
<td>7'-0”</td>
</tr>
<tr>
<td>1-1/2”</td>
<td>9'-0”</td>
</tr>
<tr>
<td>2”</td>
<td>10'-0”</td>
</tr>
<tr>
<td>2. Hard Drawn Copper &amp; Brass (Liquid Service):</td>
<td></td>
</tr>
<tr>
<td>3/4” and under</td>
<td>5'-0”</td>
</tr>
<tr>
<td>1”</td>
<td>6'-0”</td>
</tr>
<tr>
<td>1-1/4”</td>
<td>7'-0”</td>
</tr>
<tr>
<td>1-1/2”</td>
<td>8'-0”</td>
</tr>
<tr>
<td>2”</td>
<td>8'-0”</td>
</tr>
</tbody>
</table>
3. Installation of hangers shall conform to MSS SP-58 and the applicable Plumbing Code.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of products installed under Division 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS


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:

<table>
<thead>
<tr>
<th>O.D. of Pipe or insulation</th>
<th>Marker Length</th>
<th>Size of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 1-1/4”</td>
<td>8”</td>
<td>1/2”</td>
</tr>
<tr>
<td>1-1/2” to 2”</td>
<td>8”</td>
<td>3/4”</td>
</tr>
<tr>
<td>2-1/2” to 6”</td>
<td>12”</td>
<td>1-1/4”</td>
</tr>
</tbody>
</table>

Plastic tags may be used for outside diameters under 3/4”.

B. Plastic Tags: Minimum 1-1/2” square or round laminated three-layer phenolic with engraved, 1/4” minimum black letters on light contrasting background.

C. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2” square or 1-1/2” round.

D. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.

E. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

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. Number all tags and show the service of the pipe.

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. 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.

E. 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.
3.2 SCHEDULE

A. Pipes to be marked:

<table>
<thead>
<tr>
<th>Pipe Service</th>
<th>Lettering Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Water Supply</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>Heating Water Return</td>
<td>Black</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjusting, and balancing of air systems.
B. Testing, adjusting, and balancing of heating systems.
C. 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

B. ADC – Test Code for Grilles, Registers, and Diffusers.
D. ASHRAE - 2003 HVAC Applications Handbook; Chapter 37, Testing, Adjusting and Balancing.

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. Submit electronic certified copies of test reports to the Architect/Engineer for approval, 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 on site 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.

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. Recorded data shall represent actual measured or observed conditions.

C. 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.

D. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.

E. 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.

F. 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.

G. 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.
DIVISION 23 - HVAC
23 05 93 - Testing, Adjusting, And Balancing

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.

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 SYSTEM PERFORMANCE REPORT

A. After the conclusion of balancing operations, utilize the building DDC system or install portable data loggers to simultaneously record temperatures and humidity during summer and winter conditions for a seven-day period, continuous over a weekend, and
including at least one period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition and within 10°F dry bulb temperature of minimum winter design condition.

B. Design Conditions:

1. Summer: 95°F DB 78°F WB
2. Winter: -15°F DB

C. Architect/Engineer will direct all test locations.

D. Report of test results shall include original recording and three reproductions.

3.7 SUBMISSION OF REPORTS

A. Fill in test results on appropriate forms.

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 to confirm capacities used in the project design are adequate. 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. Duct Traverse:

   a. System zone/branch/location.
   b. Duct size.
   c. Free area.
   d. Velocity: specified and actual.
   e. Flow rate (cfm): specified and actual.
   f. Duct static pressure.
   g. Air temperature.
   h. Air correction factor.

2. 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 electronic copies of report.

4.2 GENERAL REQUIREMENTS

A. Title Page:

1. Project name.
2. Project location.
4. Project Engineer (KJWW Engineering Consultants).
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.

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.

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 Terminal (Inlet or Outlet):
   1. Drawing symbol.
   2. Room number/location.
   3. Terminal type and size.
   5. Flow rate (cfm): specified and actual.
   6. Percent of design flow rate.

C. Air Terminal Unit (Terminal Air Box) Data:
   1. General Requirements:
      a. Drawing symbol.
      b. Location.
      c. Manufacturer and model.
      d. Size.
      e. Type: constant, variable, single, dual duct.
   2. Flow Rate:
      b. Minimum flow rate (cfm): specified and actual.
   3. Temperature:
      a. Entering air temperature: specified and actual.
      b. Leaving air temperature (in heating mode): specified and actual.
      c. Entering water temperature: specified and actual.
      d. Leaving water temperature: specified and actual.
   4. Pressure Drop and Pressure:
      a. Inlet static pressure during testing (maximum and minimum).
      b. Coil air pressure drop: specified and actual.
      c. Water pressure drop: specified and actual.

D. 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:
   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.

END OF SECTION
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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 maximum ‘K’ value at 75°F; foil scrim kraft facing, 1.0 lb./cu. ft. density.

B. 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 0.70 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.

2.2 JACKETS


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. 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.
   7. Press tape tightly to the duct covering with a squeegee for a tight continuous seal. Fish mouths and loose tape edges are not acceptable.
   8. Staples may be used, but must be covered with tape.
   9. Vapor barrier must be continuous.
   10. Mechanically fasten on 12” centers at bottom of ducts over 24” wide and on all sides of vertical ducts.

F. 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.

G. Continue insulation with vapor barrier through penetrations unless code prohibits.

H. 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.

END OF SECTION
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).

PART 2 - PRODUCTS

2.1 INSULATION

A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; 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).

2.2 VAPOR BARRIER JACkETS


2.3 JACKET COVERINGS

A. Plastic Jackets and Fitting Covers: High impact, color selection by Architect, 0.020” thick, self-extinguishing plastic. Suitable for use indoors or outdoors with ultraviolet inhibitors. Suitable for -40°F to 150°F. 25/50 maximum flame spread/smoke developed.

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.
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. Polysocyanurate 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 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.

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:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Shield Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2” to 3”</td>
<td>12” long x 18 gauge</td>
</tr>
<tr>
<td>4”</td>
<td>12” long x 16 gauge</td>
</tr>
</tbody>
</table>

7. All piping and insulation that does not meet 25/50 that is located 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 At or Above 140°F:

1. Insulate fittings, valves, flanges, and strainers.
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.

C. 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.

3.4 JACKET COVER INSTALLATION

A. 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 below 8'-0" above floor.

6. Use colored plastic covering on the following pipes:
   a. All exposed piping where jacketing is required.

3.5 SCHEDULE

<table>
<thead>
<tr>
<th>Piping System</th>
<th>Insulation Type/Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Heating Water Supply &amp; Return; Reheat Water</td>
<td></td>
</tr>
<tr>
<td>Supply &amp; Return; Heating/Chilled Water Supply</td>
<td></td>
</tr>
<tr>
<td>and Return</td>
<td></td>
</tr>
<tr>
<td>Under 1-1/2″</td>
<td>A / 1-1/2″</td>
</tr>
<tr>
<td>1-1/2″ and above</td>
<td>A / 2″</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Complete System of Automatic Controls.
B. Control Devices, Components, Wiring and Material.
C. Instructions for Owners.
D. Remodeling.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years’ experience.
B. TCC: Company specializing in the work of this section with minimum five years temperature control experience.
C. Technician: Minimum five years’ experience installing commercial temperature control systems.
D. TCCs are limited to firms regularly employing a minimum of five full-time temperature control technicians within 100 miles of the job site.

1.3 SUBMITTALS

A. Equipment Coordination:
   1. The Controls Contractor shall obtain approved equipment submittals from other contractors to determine equipment wiring connections, to choose appropriate controllers, and to provide programming.
   2. Control valve selections shall be based on flow rates shown in approved shop drawings.
   3. Coordinate the control interface of all equipment with the equipment manufacturers prior to submittal submission.

B. Shop Drawings:
   1. Submit shop drawings per Section 23 05 00. In addition, submit an electronic copy of the shop drawings in Adobe Acrobat (.pdf) format to the Owner for review.
   2. Cross-reference all control components and point names in a single table located at the beginning of the submittal with the identical nomenclature used in this section.
3. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.

4. System Architecture: Provide riser diagrams of wiring between central control unit and all control panels. This shall include specific protocols associated with each level within the architecture. Identify all interface equipment between CPU and control panels. The architecture shall include interface requirements with other systems including, but not limited to, security systems, lighting control, fire alarm, elevator status, and power monitoring system.

5. Diagrams shall include:
   a. Wiring diagrams and layouts for each control panel showing all termination numbers.
   b. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers’ model numbers and functions. Show all interface wiring to the control system.
   c. Identification of all control components connected to emergency power.
   d. Schematic diagrams for all field sensors and controllers.
   e. A schematic diagram of each controlled system. The schematics shall have all control points labeled. The schematics shall graphically show the location of all control elements in the system.
   f. A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, label it with the same name. Label all terminals.
   g. A tabular instrumentation list for each controlled system. The table shall show element name, type of device, manufacturer, model number and product data sheet number.
   h. All installation details and any other details required to demonstrate that the system will function properly.
   i. All interface requirements with other systems.

6. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system enhancement with minimal infrastructure modifications.
7. Sequences: Submit a complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system. **The wording of the control sequences in the submittal shall match verbatim that included in the construction documents to ensure there are no sequence deviations from that intended by the Architect/Engineer. Clearly highlight any deviations from the specified sequences on the submittals.**

8. Points List Schedule: Submit a complete points list of all points to be connected to the TCS and FMCS. The points list for each system controller shall include both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, the location of the I/O device, and reference drawings. Where a control point is the same as that shown on the control system schematic, label it with the same name. Points list shall specifically identify alarms, trends, event history, archive, totalization, graphic points, and all mapped points from other systems (security systems, lighting control, fire alarm, etc.). Provide points lists, point naming convention, and factory support information for systems provided and integrated into the FMCS.

9. Valve Schedule: Valve manufacturer shall size valves and create a valve schedule. Schedule shall include a separate line for each valve and a column for each of the valve attributes:
   a. Valve Identification Tag.
   b. Location.
   c. Valve Type.
   d. Valve Size.
   e. Pipe Size.
   f. Configuration.
   g. Flow Characteristics.
   h. Capacity.
   i. Valve Cv.
   j. Design Pressure Drop.
   k. Pressure Drop at Design Flow.
   l. Fail Position.
   m. Close-off Pressure.
   n. Valve and Actuator Model Number and Type.

10. Product Data Sheets: Required for each component that includes: unique identification tag that is consistent throughout the submittal, manufacturer’s description, technical data, performance curves, installation/maintenance instructions, and other relevant items. When manufacturer’s literature applies to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification.
and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements.

11. Provide PICS files indicating the BACnet® functionality and configuration of each device.

12. Provide documentation of submitted products that have been tested and listed by the BACnet Testing Laboratory (BTL), or provide a letter on the manufacturer’s company letterhead indicating the anticipated date by which testing is expected to be completed. If, for any reason, BTL testing and listing has not been completed, a written commitment to upgrade installed controls to a version that meets BTL testing and listing requirements in the event that problems are found during BTL testing is required.

13. Graphic Display: Include a sample graphic of each system and component identified in the points list with a flowchart (site map) indicating how the graphics are to be linked to each other for system navigation.

14. Software: A list of operating system software, operator interface software, color graphic software, and third-party software.

15. Control System Demonstration and Acceptance: Provide a description of the proposed process, along with all reports and checklists to be used.

16. Clearly identify work by others in the submittal.

17. Quantities of items submitted may be reviewed but are the responsibility of the Contractor to verify.

C. Operation and Maintenance Manual:

1. In addition to the requirements of Section 23 05 00, submit an electronic copy of the O&M manuals in PDF format.

2. Provide three complete sets of manuals.

3. Each O&M manual shall include:

   a. Table of contents with indexed tabs dividing information as outlined below.

   b. Definitions: List of all abbreviations and technical terms with definitions.

   c. Warranty Contacts: Names, addresses, and 24-hour telephone numbers of contractors installing equipment and controls and service representatives of each.
d. Licenses, Guarantees, and Warranties: Provide documentation for all equipment and systems.

e. System Components: Alphabetical list of all system components, with the name, address, and telephone number of the vendor.

f. Operating Procedures: Include procedures for operating the control systems; logging on/off; enabling, assigning, and reporting alarms; generating reports; collection, displaying, and archiving of trended data; overriding computer control; event scheduling; backing up software and data files; and changing setpoints and other variables.

g. Programming: Description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.

h. Engineering, Installation, and Maintenance: Explain how to design and install new points, panels, and other hardware; recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions; how to debug hardware problems; and how to repair or replace hardware. A list of recommended spare parts.

i. Original Software: Complete original issue CDs for all software provided, including operating systems, programming language, operator workstation software, and graphics software.

j. Software: One set of CDs containing an executable copy of all custom software created using the programming language, including the setpoints, tuning parameters, and object database.

k. Graphics: A glossary or icon symbol library detailing the function of each graphic icon and graphics creation and modification. One set of CDs containing files of all color graphic screens created for the project.

D. Record Documents:

   1. Submit record documentation per Section 23 05 00.

   2. Provide a complete set of “as-built” drawings and application software on CDs. Provide drawings as AutoCAD™ or Visio™ compatible files. Provide two copies of the “as-built” drawings with revisions clearly indicated in addition to the documents on compact disk. All as-built drawings shall also be installed on the FMCS server in a dedicated directory. Provide all product data sheets in PDF format.
3. Submit two hard copies and one electronic copy of as-built versions of the shop drawings, including product data and record drawings with revisions clearly indicated. Provide floor plans showing actual locations of control components including panels, thermostats, sensors, and hardware.

4. Provide all completed testing and commissioning reports and checklists, along with all trend logs for each system identified in the points lists.

5. Submit printouts of all graphic screens with current values (temperatures, pressures, etc.) to the A/E verifying completion and proper operation of all points.

1.4 DELIVERY, STORAGE AND HANDLING
   A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.
   B. Factory-Mounted Components: Where control devices specified in this section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

1.5 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
   A. Control Valves.
   B. Temperature Sensor Sockets.
   C. Gauge Taps.

1.6 AGENCY AND CODE APPROVALS
   A. All products shall have the following agency approvals. Provide verification that the approvals exist for all submitted products with the submittal package.

   1. UL-916; Energy Management Systems.
   2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 “Signal Equipment.”

1.7 ACRONYMS
   A. Acronyms used in this specification are as follows:

   1. B-AAC BACnet Advanced Application Controller
   2. B-ASC BACnet Application Specific Controller
   3. BTL BACnet Testing Laboratories
   4. DDC Direct Digital Controls
   5. FMCS Facility Management and Control System
   6. GUI Graphic User Interface
7. IBC  Interoperable BACnet Controller
8. IDC  Interoperable Digital Controller
9. LAN  Local Area Network
10. NAC  Network Area Controller
11. ODBC  Open DataBase Connectivity
12. OOT  Object Oriented Technology
13. OPC  Open Connectivity via Open Standards
14. PICS  Product Interoperability Compliance Statement
15. PMI  Power Measurement Interface
16. POT  Portable Operator’s Terminal
17. TCC  Temperature Control Contractor
18. TCS  Temperature Control System
19. WAN  Wide Area Network
20. WBI  Web Browser Interface

1.8 SUMMARY

A. Extend Existing System:

1. Extend the existing FMCS for this project.
2. All controllers and accessories shall interface with the existing FMCS.

B. TCC shall furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management and Control System (FMCS) using Direct Digital Controls as shown on the drawings and as described herein.

C. All labor, material, equipment and software not specifically referred to herein or on the plans that is required to meet the intent of this specification shall be provided without additional cost to the Owner.

D. The Owner shall be the named license holder of all software associated with any and all incremental work on the project.

1.9 SOFTWARE LICENSE AGREEMENT

A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job-specific configuration documentation, data files, configuration tools, and application-level software developed for the project. This shall include, but is not limited to, all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN/WAN/intranet and/or Internet connected routers and devices. Provide the Owner with all required IDs and passwords for access to any component or software program. The Owner shall determine which organizations shall be named in the SI organization ID (“orgid”) of all software licenses. Owner shall be free to direct the modification of the “orgid” in any software license, regardless of supplier.
1.10 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It is this Contractor’s responsibility to check the Contract Documents for possible conflicts between the Work of this section and that of other crafts in equipment location; pipe, duct and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

1.11 WARRANTY

A. Refer to Section 23 05 00 for warranty requirements.

B. Within the warranty period, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this Contractor at no expense to the Owner.

C. Warranty requirements include furnishing and installing all FMCS software upgrades issued by the manufacturer during the one-year warranty period.

D. Update all software and back-ups during warranty period and all user documentation on the Owner’s archived software disks.

1.12 WARRANTY ACCESS

A. The Owner shall grant to this Contractor reasonable access to the TCS and FMCS during the warranty period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

<table>
<thead>
<tr>
<th>Acceptable Manufacturers</th>
<th>BACnet Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entec Delta / Tridium</td>
<td>●</td>
</tr>
</tbody>
</table>

2.2 SYSTEM ARCHITECTURE

A. General:

1. OPEN NIC STATEMENTS - All NiagaraAX software licenses shall have the following NiCS: "accept.station.in=*"; "accept.station.out=*"; "accept.wb.in=*"; and "accept.wb.out=*". All open NIC statements shall follow Niagara Open NIC specifications; systems not meeting these fully open standards are not acceptable.

2. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall consist of a network of interoperable, standalone digital controllers,
a computer system, graphic user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein.

3. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

B. Open, Interoperable, Integrated Architectures:

1. All components and controllers supplied under this Division shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data are not acceptable.

2. The supplied system must be able to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs are not acceptable.

3. Hierarchical or “flat” topologies are required to have system response times as indicated below and to manage the flow and sharing of data without unduly burdening the customer’s internal intranet network.

   a. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.

   b. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

A. The Local Area Network (LAN) shall be a 100 megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP. Provide support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:

   1. Ethernet; IEEE Standard 802.3.
   2. Cable; 100 Base-T, UTP-8 wire, Category 5.
   3. Minimum throughput; 100 Mbps.

C. Communication conduits shall not be installed closer than six feet from 110VAC or higher transformers or run parallel within six feet of electrical high power cables. Route the cable as far from interference generating devices as possible. Where communication wire must cross 110VAC or higher wire, it must do so at right angles.
D. Ground all shields (earth ground) at one point only to eliminate ground loops. Provide all shield grounding at the controller location, with the shield at the sensor/device end of the applicable wire being left long and “safed” off in an appropriate manner.

E. There shall be no power wiring in excess of 30 VAC rms run in conduit with communications wiring. In cases where signal wiring is run in conduit with communication wiring, run all communication wiring and signal wiring using separate twisted pairs (24awg) in accordance with the manufacturer’s wiring practices.

2.4 NETWORK AREA CONTROLLER (NAC)

A. The TCC shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of NACs required depends on the type and quantity of devices provided under Divisions 23 and 26. The TCC shall determine the quantity and type of devices.

B. Each NAC shall provide the interface between the LAN or WAN and the field control devices and shall provide global supervisory control functions over the control devices connected to the NAC. It shall execute application control programs to provide:

1. Calendar functions.
2. Scheduling.
3. Trending.
5. Time synchronization.
6. Integration of all controller data.
7. Network Management functions.

C. The Network Area Controller shall provide the following hardware features as a minimum:

1. One Ethernet Port – 10/100 Mbps.
2. One RS-232 port.
3. One LonWorks Interface Port – 78KB FTT-10A (for LonWorks systems only).
4. One RS-485 port.
5. Battery backup.
6. Flash memory for long-term data backup. (If battery backup or flash memory is not supplied, the controller shall contain a hard disk with at least 1 gigabyte storage capacity.)
7. The NAC must be capable of operation over a temperature range of 32°F to 122°F.
8. The NAC must be capable of withstanding storage temperatures of between 0°F and 158°F.
9. The NAC must be capable of operation over a humidity range of 5% RH to 95% RH, non-condensing.

D. The NAC shall provide multiple user access to the system and support for ODBC or SQL. Databases resident on the NAC shall be ODBC-compliant or must provide an ODBC data access mechanism to read and write data stored within it.
E. The NAC shall support standard Web browser access via the Internet or an intranet and a minimum of five (5) simultaneous users.

F. Event Alarm Notification and Actions:

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a LAN, remote via dial-up telephone connection, or WAN.

3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
   a. Alarm
   b. Normal

4. Provide for the creation of a minimum of eight alarm classes with different routing and acknowledgement properties, e.g. security, HVAC, Fire, etc.

5. Provide timed (scheduled) routing of alarms by class, object, group, or node.

6. Provide alarm generation from binary object “runtime” and/or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

G. Treat control equipment and network failures as alarms and annunciated.

H. Annunciate alarms in any of the following manners as defined by the user:

1. Screen message text.

2. E-mail of the complete alarm message to multiple recipients. Provide the ability to route and e-mail alarms based on:
   a. Day of week.
   b. Time of day.
   c. Recipient.

3. Pagers via paging services that initiate a page on receipt of e-mail message.

4. Graphic with flashing alarm object(s).

5. Printed message, routed directly to a dedicated alarm printer.
I. The FMCS shall record the following for each alarm:

1. Time and date.
2. Location (building, floor, zone, office number, etc.).
3. Equipment tag.
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

J. Give defined users proper access to acknowledge any alarm.

K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

L. Provide a “query” feature to allow review of specific alarms by user-defined parameters.

M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

N. An error log to record invalid property changes or commands shall be provided and available for review by the user.

2.5 BACNET FMCS

A. The intent of this specification is to provide a peer-to-peer networked, standalone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices in the system. Adherence to industry standards including the latest ANSI/ASHRAE Standard 135 (BACnet) to assure interoperability between all system components is required. For each BACnet device, the device supplier must provide a PICS document showing the installed device’s compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP) and/or RS-485 (BACnet MSTP).

C. Interoperable BACnet Controller (IBC):

1. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the latest ANSI/ASHRAE Standard 135. Provide IBGs for unit ventilators, fan coils, heat pumps, terminal air boxes (TAB) and other applications. The application control program shall reside in the same enclosure as the input/output circuitry that translates the sensor signals. Provide a PICS document showing the installed system’s compliance level to ANSI/ASHRAE Standard 135. Minimum compliance is Level 3.
2. The IBCs shall be listed by the BACnet Testing Laboratory (BTL) as follows:
   a. BACnet Building Controller(s) (B-BC).
   b. BACnet Advanced Application Controller(s) (B-ACC).
   c. BACnet Application Specific Controller(s) (B-ASC).

3. The IBCs shall communicate with the NAC via an Ethernet connection at a baud rate of not less than 10 Mbps.

4. Each IBC sensor shall connect directly to the IBC and shall not use any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the POT.

5. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable) require a 10% spare point capacity to be provided for all applications. Store all control sequences within or programmed into the IBC in non-volatile memory that does not depend on a battery to be retained.

6. The Contractor supplying the IBCs shall provide documentation for each device, with the following information at a minimum:
   a. BACnet Device; MAC address, name, type and instance number.
   b. BACnet Objects; name, type and instance number.

7. It is the responsibility of the Contractor to ensure that the proper BACnet objects are provided in each IBC.

D. Object Libraries

1. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

2. The objects in this library shall be capable of being copied and pasted into the user’s database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

3. In addition to the standard libraries specified here, the system supplier shall maintain an on-line accessible (over the Internet) library, available to all registered users, to provide new or updated objects and applications as they are developed.

4. All control objects shall conform to the control objects specified in the BACnet specification.
5. The library shall include applications or objects for the following functions, at a minimum:

a. Scheduling Object: The schedule must conform to the schedule object as defined in the BACnet specification, providing seven-day plus holiday and temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphic sliders to speed creation and selection of on-off events.

b. Calendar Object: The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphic “point-and-click” selection. This object must be “linkable” to any or all scheduling objects for effective event control.

c. Override Object: Provide override object that is capable of restarting equipment turned off by other energy saving programs to maintain occupant comfort or for equipment protection.

d. Start-Stop Time Optimization Object: Provide a start-stop time optimization object to start equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled unoccupied time just far enough ahead to take advantage of the building’s “flywheel” effect for energy savings. Provide automatic tuning of all start-stop time object properties based on historical performance.

e. Demand Limiting Object: Provide a demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, gas, etc.). The object shall be able to monitor a demand value and predict (using a sliding window prediction algorithm) the demand at the end of the user-defined interval period (1 to 60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user-defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment setpoints to provide the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the setpoint, display a message on the user’s screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to provide both equipment protection and occupant comfort.
6. The library shall include control objects for the following functions:

a. Analog Input Object: Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.

b. Analog Output Object: Minimum requirement is to comply with the BACnet standard for data sharing.

c. Binary Input Object: Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment runtime by counting the amount of time the hardware input is in an “on” condition. The user must be able to specify either input condition as the “on” condition.

d. Binary Output Object: Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as start-to-start delay must be provided. Incorporate the BACnet Command Prioritization priority scheme to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide 16 levels of priority as a minimum. Systems not employing the BACnet method of contention resolution are not acceptable.

e. PID Control Loop Object: Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable to allow proportional control only, or proportional with integral control, or proportional, integral and derivative control.

f. Comparison Object: Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.

g. Math Object: Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.

h. Custom Programming Objects: Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including, but not limited to, math and logic functions...
and string manipulation. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for reuse.

i. Interlock Object: Provide an interlock object that provides a means of coordination of objects within a piece of equipment, such as an air handler or other similar types of equipment. An example is to link the return fan to the supply fan such that, when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming, thereby eliminating nuisance alarms during the off period.

j. Temperature Override Object: Provide an object whose purpose is to override a binary output to an “on” state in the event a user-specified high or low limit value is exceeded. Link this object to the desired binary output object as well as to an analog object for temperature monitoring to cause the override to be enabled. This object will execute a start command at the Temperature Override level of start/stop command priority, unless changed by the user.

k. Composite Object: Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the “contained” application that are represented on the graphic shell of this container.

7. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). Provide the following as part of the standard library included with the programming software:

a. LonMark/LonWorks Devices: These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. Support all network variables defined in the LonMark profile. The device manufacturer shall provide information (type and function) regarding network variables not defined in the LonMark profile.

b. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable
information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file, and documentation for the device to facilitate device integration.

c. For BACnet devices, provide the following objects:

1) Analog In.
2) Analog Out.
3) Analog Value.
4) Binary.
5) Binary In.
6) Binary Out.
7) Binary Value.
8) Multi-State In.
9) Multi-State Out.
10) Multi-State Value.
11) Schedule Export.
12) Calendar Export.
13) Trend Export.
14) Device.

d. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

e. For BACnet devices, provide the following support at a minimum:

1) Segmentation.
2) Segmented Request.
3) Segmented Response.
4) Application Services.
5) Read Property.
6) Read Property Multiple.
7) Write Property.
8) Write Property Multiple.
9) Confirmed Event Notification.
10) Unconfirmed Event Notification.
11) Acknowledge Alarm.
12) Get Alarm Summary.
13) Who-has.
14) I-have.
15) Who-is.
16) I-am.
17) Subscribe COV.
18) Confirmed COV notification.
19) Unconfirmed COV notification.
20) Media Types.
21) Ethernet.
22) BACnet IP Annex J.
23) MSTP.
24) BACnet Broadcast Management Device (BBMD) function.
25) Routing.

2.6 TERMINAL AIR BOX (TAB) CONTROLLERS

A. FMCS Volume Controller: Electronic, furnished and installed by TCC. Boxes shall have pressure independent control to maintain constant air volume regardless of duct pressure changes up to 6 inches w.c. Provide velocity and static sensor at box inlet for use by unit controller. Set boxes for maximum and minimum settings shown on the drawings. Refer to Section 23 36 00 for additional information.

B. The controller shall support various digital and analog inputs and outputs as needed for damper control, control valves, electric coils, airflow sensors, remote heating, occupancy sensors, etc. and shall be capable of independent occupancy scheduling.

C. Controller shall provide continuous zone temperature histories internal to device for up to 24 hours and perform its own limit and status monitoring and alarms to limit unnecessary communications.

D. Operator interface to any ASC point data or programs shall be through network resident programs or portable operator’s terminal connected to the specific controller.

E. Store all system setpoints, proportional bands, control algorithms, and other programmable parameters such that a power failure of any duration does not necessitate reprogramming of the controller.

F. BACnet TAB controllers shall either be B-AAC devices or B-ASC devices as required to meet the performance and BTL listing.

2.7 SYSTEM PROGRAMMING

A. The GUI software shall perform system programming and graphic display engineering. Access to the GUI software shall be through password access as assigned by the system administrator.

B. Provide a library of control, application, and graphic objects to enable creation of all applications and user interface screens. Applications shall be created by selecting the control objects from the library, dragging or pasting them on the screen, and linking them together using a built-in graphic connection tool. Completed applications may be stored in the library for future use. GUI screens shall be created in the same fashion. Data for the user displays shall be obtained by graphically linking the user display objects to the application objects to provide “real-time” data updates. Any real-time data value or object property may be connected to display its current value on a user display. Provide all software tools or processes to create applications and user interface displays.
C. Programming Methods

1. Provide the capability to copy objects from the supplied libraries or from a user-defined library to the user’s application. Link objects with a graphic linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; e.g., internal, external, hardware, etc.

2. Configuration of each object shall be done through the object’s property sheet using fill-in-the-blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration is not acceptable.

3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

4. All programming shall be done in real time. Systems requiring the uploading, editing, and downloading of database objects are not allowed.

5. The system shall support object duplication in a customer’s database. An application, once configured, can be copied and pasted for easy reuse and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.8 DDE DEVICE INTEGRATION

A. The NAC shall support the integration of device data via Dynamic Data Exchange (DDE) over the Ethernet network. The NAC shall act as a DDE client to another software application that functions as a DDE server.

B. Provide the required objects in the library included with the Graphic User Interface programming software to support the integration of these devices into the FMCS. Objects provided shall include, at a minimum:

1. DDE Generic AI Object.
2. DDE Generic AO Object.
3. DDE Generic BO Object.
4. DDE Generic BI Object.
2.9 HYDRONIC CONTROL VALVES

A. General:
   1. Two-position valves shall be a minimum of line size with a maximum allowable pressure drop of 2 psi.
   2. Size two-way and three-way modulating valves to provide a pressure drop at full flow of 1 to 4 psi, except boiler three-way and cooling tower bypass valves shall not have a pressure drop over 2 psi.
   3. Two-way valves shall be 100% tight-closing. Three-way valves shall be 100% tight-closing in both extreme positions.
   4. Modulating two-way valves shall have equal percentage flow characteristics.
   5. Modulating three-way valves shall have linear flow characteristics.
   6. Piping geometry correction factors for C_v ratings shall be used and stated for ball valves, butterfly valves, or non-characterized valves.

B. Modulating:
   1. Ball 2" and under:
      a. Design Pressure: 400 psi
         Design Temperature: 212°F
         Design Flow Differential Pressure Rating: 35 psi
      b. Bronze or brass body, stainless steel stem, chrome plated brass or stainless steel full port ball, PTFE or RTFE seats and seals, screwed ends (solder ends are acceptable only if rated for soldering in line with 470°F melting point of 95-5 solder).

2.10 VALVE ACTUATORS

A. General:
   1. Actuators shall be sized to operate the valve through its full range of motion and shall close against pump shutoff pressure without producing audible noise at any valve position.
   2. Provide visual position indication.
   3. Mount actuator directly on valve or provide linear motion assembly as required for valve type.
B. Valve Actuators - Electronic:

1. Actuator shall be UL listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation, and “V” bolt clamp with matching “V” toothed cradle (single bolt or setscrew fasteners not acceptable).

2. Actuators shall be rated for 60,000 full stroke cycles at rated torque. Stall motor not acceptable.

3. Tri-state/floating actuators shall have auto-zeroing function for realigning valve position.

4. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.

5. Spring return actuators shall have an internal spring return mechanism. Non-mechanical forms of fail-safe operation are not acceptable.

6. Provide analog feedback signal for positive position indication as required by control diagrams.

2.11 CONTROL INSTRUMENTATION

A. Temperature Sensors:

1. Room Temperature Sensor:
   
a. Sensor Only: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range, ± 0.50°F accuracy, no setpoint adjustment or override button.

b. Sensor with Setpoint Adjustment: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range, ± 0.50°F accuracy, with exposed single setpoint adjustment (no numeric temperature scale – provide with a single warmer/cooler or red/blue visual scale), no override button.

c. Sensor with Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range, ± 0.50°F accuracy, occupied/unoccupied override button with LED, no setpoint adjustment.

d. Sensor with Setpoint Adjustment and Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or
resistance temperature device (RTD), 45°F to 90°F operating range, ± 0.50°F accuracy, with exposed single setpoint adjustment (no numeric temperature scale – provide with a warmer/cooler or red/blue visual scale), occupied/unoccupied override button with LED.

2. Duct Temperature Sensor:
   a. Thermistor or RTD type. Pneumatic transmitters with transducers are not acceptable.

3. Water Temperature Sensor:
   a. Install in immersion wells. Separate thermometers as specified elsewhere, also of the immersion well type, shall be installed within 2 feet of each temperature sensor.

2.12 CONDUIT
   A. Conduit and Fittings: Refer to Electrical Section 26 05 33 for materials and sizing.

2.13 WIRE AND CABLE
   A. Wire and Cable Materials: Refer to Electrical Section 26 05 13 for wire and cable materials.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION
   A. Verify that systems are ready to receive work. Beginning of installation means installer accepts existing conditions.

   B. Install system and materials in accordance with manufacturer’s instructions.

   C. Drawings of the TCS and FMCS network are diagrammatic only. Any apparatus not shown but required to meet the intent of the project documents shall be furnished and installed without additional cost.

   D. Install all operators, sensors, and control devices where accessible for service, adjustment, calibration, and repair. Do not install devices where blocked by piping or ductwork. Devices with manual reset or limit adjustments shall be installed below 6'-0” if practical to allow inspection without using a ladder.

   E. Verify locations of wall-mounted devices (such as thermostats, temperature and humidity sensors, and other exposed sensors) with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Maximum height above finished floor shall not exceed 48’’.
F. Provide valves over 3/4" size with position indicators and pilot positioners where sequenced with other controls.

G. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room.

H. After completion of installation, test and adjust control equipment.

I. Check calibration of instruments. Recalibrate or replace.

J. Furnish and install conduit, wire, and cable per the National Electric Code, unless noted otherwise in this section.

K. All controls associated with the proper operation of air handling units, pumps, or other mechanical equipment served by emergency power shall be connected to the emergency power system. Control components shall not be powered from the life safety branch of the emergency power system. Coordinate emergency power source connections with the Architect/Engineer.

L. All hardware, software, equipment, accessories, wiring (power and sensor), piping, relays, sensors, power supplies, transformers, and instrumentation required for a complete and operational FMCS system, but not shown on the electrical drawings, are the responsibility of the TCC.

M. Remodeling:

1. All room devices as indicated on the drawings shall be removed by this Contractor. The Contractor shall also prepare the wall for finishes. Preparing the wall shall include patching old anchor holes (after the anchoring device has been removed) and sanding the wall to remove old paint outlines remaining from original devices. The wall shall be painted to match the existing wall prior to the installation of the new room device. In the event that wall covering requires patching, the Contractor shall furnish new wall covering to match existing. If new wall covering is not available to match existing, the Contractor shall furnish a white acrylic or Plexiglas plate, 1/4” thick and sized to cover the void.

N. Labels For Control Devices:

1. Provide labels indicating service of all control devices in panels and other locations.

2. Labels may be made with permanent marking pen in the control panels if clearly legible.

3. Use engraved labels for items outside panel such as outside air thermostats.
4. Labels are not required for room thermostats, damper actuators and other items where their function is obvious.

3.2 CONDUIT INSTALLATION

A. Conduit Sizing and Installation: Refer to Electrical Section 26 05 33 for execution and installation.

1. Thermostats/temperature sensors shall be installed in junction boxes, flush with the wall, and shall be coordinated for orientation with Architect/Engineer.

3.3 WIRE AND CABLE INSTALLATION

A. Wire and Cable Materials Installation: Refer to Electrical Section 26 05 13 for execution and installation.

B. Field Quality Control:

1. Inspect wire and cable for physical damage and proper connection.

2. Torque test conductor connections and terminations to manufacturer’s recommended values.

3. Perform continuity test on all conductors.

4. Protection of cable from foreign materials:

   a. It is the Contractor’s responsibility to provide adequate physical protection to prevent foreign material application or contact with any 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.

   b. Overspray of paint on any cable, cable jacket or cable termination component 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. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement
from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

C. Installation Schedule:

1. Conduit terminations to all devices installed in applications with rotating equipment, expansion/contraction or vibration shall be made with flexible metallic conduit, unless noted otherwise. Final terminations to exterior devices installed in damp or wet locations shall be made with liquidtight flexible metallic conduit. Terminations in hazardous areas, as defined in the National Electrical Code, shall be connected using flexible conduit rated for the environment.

3.4 FMCS INSTALLATION

A. Coordinate voltage and ampacity of all contacts, relays, and terminal connections of equipment being monitored or controlled. Voltage and ampacity shall be compatible with equipment voltage and be rated for full ampacity of wiring or overcurrent protection of circuit controlled.

B.Naming Conventions: Coordinate all point naming conventions with Owner standards. In the absence of Owner standards, naming conventions shall use equipment designations shown on plans.

3.5 PREPARATION FOR BALANCING

A. Verify that all dampers are in the position indicated by the controller (e.g., open, closed or modulating).

B. Check the calibration and setpoints of all controllers.

C. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.

D. Check that all sequences operate as specified. Verify that no simultaneous heating and cooling occurs, unless specified. Observe that heating cannot begin at TAB reheat terminals until the unit is at the minimum cfm.

E. Verify the operation of all interlock systems.

3.6 TEST AND BALANCE COORDINATION

A. The Contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.

B. The Contractor shall provide a minimum of four (4) hours training for the Balancing Contractor in the use of these tools.
C. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process until the first 20 terminal units are balanced.

D. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

3.7 DEMONSTRATION AND ACCEPTANCE

A. At completion of installation, provide two days minimum instruction for operators. Demonstrate operation of all controls and systems. Describe the normal operation of all equipment.

3.8 TRAINING

A. On-Site:

1. After completion of commissioning, the manufacturer shall provide 8 hours of training for 2 Owner’s representatives. The training course shall enable the Owner’s representatives to perform Day-to-Day Operations as defined herein. A factory-trained instructor with experience in presenting the training material and the system programmer for this project shall perform the training.

B. Day-to-Day Operations - Training Description:

1. Proficiently operate the system.
2. Understand control system architecture and configuration.
3. Understand FMCS systems components.
4. Understand system operation, including FMCS system control and optimizing routines (algorithms).
5. Operate the workstation and peripherals.
6. Log-on and off the system.
7. Access graphics, point reports, and logs.
8. Adjust and change system setpoints, time schedules, and holiday schedules.
9. Recognize malfunctions of the system by observation of the printed copy and graphic visual signals.
11. Understand the job layout and location of control components.
12. Access data from FMCS controllers and ASCs.
13. Operate portable operator’s terminals.

C. Advanced Operations - Training Description:

1. Make and change graphics on the workstation.
2. Create, delete, and modify alarms, including annunciation and routing of these.
3. Create, delete and modify point trend logs and graph or print these both on and ad-hoc basis and at user-definable time intervals.
4. Create, delete, and modify reports.
5. Add, remove, and modify system’s physical points.
6. Create, modify and delete programming.
7. Add panels when required.
8. Add operator interface stations.
9. Create, delete, and modify system displays, both graphic and others.
10. Perform FMCS system field checkout procedures.
11. Perform FMCS controller unit operation and maintenance procedures.
12. Perform workstation and peripheral operation and maintenance procedures.
13. Perform FMCS system diagnostic procedures.
14. Configure hardware including PC boards, switches, communication, and I/O points.
15. Maintain, calibrate, troubleshoot, diagnose, and repair hardware.
16. Adjust, calibrate, and replace system components.

D. System Management - Training Description:

1. Maintain software and prepare backups.
2. Interface with job-specific, third-party operator software.
3. Add new users and understand password security procedures.

E. Provide course outline and materials in accordance with the “SUBMITTALS” article in Part 1 of this section. The instructor(s) shall provide one copy of training material per student.

3.9 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer’s recommendations.

B. Mount sensors rigidly and adequately for the environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

E. Averaging sensors and low limits shall be installed at the top of the assembly with the element on a slight downward incline away from the sensor making a serpentine pattern over the cross-sectional area with elements spaced not over 12” apart and within 6” of the top and bottom of the area.

F. All pipe-mounted temperature sensors shall be installed in immersion wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

G. Install outdoor air temperature sensors on exterior of north wall, complete with sun shield at designated location approved by Architect/Engineer. TCC shall prime and paint the device enclosure. Color selection by Architect.

END OF SECTION
INSTRUMENTATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Test Plugs.

1.2 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Include list that indicates use, operating range, total range and location for manufactured components.

PART 2 - PRODUCTS

2.1 TEST PLUGS

A. Test Plug: 1/4” or 1/2” brass fitting and cap, with Nordel core for temperatures up to 275°F, for receiving 1/8” outside diameter pressure or temperature probe. Plugs shall be rated for zero leakage from vacuum to 500 psi.

B. Provide extended units for all plugs installed in insulated piping.

C. Test Kit: Carrying case, internally padded and fitted containing one 3-1/2” diameter pressure gauge with 0-100 psi range, one gauge adapter with 1/8” probes, two 1-1/2” dial thermometers with 0° to 220°F and -25°F to 125°F ranges and 5” stems.


PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install per manufacturer's instructions.

2. Install gauges and thermometers in locations where they are easily read from normal operating level.

3. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings.
B. Valves.
C. Heating Water Piping System.

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 SUBMITTALS

A. Submit product data under provisions of Section 23 05 00. Include data on pipe materials, fittings, valves, and accessories.

1.4 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.

1.5 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

A. Design Pressure: 125 psig.
   Maximum Design Temperature: 225°F. (230°F for mechanical couplings)

B. Piping - 3” and Under (Contractor’s Option):
   1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.


C. Shutoff Valves:

1. 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.

D. 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.

E. Check Valves:

1. CK-1: 2” and under, 125 psi S @ 353°F, 200 psi WOG @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319, Walworth #406, Milwaukee #509, Watts #B-5000, or NIBCO #T-413.
F.  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.

2.2  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.

2.3  STRainers
   A.  Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>1/4” - 2”</th>
<th>2-1/2” - 8”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>1/32”</td>
<td>1/16”</td>
</tr>
</tbody>
</table>

   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.

2.4  BALANCING VALVE
   A.  Rated for 125 psi working pressure and 250°F 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.


G. Manufacturer shall size balancing valves for the scheduled flow rate. Flow rate shall be measurable on manufacturer’s standard meters.

2.5 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.


2.6 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.

2.7 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. Connect to all equipment with flanges or unions.

D. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for treatment.

3.2 TESTING PIPING

A. Heating Water:

1. Test pipes 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 100 psig water 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.

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, or bottom 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. 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. Install balancing valves with the manufacturer’s recommended straight upstream and downstream diameters of pipe.

6. Prepare pipe, fittings, supports, and accessories for finish painting.

7. 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.

8. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.
9. Provide flanges or unions at all final connections to equipment, traps and valves.

10. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.

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. Mechanical Press Connection:
   1. Copper press fitting shall be made in accordance with the manufacturer’s installation instructions.
   2. Fully insert tubing into the fitting and mark tubing.
   3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
   4. Joint shall be pressed with a tool approved by the manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Galvanized Ductwork
B. Ductwork Reinforcement
C. Ductwork Sealants
D. Rectangular Ductwork - Single Wall
E. Round Ductwork - Single Wall
F. Flexible Duct
G. Leakage Testing
H. Ductwork Penetrations

1.2 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.

1.3 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. KJWW will provide electronic file copies of ventilation drawings for contractor’s use if the contractor signs and returns the “Electronic File Transfer” waiver attached at the end of this specification section. KJWW will not consider blatant reproductions of original file
copies an acceptable alternative to 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. Slip cable hangers are acceptable. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.

6. 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.

B. 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.

C. 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. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:

a. 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.

b. Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.

c. Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.

d. Omitting every other vane is prohibited.
3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. Cushion heads are acceptable only downstream of TAB devices in ducts up to ±2” pressure class, and must be less than 6” in length.

10. 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.
11. 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 DUCTWORK - SINGLE WALL

A. Conform to applicable portions of Rectangular Duct Section. Round 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. Snap lock seams are not permitted.

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. 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, Accuflange, or Sheet Metal Connectors are acceptable. Self-sealing duct systems are also acceptable (Lindab, Ward “Keating Coupling”).

2.6 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.

D. Inner liner shall be airtight and suitable for 6” WC static pressure 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 ft²*ºF*hr/Btuh. Temperature range of at least 0-180ºF. Maximum velocity of 4,000 fpm.

E. 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.

F. 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.

G. 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 not 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. During construction 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” 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.

L. 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.
3.2 DUCTWORK APPLICATION SCHEDULE

<table>
<thead>
<tr>
<th>USAGE</th>
<th>MATERIAL</th>
<th>PRESSURE CLASS</th>
<th>SEAL CLASS †</th>
<th>INSULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Duct from Existing Duct Riser to Terminal Air Boxes – Single Wall</td>
<td>Galvanized Sheet Metal - Rectangular</td>
<td>+4”</td>
<td>A</td>
<td>1-1/2” thick Type A</td>
</tr>
<tr>
<td>Supply Duct from Terminal Air Boxes to Outlets</td>
<td>Galvanized Sheet Metal - Rectangular</td>
<td>+2”</td>
<td>A</td>
<td>1-1/2” thick Type A</td>
</tr>
<tr>
<td>Return Duct</td>
<td>Galvanized Sheet Metal</td>
<td>-2”</td>
<td>A</td>
<td>1” thick Type G</td>
</tr>
<tr>
<td>Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1-1/2” thick Type A</td>
</tr>
<tr>
<td>All Terminal Air Box/ Reheat Coil Headers and Duct Mounted Coil Headers</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1-1/2” thick Type A</td>
</tr>
</tbody>
</table>

† Seal Class is per SMACNA HVAC Air Duct Leakage Test Manual

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.

B. Duct - 3" WG and Above (positive or negative):

1. A minimum of 25% of interior ductwork shall be tested. The Owner or designated representative shall select the sections to be tested. If duct has outside wrap, testing shall be done before it is applied.

2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.

3. Seal ducts to bring the air leakage into compliance.

4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.

C. Test procedure shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:

1. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
2. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.

3. All joints shall be felt by hand, and all discernible leaks shall be sealed.

4. Totaling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.

5. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.

6. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.

7. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.

8. The required leakage class for Seal Class A, both round and rectangular ducts, shall be 4.

9. Positive pressure leakage testing is acceptable for negative pressure ductwork.

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 galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms.

END OF SECTION
**TERMS AND CONDITIONS FOR USE:**

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**Accepted by:** ___________________________ **Title:** ___________________________
**Company:** ___________________________ **Phone:** ___________________________
**Address:** ___________________________ **E-mail:** ___________________________
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual Volume Dampers.
B. Duct Access Doors.
C. Duct Test Holes.
D. Remote Volume Control Devices.

1.2 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 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 automatic controls, duct coils and other equipment requiring service inside the duct.
C. 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.

D. Access doors with sheet metal screw fasteners are not acceptable.

E. Minimum size for access doors shall be 24” x 16” or full duct size, whichever is less.

F. 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.

2.3 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.

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. Grease duct access doors shall be installed per approvals from manufacturer’s ICC-ES Evaluation Report.

6. 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.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Single Duct Variable Air Volume Terminal Box.

1.2 SUBMITTALS
   A. Submit shop drawings under provisions of Section 23 05 00.
   B. Submit shop drawings indicating configuration, general assembly, and materials used in fabrication.
   C. Submit product data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate airflow, static pressure, and NC designation.
   D. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of one to 4 inch WG.
   E. Submit manufacturer’s installation instructions.

1.3 OPERATION AND MAINTENANCE DATA
   A. Submit operation and maintenance data.
   B. Include manufacturer’s descriptive literature, operating instructions, maintenance and repair data, and parts lists.
   C. Include directions for resetting constant volume regulators.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CONSIDERATIONS (THIS APPLIES TO ALL UNITS)
   A. All units shall have noise data certified in accordance with AHRI Standard 885-98 with 5/8” 20-lb. density mineral fiber ceiling tile and shall not produce space noise values over NC-35 due to radiated and airborne noise combined.

2.2 SINGLE DUCT VARIABLE AIR VOLUME TERMINAL BOX
   A. Casing: Minimum 22 gauge galvanized steel. Fully lined with minimum 1”, minimum 1-1/2 pound density fiberglass insulation. Insulation shall be UL listed and meet NFPA 90A requirements.
B. All insulation in contact with the air stream shall be foil faced, UL listed and NFPA 90A approved.

C. Damper Blade: Extruded aluminum or minimum 18 gauge galvanized steel. Nylon or bronze bushings on damper shafts. Dampers shall seal against gasketed stops. Leakage shall not exceed 4% of unit nominal cfm at 3.0 inches WG inlet static pressure.

D. Damper Operators: Electronic, furnished and installed by TCC. Refer to Section 23 09 00 for additional information.

E. DDC Volume Controller: Electronic, furnished and installed by TCC. Boxes to be pressure independent control to maintain constant air volume regardless of duct pressure changes up to 6 inches w.c. Provide velocity and static sensor at inlet to box for use by unit controller. Boxes shall be set for maximum and minimum settings shown on the drawings. Refer to Section 23 09 00 for additional information.

F. Hot Water Coils: Copper tubes, aluminum fins, minimum 0.016” wall thickness, leak tested at 300 psig. Air pressure drop shall not exceed scheduled value. Provide access door or removable panel for access to the upstream side of the heating coil. Capacity shall be as scheduled on the drawings. Hot water control valve shall be by the TCC.

G. Electric Heating Coil: Open nichrome type electric resistance coils, automatic reset thermal cutout primary safety device, manual reset thermal cutout secondary safety device, airflow switch interlock, disconnect switch on face of integral control panel, magnetic contactors, 24 volt control, control voltage transformer and fusing, pressure-electric switch for two-stage step control. Capacity and voltage shall be as scheduled on the drawings.

H. Boxes shall not exceed the static pressure drop and N.C. level scheduled on the drawings.

I. Refer to control diagrams and notes on control drawings for complete sequence of control.


PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.
D. Where boxes are located adjacent to a wall or joist, the damper motors and control valves shall be located on the side of the box away from the wall or joist to permit easy access.

E. Comb fins on coils to repair bent fins.

F. Insulate terminal air box reheat coils to prevent condensation. Tape insulation tight to box. Do not insulate the box itself to prevent interference with actuator, access panel and control panel.

3.2 ADJUSTING

A. All boxes shall be set to the cfm shown on the drawings. TCC shall be responsible to field recalibrate all boxes that are not set correctly.

END OF SECTION
AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grilles And Registers.
B. Architectural Square Panel Diffusers.

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 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.

1.4 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A.
B. Conform to ASHRAE 90.1.

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.

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. 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.


2.2 ARCHITECTURAL SQUARE PANEL DIFFUSERS

A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.

B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule. Flat-oval inlets are not acceptable for connection to flexible ducts.

C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should 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.

D. The capacity and size of the unit shall be as shown on the drawings.

E. 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.

F. Diffusers shall be architectural solid square panel and flush with ceiling.
G. The exposed surface shall be smooth, flat and free of visible fasteners. The face panel shall be 22 gauge steel with a rolled edge or shall be 18 gauge with a smooth ground, uniform edge.

H. The back pan shall be one piece 22 gauge stamped and shall include an integral inlet. (Welded inlets and corner joints are not acceptable).

I. Diffusers with a 24x24 back pan shall have a minimum 18x18 face panel size. Diffusers with a 12x12 back pan shall have a minimum 9x9 face panel size.

J. The face panel shall be mechanically fastened to the back panel with steel components. (Plastic fasteners are not acceptable.)


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.

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.

END OF SECTION
TERMINAL HEAT TRANSFER UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Finned Tube Radiation.

1.2 SUBMITTALS
   A. Submit shop drawings per Section 23 05 00.
   B. Submit catalog data including arrangements, cross sections of cabinets, grilles, bracing, typical elevations.
   C. Submit schedules of equipment and enclosures indicating length, number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, and comparison of specified to actual heat output.
   D. Indicate mechanical and electrical service locations and requirements. Show deviations from scheduled products.
   E. Submit manufacturers' installation instructions.

1.3 DELIVERY, STORAGE AND HANDLING
   A. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.4 REGULATORY REQUIREMENTS
   A. Conform to ASHRAE 90.1.

1.5 OPERATION AND MAINTENANCE DATA
   A. Submit manufacturer's operation and maintenance data. Include operating, installation, maintenance and repair data, and parts listings.

PART 2 - PRODUCTS

2.1 FINNED TUBE RADIATION - PEDESTAL MOUNT
   A. Cabinets shall be minimum 16 gauge steel with baked enamel finish.
   B. Final color selection shall be by the Architect.
   C. Provide end caps, corner pieces, adjustable extensions, and other accessories required for proper appearance and service.
D. Provide supports with matte black finish.
E. Provide access doors at all valves if cabinet is not easily removable.
F. All cabinet and accessories shall be securely connected with no exposed fasteners.
G. Support 1/2" tubes on 36” centers and larger tubes on 48” centers.
H. Elements shall be copper tube with aluminum fins.
I. Cabinet size, element length and element size shall meet the scheduled capacities, but not be less than the sizes scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:
   1. Install all products per manufacturers' instructions.
   2. Coordinate recess sizes for recessed equipment.
   3. Protect units with protective covers during construction.
   4. Comb all coils to repair bent fins.

B. Fin Tube:
   1. Locate finned tube radiation as shown and run cover wall-to-wall, unless otherwise shown. Center elements under windows.

3.2 CLEANING

A. After construction is complete, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, with materials furnished by manufacturer.

C. Install new filters.

END OF SECTION
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. This section is also applicable to Interior Communications Pathways Section 27 05 28. This section is also applicable to Fire Alarm and Detection Systems Section 28 31 00.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced in each specification section.

1.2 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 light fixtures, equipment, motors, devices, etc.

2. Rework of existing grounding system.

3. Rework of existing fire alarm system.

4. Wiring system for temperature control system as shown on the drawings.

5. Wiring of equipment furnished by others.

6. Removal work and/or relocation and reuse of existing systems and equipment.

7. Technology Systems as described in Division 27/28 and on the T-series documents as described in the Suggested Matrix of Scope Responsibility.

D. Work Not Included:

1. Telecommunications 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.
1.3 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.

1.4 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. “Technology Contractors” refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. Low Voltage Technology Wiring: The wiring associated with the Technology Systems, used for analog or digital signals between equipment.

10. Telecommunications Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications information outlets.

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. 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. Lighting Fixtures
   b. Gravity flow piping, including steam and condensate.
   c. Electrical bus duct.
   d. Sheet metal.
   e. Cable trays, including access space.
   f. Other piping.
   g. 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.

H. Technology Contractor’s Responsibility:

1. Assumes all responsibility for the Low Voltage Technology Wiring of all systems, including cable support where open cable is specified.

2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the “Suggested Matrix of Scope Responsibility”.

3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).

4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of Technology equipment which is required to be bonded to the telecommunications ground bar.
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.

1.5 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5” and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5” and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

d. Maintenance clearances and code-required dedicated space shall be included.

e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.

2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to
this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. KJWW 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 KJWW. KJWW will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

a. Scale of drawings:

   1) General plans: 1/4 Inch = 1 ‘-0” (minimum).

   2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0” (minimum).

   3) Shafts and risers: 1/2 Inch = 1'-0” (minimum).

   4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 ‘-0” (minimum).

   5) Sections of congested areas: 1/2 Inch = 1'-0” (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.

3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.

4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner’s Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.

4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.

8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
   a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
   b. Potential layout changes shall be made to avoid additional access panels.
   c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
   d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
   e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.

12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 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 Dixon, Illinois, Codes, Laws, Ordinances and other regulations having jurisdiction over this installation.

2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.

3. 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.

4. 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.

5. If there is a discrepancy between manufacturer’s recommendations and these specifications, the manufacturer’s recommendations shall govern.

6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code 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 contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.

6. 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 so as 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 KJWW.

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 KJWW 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 KJWW as to the accuracy or correctness of the information provided. KJWW 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.

1.7 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:

<table>
<thead>
<tr>
<th>Section</th>
<th>Submittal Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 05 35</td>
<td>Surface Raceways</td>
</tr>
<tr>
<td>26 09 33</td>
<td>Lighting Control System</td>
</tr>
<tr>
<td>26 27 26</td>
<td>Wiring Devices</td>
</tr>
<tr>
<td>26 51 00</td>
<td>Lighting</td>
</tr>
<tr>
<td>28 31 00</td>
<td>Fire Alarm and Detection Systems</td>
</tr>
</tbody>
</table>

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, 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: 26 XX XX.description.YYYYMMDD
   b. Transmittal file name: 26 XX XX.description.YYYYMMDD

5. **File Size:** Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.8 **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 the cost for each of the following:
   a. Overhead and profit.
   b. Bonds.
   c. Insurance.
   d. General Requirements: Itemize all requirements.
2. 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.

   a. Contractor’s own labor forces.
   b. All subcontractors.
   c. All major suppliers of products or equipment.

3. Break down all costs into:

   a. Material: Delivered cost of product with taxes paid.
   b. Labor: Labor cost, excluding overhead and profit.

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 (medium voltage, normal, emergency, 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. Site utilities (5’ beyond building)
   f. Testing
   g. Commissioning
   h. Record drawings
   i. 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.
1.9 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.

1.10 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.

1.11 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.

1.12 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.
1.13 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.
2. Installing hard or suspended ceilings and soffits.

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. Light fixtures, including ceiling-mounted exit and emergency lights, are installed and operational.
   c. Light fixture whips are suspended above the ceiling.
   d. Light fixtures are suspended independently of the ceiling system when required by these contract documents.
   e. All wall penetrations have been sealed.

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 seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.
B. Final Jobsite Observation:

1. In order 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 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.

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.div23.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as “1 of 2”, “2 of 2”, etc.

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. 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.

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.

3.7 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. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

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. Painting shall be performed as described in project specifications.

C. 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.

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, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect his color preference before ordering.

E. 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.

F. Do NOT paint electric conduits in crawl spaces, tunnels, 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.

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.

3.11 SYSTEM COMMISSIONING

A. The electrical systems shall be complete and operating. System start-up, testing, balancing, and 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. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

1. 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.

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, electrical apparatus or lighting fixture, 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.

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.

END OF SECTION
READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

In order 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.

* * * * *
WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Building wire
B. Remote control and signal cable

1.2 REFERENCES
A. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
B. UL 44 – Thermoset-Insulated Wires and Cables
C. UL 83 – Thermoplastic-Insulated Wires and Cables
D. UL 854 – Service-Entrance Cables
E. UL 1581 – Standard for Electrical Wires, Cables, and Flexible Cords

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 in Underground Conduit: Copper, stranded conductor, 600 volt insulation, THWN or XHHW-2.
C. 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.
D. Control Circuits: Copper, stranded conductor 600 volt insulation, THHN/THWN.
E. 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 REMOTE CONTROL AND SIGNAL CABLE
A. 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.
B. Control 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 PVC jacket; UL listed.
C. 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.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

A. Above Accessible Ceilings: Building wire in raceways. Low voltage cable (less than 100 volts) may be installed without conduit. Low voltage cables in ducts, plenums and other air-handling spaces shall be plenum listed.

B. All Other Locations: Building wire in raceway.

C. Above Grade: All conductors installed above grade shall be type “THHN”.

3.2 WIRE FOR SPECIALIZED SYSTEMS

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. Sound
4. TV
5. Telephone
6. Data
7. Clock

3.3 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16.

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.

C. Record drawing shall include the calculations and sketches.

3.4 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.

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 National Electrical Code, Article 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.

3.5 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 thru 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.

3.6 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. J-hooks shall be Caddy CAT or Mono Systems H-433 series.

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 supports shall be installed at a maximum of five-foot (5') intervals. 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.

3.7 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 copper 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 copper, compression connectors applied with circumferential crimp for copper wire splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

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.

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: Test shall be made by means of an insulation testing device such as a “Megger” using not less than 500 volts D.C. test potential.

C. Inspect wire and cable for physical damage and proper connection.

D. Torque test conductor connections and terminations to manufacturer’s recommended values.

E. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
F. 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.

G. 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
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment grounding system
B. Bonding system

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 Grounding and Bonding Equipment.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.


1.3 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 with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. 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.

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.


5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. 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.

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.
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.

E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, below access floors, and elsewhere as indicated, with bolted connections to form a continuous ground path.

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. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

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. 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.

C. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.
D. Terminal Cabinets: Terminate bonding conductor on cabinet grounding terminal.

E. 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
CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical metallic tubing and fittings
B. Flexible metallic conduit and fittings
C. Liquidtight flexible metallic conduit and fittings
D. Wall and ceiling outlet boxes
E. Electrical connection
F. Pull and junction boxes
G. Rough-ins
H. Accessories

1.2 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

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. National Fire Protection Association (NFPA):
   1. ANSI/NFPA 70 – National Electrical Code

F. Underwriters Laboratories (UL): Applicable Listings
   1. UL 1 – Flexible Metal Conduit
   2. UL 6 – Rigid Metal Conduit
   3. UL 360 – Liquid Tight Flexible Steel Conduit
4. UL514-B – Conduit Tubing and Cable Fittings
5. 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.
7. Slab: Horizontal pour of concrete used for the purpose of a floor or sub-floor.

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, LTV, Steelduct, Wheatland Tube Co, or approved equal.

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
2. Larger than 2": Compression type of steel designed for their specific application.
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.
   2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.

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), 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. Cast Boxes: NEMA FB1, Type FD, Aluminum or cast ferroloy, deep type, gasketed cover, threaded hubs.

C. 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.

D. 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.

E. Outlet boxes for telephone substation 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.

F. 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. Flanged type boxes shall be used where installed flush in wall.

2.7 ROUGH-IN

A. Provide with one (1) flush mount double gang box with single gang plaster ring and appropriate cover plate,

B. Conduit stubbed to above the lay-in ceiling.

C. [RI-TECH]: Technology Rough-in:

1. Rough-in shall have one (1) 1” conduit.
D. **[RI-TECH-W]: Technology Rough-in - Wall Phone:**

1. Mount on wall +54” or as noted in plans. Rough-in shall have one (1) 1” conduit.

**PART 3 - EXECUTION**

3.1 **CONDUIT SIZING**

A. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to N.E.C. (Latest Edition). Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the National Electrical Code (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.

B. **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. Telecommunication Conduit: 1 inch.

3. Controls Conduit: 1/2 inch.

C. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.2 **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. Conduit shall not share the same cell as structural reinforcement in masonry walls.

C. 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.

D. 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.

E. Contractor shall cooperate with all Contractors on the project. He shall obtain details of other Contractor’s work in order 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.

3.3 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 deck (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 National Electrical Code 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. 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.

3.4 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. 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. Telecommunications conduits shall have no more than two (2) 90 degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.

a. A third bend is acceptable if:

   1) The total run is not longer than (33) feet.
   2) The conduit size is increased to the next trade size.
4. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter into the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.

5. Telecommunications conduit bend radius shall be six (6) times the diameter for conduits under 2” and ten (10) times the diameter for conduits over 2”.

6. 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 National Electrical Code.

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. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.

4. 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.

5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.

6. 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.

7. 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.

8. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
9. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3” above finished floor (AFF).

10. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4” below ceiling and as close to the wall as possible.

11. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4” above finished floor (AFF) and as close to the wall as possible.

3.5 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, 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. 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 any and all foreign matter prior to any wires or pull cords being installed.

3.6 CONDUIT INSTALLATION SCHEDULE

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 National Electrical Code shall be required.

B. The following schedule shall be adhered to unless they constitute a violation of applicable codes or are noted otherwise on the drawings. The installation of RMC conduit will be permitted in place of any and all conduit specified in this schedule.

1. Exposed:

   a. Branch Circuits (lighting, receptacles, controls, etc.): EMT.
b. Controls: EMT painted blue or dyed blue.

2. Finished Spaces/Concealed: EMT.

3. Interior Locations:
   a. Exposed: EMT conduit.
      1) Exposed Controls Conduit: EMT painted blue or dyed blue.
   b. Concealed: EMT.

3.7 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.

B. Cast boxes shall be used in:
   1. Exposed interior locations within 8’ of the highest platform level.
   2. Direct contact with concrete in slab on grade.
   3. Wet locations.

3.8 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.
3.9 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.

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 are 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, and where exposed rigid or intermediate conduit is used.

3.10 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.

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.

3.11 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.

G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Surface metal raceways

1.2 REFERENCES
A. FS W-C-582 - Conduit, Raceway, Metal, and Fitting; Surface

1.3 SUBMITTALS
A. Submit shop drawings under provisions of Section 26 05 00.
B. Include product data for surface metal raceways, multi-outlet assemblies, surface non-metallic raceways, auxiliary gutters, and accessories.

PART 2 - PRODUCTS

2.1 SURFACE METAL RACEWAY
A. Surface Metal Raceway: FS W-C-582; sheet metal channel with fitted cover, suitable for use as a continuous surface metal raceway.
B. Finish: Ivory enamel.
C. Fittings: Couplings, elbows, and connectors designed for use with raceway system.
D. Boxes and Extension Rings: Designed for use with raceway systems.
E. Coverplates shall be same material and finish as raceway.
F. Normal power receptacles shall be same color as raceway. Coordinate color with Architect.
G. Receptacles and outlets shown on raceway on drawings shall be mounted with overlapping faceplates in the raceway and shall not be mounted in boxes unless specifically noted otherwise.
H. [WW-1]: Surface metal raceway, metallic cover, minimum 4" opening, power / communication divider, minimum 16.6 square inch capacity.

PART 3 - EXECUTION

3.1 INSTALLATION - SURFACE METAL RACEWAY

A. Use flat-head screws to fasten channel to surfaces. Mount plumb and level.

B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

C. Maintain grounding continuity between raceway components to provide a continuous grounding path.

D. Fastener: Use clips and straps suitable for the purpose.

E. Field cuts to be clean and straight and use the proper tools as recommended by the system manufacturer to prohibit damage to factory finish or raceway. Joints to be matched so there are no gaps or spaces in the cover. Furnish and install manufacturer’s raceway accessories as needed.

F. Provide conduits to technology raceway per drawings or provide a minimum of one (1) 1-1/4” conduit per six feet of assembly (minimum 2) to above ceiling for technology requirements if assembly has technology raceway (Contractor shall provide quantities of conduits that provide maximum capacity to assembly). Provide conduits equally spaced within entire length of assembly.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates and tape labels
B. Wire and cable markers
C. Conductor color coding
D. Electrical gear labeling
E. Power distribution equipment labeling
F. Transformer equipment labeling

1.2 REFERENCES

B. NFPA 70 – National Electrical Code
C. ANSI A13.1 – Standard for Pipe Identification
D. ANSI Z535.4 – Standard for Product Safety Signs and Labels

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION PRODUCTS

A. Colored Adhesive Marking Tape for Banding Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

B. 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 pretensioned gripping action when coiled around the cable.

C. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

D. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50°F to 350°F. Provide ties in specified colors when used for color coding.

E. Aluminum, Wraparound Marker Bands: 1” in width, .014 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.
F. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label, minimum of 3/4" high x 9/16" wide, with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.

2.2 NAMEPLATES AND SIGNS

A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners. Engraving legend shall be as follows:
   1. Black letters on white face for normal power.
   2. White letters on red face for emergency power.
   3. White letters on green face for grounding.
   4. Black letter on yellow face for Caution or UPS.

B. 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.

C. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with .0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting ¼" grommets in corners.


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.

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 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. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape, Brother self-laminating vinyl label, or permanent magic marker (color coded), neatly hand printed. In rooms that are painted out, provide labeling on inside of cover.

E. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power or Lighting 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.

F. 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.

2. Emergency Operating Signs: Install, 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, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

G. 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.

H. 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.
I. Install ARC FLASH WARNING signs on all switchboards, panelboards, industrial control panels, and motor control centers. Sign at a minimum shall contain:

![WARNING](image)

J. Circuits with more than 600V: Identify raceway and cable with "DANGER—HIGH VOLTAGE" in black letters 2 inches high on orange background at 10'-0 foot intervals.

1. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.

2. Wall surfaces directly external to conduits concealed within wall.

3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.

3.2 BOX LABELING

A. All junction, pull, and connection boxes shall be identified as follows:

1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").

2. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

B. Box covers shall be painted to correspond with system type as follows:

1. Fire Alarm: Red

3.3 CONDUCTOR COLOR CODING

A. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes 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.

B. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.
C. 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 tape bands at 6-inch centers. Contractor option to use colored cabling in lieu of the tape at each end for conductor 6 AWG to 500 KCM.

D. Wire and cables smaller than 6 AWG shall be color coded by the manufacturer.

E. 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 from the termination and spaced at 3-inch centers. Tighten to a snug fit, and cut off excess length.

F. 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.

G. Conductors shall be color coded as follows:
   1. 208Y/120 Volt, 4-Wire:
      a. A-Phase – Black
      b. B-Phase – Red
      c. C-Phase – Blue
      d. Neutral – White
      e. Ground Bond – Green
   2. 480Y/277 Volt, 4-Wire:
      a. A-Phase – Brown
      b. B-Phase – Orange
      c. C-Phase – Yellow
      d. Neutral – Gray
      e. Ground Bond – Green

3.4 ELECTRICAL GEAR LABELING

A. Exterior electrical gear shall be identified with vinyl label names and numbers to be visible on the exterior of the gear. The labels shall correspond to the 1-line nomenclature and identify each cubicle of multi-section gear.

3.5 CONTROL EQUIPMENT IDENTIFICATION

A. Provide identification on the front of all control equipment, such as disconnect switches, starters, VFDs, contactors, motor control centers, etc. Nameplate text shall be a minimum of 1/4” high.
B. 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.

EXHAUST FAN EF-1 ("LOCATED ON ROOF")
480V, 3-PHASE
FED FROM “1HA1-1”

3.6 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

A. Provide identification on the front of all power distribution equipment, such as panelboards, switchboards, etc. The identification material shall be engraved plastic-laminated labels. Text shall be a minimum of 1/4” high, Swiss 721 Bold.

B. Labeling shall include:

1. Equipment type and contract documents designation of equipment.
2. Voltage of the equipment.
3. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.

DISTRIBUTION PANEL DP-H1
480Y/277V
FED FROM SWITCHBOARD “SB-1” (LOCATED IN MAIN ELECTRIC ROOM)

C. A separate nameplate for the service entrance equipment shall be labeled with the MAXIMUM AVAILABLE FAULT CURRENT and DATE of calculation given on the one-line diagram.

D. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1").

E. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 05 00 for other requirements.

3.7 TRANSFORMER EQUIPMENT IDENTIFICATION

A. Provide identification on the front of all transformers. The identification nameplate shall be an engraved plastic-laminated label. Text shall be a minimum of 1/4” high.
B. Labeling shall include:

1. Equipment type and contract documents designation of equipment
2. Name of the upstream equipment.
3. Voltage and rating of the equipment.
4. Location of the upstream equipment if it is not located within sight.

TRANSFORMER TR-15
480V: 208Y/120V 15KVA
FED FROM SWITCHBOARD “SB-1” (LOCATED IN MAIN ELECTRIC ROOM)

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting control panels, control station and programming software.
B. Line and low voltage, occupancy sensors, photo sensors and related power supplies.
C. Communications wiring and interfaces related to lighting controls.

1.2 RELATED WORK

A. Section 23 09 00 - Facility Management Control System (FMCS)

1.3 QUALITY ASSURANCE

A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
B. All components and assemblies are to be factory pre-tested prior to delivery and installation.
C. Comply with NEC as applicable to electrical wiring work.
D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.
F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

1.4 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code
C. UL Standard 916 Energy Management Equipment

1.5 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.
B. Submit product data showing dimensions and ratings for relays, dimmers, power supplies, control stations, sensors, and accessory modules.
C. Submit control riser diagram of the specific project system configuration.
D. Submit typical wiring diagrams for all components including, but not limited to, dimmer panels, dimmers, relay panels, relays, low voltage switches, occupancy sensors, control stations, and communication interfaces.

E. Submit manufacturer 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.

1.6 PROJECT RECORD DOCUMENTS

A. Submit project record documents under provisions of Section 26 05 00.

B. Accurately record location of control panels, stations, switches, power supplies, and control enclosures. Include description of switching and circuiting arrangements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit emergency, operation, and maintenance data under provisions of Section 26 05 00. Data shall also include the following:

1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.

2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.

3. Replacement part numbers for all system components.

B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.

C. Submit software operating and maintenance manuals, program software backup on compact disc or compatible media with data files, device address list, and a printout of software application and graphic screens, where applicable.

1.8 SYSTEM DESCRIPTION

A. Provide an integrated lighting controls system consisting of panels, sensors, relays, switches, devices, etc. necessary to comply with the Lighting Control Sequence of Operation, plans and specifications. The system may consist of centralized control, local control and standalone controls. Contractor is responsible for confirming that panels and sensors interoperate as a single system.

B. The lighting control system (LCS) shall be networked with BACnet capabilities.
1.9 WARRANTY

A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.

B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers as listed below meet the qualifications as outlined within this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.

Manufacturer Selection Matrix

1. nLight by Acuity Controls

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches (see Networked LED Luminaire section).

D. Intelligent lighting control devices shall communicate digitally, require <7 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.

E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

F. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.

G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, controls enabled luminaires, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

K. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

L. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.

M. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control schedules and profiles.

N. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

O. Devices located in different lighting zones shall be able to communicate occupancy, photocell (non-dimming), and switch information via the wired backbone.

P. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week, utilization of a space. Note: Operating modes should be utilized only in manners consistent with local energy codes.

1. Auto-On / Auto-Off (via occupancy sensors)
   a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
   c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
2. **Manual-On / Auto-Off (also called Semi-Automatic)**
   a. Pushing a switch will turn lights on.
   b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

3. **Manual-On to Auto-On/Auto-Off**
   a. Pushing a switch will turn lights on.
   b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
   c. Sequence can be reset via scheduled (ex. daily each morning) events.

4. **Auto-to-Override On**
   a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   b. Zone lighting then goes into an override on state for a set amount of time, or until the next time event returns the lighting to an auto-off style of control.
   c. Sequence can be reset via scheduled (ex. daily each morning) events.

5. **Manual-to-Override On**
   a. Pushing a switch will turn lights on.
   b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
   c. Sequence can be reset via scheduled (ex. daily each morning) events.

6. **Auto On / Predictive Off**
   a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
   c. Pressing the switch will turn the lights off and a short “exit timer” begins. After the timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to
7. Multi-Level Operation (multiple lighting levels per manual button press)
   a. Operating mode designed specifically for bi-level applications.
   b. Enables the user to cycle through up to four potential on/off/dim low/dim high lighting states using only a single button.
   c. Eliminates user confusion as to which of two buttons controls which load.
   d. Three different transition sequences are available in order to comply with energy codes or user preference.
   e. Mode available as a setting on all devices that have single manual on/off switch (ex. nPODM, nPODM-DX, nWSX LV).
   f. Depending on the sequence selected, every button push steps through relay/dimming states according to below table.
   g. In addition to achieving bi-level lighting control by switching loads with relays, the ability to command dimming outputs to “step” in a sequence that achieves bi-level operation is present.

![State of load after each pushbutton press](image)

<table>
<thead>
<tr>
<th>MLO Mode</th>
<th>1st Press</th>
<th>2nd Press</th>
<th>3rd Press</th>
<th>4th Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-State (Alternating)</td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Off</strong></td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td>2-State (Both On, A First)</td>
<td><strong>On</strong></td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Off</strong></td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td>2-State (Both On, B First)</td>
<td><strong>Off</strong></td>
<td><strong>On</strong></td>
<td><strong>On</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td></td>
<td><strong>On</strong></td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td>3-State</td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Off</strong></td>
<td><strong>On</strong></td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
</tr>
<tr>
<td>A and B On</td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Off</strong></td>
<td><strong>On</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td>A On Only</td>
<td><strong>On</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Off</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td>A and B On &amp; Dim High</td>
<td><strong>High</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td></td>
<td><strong>High</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td>Dim Low / High</td>
<td><strong>Low</strong></td>
<td><strong>High</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
</tr>
<tr>
<td></td>
<td><strong>High</strong></td>
<td><strong>Low</strong></td>
<td><strong>Off</strong></td>
<td><strong>-</strong></td>
</tr>
</tbody>
</table>

**NOTE 1:** Modes for use only when Auto-On state of Load A & B is different than first MLO state.
Q. A taskbar style desktop application shall be available for personal lighting control.

R. An application that runs on “smart” handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.

S. Control software shall enable logging of system performance data and presenting this information in a web-based format and downloadable to .CSV files.

T. Control software shall enable integration with a BMS via BACnet IP, although a hardware BACnet IP integration solution is also available.

U. System shall provide the option of having pre-terminated plenum rated CAT-5e cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Control Module (Gateway):

1. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet network.

2. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.

3. Control device shall have three RJ-45 ports for connection to the graphic touch screen, other backbone devices (bridges) or directly to lighting control devices (up to 128 per port).

4. Device shall automatically detect all devices downstream of it.

5. Device shall have a standard and astronomical internal time clock.

6. Device shall have one RJ-45 10/100 BaseT Ethernet connection.

7. Device shall have a USB port

8. Each control gateway device shall be capable of linking 1500 devices to the management software, with reduced memory version capable of support up to 400 devices.

9. Device shall be capable of using a dedicated static or DHCP assigned IP address.

10. Network Control Gateway device shall be the following nLight model Series:
    a. nGWY2

B. [SW-OC-D] Networked System Occupancy Sensors:

1. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
2. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.

3. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

4. All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

5. Sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).

6. Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.

7. Sensors shall be available in multiple lens options which are customized for specific applications.

8. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

9. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.

10. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate a potential wiring issue.

11. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.

12. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.

13. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.

14. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
15. Wall switch sensors shall be Ivory.

16. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls.

17. Wall switch sensors shall be the following nLight model numbers, with device color and optional features as specified:
   a. nWSX PDT LV DX (Dual Tech, No Relay, Raise/Lower Dim Ctrl) [WC]

18. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.

19. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.

20. Sensors shall be the following nLight model numbers, with device options as specified:

<table>
<thead>
<tr>
<th>Model # Series</th>
<th>Occupancy Poles</th>
<th># of Relays</th>
<th>Lens Type</th>
<th>Detection Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>nCM(B) PDT 9</td>
<td>1</td>
<td>-</td>
<td>Standard</td>
<td>Dual</td>
</tr>
<tr>
<td>nCM(B) PDT 9 2P</td>
<td>2</td>
<td>-</td>
<td>Standard</td>
<td>Dual</td>
</tr>
<tr>
<td>nCM PDT 9 RJB</td>
<td>1</td>
<td>-</td>
<td>Standard</td>
<td>Dual</td>
</tr>
<tr>
<td>nCM PDT 9 2P RJB</td>
<td>2</td>
<td>-</td>
<td>Standard</td>
<td>Dual</td>
</tr>
<tr>
<td>nCM(B) PDT 10</td>
<td>1</td>
<td>-</td>
<td>Extended</td>
<td>Dual</td>
</tr>
<tr>
<td>nCM(B) PDT 10 2P</td>
<td>2</td>
<td>-</td>
<td>Extended</td>
<td>Dual</td>
</tr>
<tr>
<td>nCM PDT 10 RJB</td>
<td>1</td>
<td>-</td>
<td>Extended</td>
<td>Dual</td>
</tr>
<tr>
<td>nCM PDT 10 2P RJB</td>
<td>2</td>
<td>-</td>
<td>Extended</td>
<td>Dual</td>
</tr>
<tr>
<td>nRM PDT 9</td>
<td>1</td>
<td>-</td>
<td>Standard</td>
<td>Dual</td>
</tr>
<tr>
<td>nRM PDT 10</td>
<td>1</td>
<td>-</td>
<td>Extended</td>
<td>Dual</td>
</tr>
<tr>
<td>nWV PDT 16</td>
<td>1</td>
<td>-</td>
<td>Wide View</td>
<td>Dual</td>
</tr>
<tr>
<td>nHW13</td>
<td>1</td>
<td>-</td>
<td>Hallway</td>
<td>PIR</td>
</tr>
</tbody>
</table>

C. [SW-LS-D] Networked System Daylight (Photocell and/or Dimming) Sensors:

1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

2. Photocell and dimming sensor’s set-point and deadband shall be automatically calibrated through the sensor’s microprocessor by initiating an “Automatic Set-
point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.

3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

4. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the “auto set-point” setting.)

5. Combination units that have all features of on/off photocell and dimming sensors shall also be available.

6. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an “offset” from the primary zone.

7. Sensor shall be the following nLight model numbers, with device options as specified:
   a. nRM ADCX (remote automatic dimming control photocell)

8. Network system shall have dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.

9. Embedded sensors shall be the following nLight model number:
   a. nES ADCX (Dimming Photocell)

D. Networked System Power (Relay) Packs:

1. Power Packs shall incorporate one Class 1 relay, a 0-10 VDC dimming output, and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.

2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.

3. All devices shall have two RJ-45 ports.

4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.

5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel.
Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

7. Power Packs (Secondary) shall be available that provide up to 16 Amp switching of all lighting load types.

8. Power Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming or fluorescent ballasts/LED drivers.

9. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).

10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.

11. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.

12. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.

13. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.

14. Power (Secondary) Packs shall be available that provide up to 20 Amps switching of general purpose receptacle (plug-load) control.

15. Power (Relay) Packs and Supplies shall be the following nLight model numbers:
   a. nPP16 (Power Pack w/ 16A relay)
   b. nPP16 D (Power Pack w/ 16A relay and 0-10VDC dimming output)
   c. nPP16 WIFI (Power Pack w/ 16A relay, WIFI enabled)
   d. nEPP5 D (Power Pack w/ 5A relay and 0-10VDC dimming output)
   e. nSP16 (Secondary Pack w/ 16A relay)
f. nPP16 ER (UL924 Listed Secondary Pack w/ 16A relay for switching emergency power circuits)

g. nPP16 D ER UL924 Listed Secondary Pack w/ 16A relay and 0-10VDC dimming output for switching/dimming emergency power circuits)

h. nSP5 PCD ELV 120 (Secondary Pack w/ 4A relay and electronic low voltage dimming output)

i. nSP5 2P LVR (Louver/Damper Control Pack)

j. nSHADE (Pulse On/Off Control Pack)

k. nPP20 PL (Secondary Pack w/ 20A relay for general purpose receptacle load)

l. nPS 80 (Auxiliary Bus Power Supply)

m. nPS 80 WIFI (Auxiliary Bus Power Supply, WiFi enabled)

n. nAR 40 (Low voltage auxiliary relay pack)

E. Networked Auxiliary Input / Output (I/O) Devices:

1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½” knockout.

2. Devices shall have two RJ-45 ports

3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

4. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current.

5. Specific I/O devices shall have an input that reads a 0-10 VDC signal from an external device.

6. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event (toggle the lighting load) or run a local/remote control profile.

7. Specific I/O devices shall sense state of low voltage outdoor photocells.

8. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.

9. Specific I/O devices shall sense momentary and maintained contact closures, and either toggle a connected load after a momentary contact or ramp the load high/low during a maintained contact (stopping when the contact releases).
10. Auxiliary Input/Output Devices shall be the following nLight model numbers:
   a. nIO D (I/O device with 0-10 dimming output)
   b. nIO 1S or nIO RLX (I/O device with contact closure or 0-10VDC dimming input)

F. Networked LED Luminaires:
   1. Networked LED luminaire shall have a mechanically integrated control device
   2. Networked LED luminaire shall have two RJ-45 ports available (via control device directly or incorporated RJ-45 splitter)
   3. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
   4. Networked LED luminaire shall provide low voltage power to other networked control devices (excluding EMG versions)
   5. System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports “sleep mode”
   6. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
   7. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
   8. Integrated control devices shall be the following nLight model series:
      a. nIO LEDG (ER)
      b. nIO EZ PH (ER)
      c. nPS 80 EZ (ER)
      d. nEPS 60 IO EZ
      e. nEIO EZ LC (ER)

G. Networked System Wall Switches and Dimmers [WC-#]:
   1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
   2. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
   3. All devices shall have two RJ-45 ports.
   4. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
5. Devices shall be Ivory.

6. Devices with mechanical push-buttons shall provide tactile and LED user feedback.

7. Devices with mechanical push-buttons shall be made available with custom button labeling.

8. Devices with a single “on” button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.

9. Wall switches & dimmers shall be the following nLight model numbers, with device options as specified:
   a. nPODM DX (single on/off, single dimming raise/lower, push-buttons, LED user feedback)
   b. nPODM 2P DX (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)

H. Communication Bridges:

1. Device shall surface mount to a standard 4” x 4” square junction box.

2. Device shall have 8 RJ-45 ports.

3. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.

4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.

5. Device shall be capable of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

6. Communication Bridge devices shall be the following nLight model numbers:
   a. nBRG 8 (8 Ports)

2.4 LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.
B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.

C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.

D. Specific device parameters (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.

E. All lighting control profiles shall be stored on the network control gateway device, with a system backup on the software’s host server.

F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.

J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.5 MANAGEMENT SOFTWARE

A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software.

B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).

C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.

D. A printable network inventory report shall be available via the software.

E. A printable report detailing all system profiles shall be available via the software.

F. Software shall require all users to login with a User Name and Password.
G. Software shall provide at least three permission levels for users.

H. All sensitive stored information and privileged communication by the software shall be encrypted.

I. All device firmware and system software updates must be available for automatic download and installation via the internet.

J. Software shall be capable of managing systems interconnected via a WAN (wide area network)

2.6 SYSTEM ENERGY ANALYSIS AND REPORTING SOFTWARE

A. System shall be capable of reporting lighting system events and performance data back to the management software for display and analysis.

B. Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.

C. An “Energy Scorecard” shall be display that shows calculated energy savings in dollars, KWHr, or CO2.

D. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc).

E. Energy savings data shall be calculated for the system as a whole or for individual zones.

F. A time scaled graph showing all relay transitions shall be presented.

G. A time scaled graph showing a zones occupancy time delay shall be presented

H. A time scaled graph showing the total light level shall be presented.

I. User shall be able to customize the baseline run-time hours for a space.

J. User shall be able to customize up to four time-of-day billing rates and schedules.

K. Data shall be made available via a .CSV file

2.7 START-UP AND SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.
D. All system devices shall be capable of being given user defined names.

E. All devices within the network shall be able to have their firmware upgraded remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

F. All sensor devices shall have the ability to detect improper communication wiring and blink it’s LED in a specific cadence as to alert installation/startup personnel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring and shall maintain 150 mm (6 inch) spacing from electronic ballast and other RFI/EMI sources.

C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

3.3 SUPPORT SERVICES

A. Documentation:

1. Manufacturer shall provide system documentation including:

   a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or BMS/BAS interface unit.

   b. Drawings for each panel showing hardware configuration and numbering.
c. Panel wiring schedules.

d. Typical diagrams for each component.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Device plates and box covers
B. Receptacles including GFCI
C. Wall switches

1.2 QUALITY ASSURANCE
A. Provide similar devices from a single manufacturer.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
C. Comply with NFPA 70.

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. FS W-S-896 - Switch, Toggle
D. NEMA WD 1 – General Color Requirements for Wiring Devices
E. NEMA WD 6 – Wiring Devices – Dimensional Requirements
F. UL 498 – Standard for Attachment Plugs and Receptacles
G. UL 943 – Standard for Ground Fault Circuit Interrupters
H. UL 1472 – Solid-State Dimming Controls

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 ivory, unless indicated otherwise.

2.2 COVERPLATES
   A. All switches, receptacles, and outlets shall be complete with the following:
      1. Unbreakable thermoplastic/thermoset plastic coverplates in finished spaces where wall are finished.
      2. #302 stainless steel coverplates in unfinished spaces for flush 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. Devices that are shaded on the drawings shall be red.
   C. [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.
   D. [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.


E. [REC-SIM-520R]: NEMA 5-20R Simplex Receptacle:
   1. 125 volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.
   2. Approved Manufacturers: Hubbell HBL5361, Leviton, 5361, Pass & Seymour 5361, Cooper 5361.

F. [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.

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 the 2006 edition of U.L. 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 during installation.

2.4 WALL SWITCHES

A. Refer to Electrical Symbols List for device type.

B. [SW-1P]: Single Pole Switch:
   1. Single throw, 120/277 volt, 20 amp maintained contact. Toggle handle, side and back wired.
   2. Approved Manufacturers: Hubbell HBL1221, Leviton 1221-2, Pass & Seymour PS20AC1, Cooper AH1221.

2.5 POKE-THROUGH FITTINGS

A. UL listed as fire-rated poke-through device for 2 hour rated floors: include fire stops and smoke barriers in through-floor component. UL514A listed for scrub locations.

B. Terminate in 4-inch square by 2-1/2 inch deep junction box.

C. Suitable for installation with a floor thickness of 2-1/4 to 7 inches.
D. Semi-flush die-cast aluminum carpet flange.

E. Spring loaded receptacle covers.

F. Verify color with Architect.

G. [REC-FB-P]: Fire Rated Poke-Through:
   1. Flush mounted. For use with 3-inch core holes. 125 volt, 20 amp, NEMA 5-20R duplex receptacle with 3/4” conduit and junction box. Provide with two (2) data jacks. With solid brass flange.
   2. Approved Manufacturers: Hubbell PT2X2, Wiremold, Thomas & Betts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install light switches and 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. Drill opening for poke-through fitting installation in accordance with manufacturer’s instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.

D. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.

E. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.

F. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

G. Install devices and wall plates flush and level.

H. 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.

I. Test receptacles for proper polarity, ground continuity and compliance with requirements.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires and accessories
B. Lamps
C. Ballasts

1.2 REFERENCES

A. ANSI C78.377-2008 – Specifications for the Chromaticity of Solid State Lighting Products
B. ANSI C82.77-2002 – Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
C. IEEE C2 - National Electrical Safety Code
D. NEMA LE 2 - H-I-D Lighting System Noise Criterion (LS-NC) Ratings

1.3 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.
B. Submit product data sheets for luminaires, lamps, ballasts, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with fixtures listed in ascending order, and with each luminaire's associated lamp, ballast, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
C. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
D. Include outline drawings, support points, weights, and accessory information for each luminaire type.
E. Submit utility rebate forms, where offered at project location, with rebate items completed.
F. LED luminaire submittals shall include photometric report per IESNA LM-79-08 for the latest generation system being furnished, including independent testing laboratory name, report number, date, luminaire model number, input wattage, luminaire, and light source specifications. Manufacturer origin of LED chipset and driver shall be submitted.
G. For all LED luminaires specified as dimmer controlled, submit dimmer device data that is approved by manufacturer of submitted luminaire and that Contractor proposes to furnish and install. Contractor is responsible for verifying that installed dimming controls are compatible with and approved by the luminaire manufacturer.
1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site. Store and protect under provisions of Section 26 05 00.

B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.

C. Handle site lighting poles carefully to prevent breakage and damage to finish.

1.5 WARRANTY

A. Light emitting diode (LED) light engines and drivers shall have a five-year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.

B. Exit Signs: Stencil face, 6 inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings.

C. Self-Powered Exit Signs: Stencil face, 6 inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings. One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

D. Painted reflector surfaces shall have a minimum reflectance of 90%.

2.2 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

A. Light emitting diodes used in interior applications shall have a minimum color rendering index (CRI) of 80. Light emitting diodes used in exterior applications shall have a minimum color rendering index (CRI) of 70. Color temperature of the luminaires shall be as noted on the luminaire schedule.

B. LED chip arrays specified as color changing shall have chip colors as noted on the luminaire schedule.

C. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.
D. LED Driver:

1. Solid state driver with integral heat sink. Driver shall have overheat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 20%. Surge suppression device for all exterior luminaires.

2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type.

3. Driver shall have a minimum of 50,000 hours rated life.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. If ceiling framing is not listed for luminaire size or weight, support luminaires independent of ceiling grid with a minimum of two (2) #12 gauge wires located on diagonal corners.

B. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Support luminaires independent of ceiling with a minimum of two (2) #12 gauge wires located on diagonal corners.

C. Support surface-mounted luminaires directly from building structure. Install luminaires larger than eight square feet (8 ft²) or weighing more than 30 pounds independent of ceiling framing.

D. Support suspended or pendant mounted luminaires independent of ceiling grid with a minimum of two #12 gauge wires. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.

E. Install lamps in lamp holders of luminaires.

F. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.

3.2 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

3.3 LUMINAIRE SCHEDULE

A. As shown on the drawings.

END OF SECTION
BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.

1.2 SCOPE OF WORK

A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the Communications Systems as shown on the drawings and specified herein.

B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make their portion of the Communications Systems a finished and working system.

C. Description of Systems include but are not limited to the following:

1. Complete Structured Cabling System including, but not limited to:
   a. Voice and data horizontal cabling and terminations.
   b. Information outlets (IO’s) including faceplates, jacks and labeling.
   c. Cable management and equipment.
   d. Telecommunication Room equipment including patch panels.
   e. Cabling pathways.
   f. Grounding and Bonding
   g. Testing

2. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.

3. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the “Suggested Matrix of Scope Responsibility”.

1.3 OWNER FURNISHED PRODUCTS

A. Active network electronic equipment including routers, switches, gateways, telephone system head end equipment, desktop and wall mount telephones, printers/fax machines, etc.

B. AV equipment including projectors, screens, control system, source equipment, and all associated AV cabling, etc.
1.4 WORK SEQUENCE

A. All construction work that will produce excessive noise levels and interference with normal operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

1.5 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in 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 in the contract documents. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. “Electrical Contractor” as referred to herein refers to the Contractors listed in Division 26 of this Specification.

2. “Electrical Contractor” shall also refer to the Contractor listed in Division 27 of this specification when the “Suggested Matrix of Scope Responsibility” indicates the work shall be provided by the EC. Refer to the Contract Documents for the “Suggested Matrix of Scope Responsibility”.

3. “Communications Contractor” as referred to herein refers to the Contractors listed in Division 27 of this Specification.

4. Low Voltage Communications Wiring: The wiring (less than 120VAC) associated with the Communications Systems, used for analog and/or digital signals between equipment.

5. Telecommunications Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications information outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling. Where surface mounted backboxes are required, conduit shall be routed to above the lay-in ceiling.

C. General:

1. The purpose of these Specifications is to outline typical Electrical and Communications Contractor’s work responsibilities as related to Communications Systems including Telecommunications rough-in, conduit, power wiring and Low Voltage Communications Wiring. The prime contractor is responsible for all divisions of work.
2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the Communications Drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the Communications Drawings but required for the successful operation of the systems shall be the responsibility of the Communications Contractor and included in the Contractor’s bid.

3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Communications systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Communications Contractor has convened to determine the exact location and requirements of the installation.

4. This Contractor shall establish Electrical and Communications utility elevations prior to fabrication and installation. The Communications Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

   a. Lighting Fixtures
   b. Gravity Flow Piping, including Steam and Condensate
   c. Sheet Metal
   d. Electrical Busduct
   e. Sprinkler Piping and other Piping
   f. Conduit and Wireway
   g. Open Cabling

D. Electrical Contractor’s Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the “Suggested Matrix of Scope Responsibility” to be provided by the Electrical Contractor.

2. Responsible for Communications Systems grounding and bonding.

3. 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. Communications Contractor’s Responsibility:

1. Assumes all responsibility for the Low Voltage Communications Wiring of all systems, including cable support where open cable is specified.

2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the “Suggested Matrix of Scope Responsibility.”
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).

4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of Communications equipment which is required to be bonded to the Communications ground 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.

1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

   a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

   b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5” and larger, conduit racks, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

   c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5” and larger, conduit racks, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

   d. Maintenance clearances and code-required dedicated space shall be included.

   e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.

2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

   a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. KJWW 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 KJWW. KJWW will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

   a. Scale of drawings:

      1) General plans: 1/4 Inch = 1 ’-0” (minimum).

      2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1’-0” (minimum).

      3) Shafts and risers: 1/2 Inch = 1’-0” (minimum).

      4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 ’-0” (minimum).

      5) Sections of congested areas: 1/2 Inch = 1’-0” (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.

3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner’s Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.

2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.

4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.

8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

   a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

   b. Potential layout changes shall be made to avoid additional access panels.

   c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.

e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.

11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.

12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.7 QUALITY ASSURANCE

A. Telecommunications Structured Cabling System Standards:

1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:

   a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling

   b. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises

      1) C.1 - Commercial Building Telecommunications Standard

      2) C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard

   c. ANSI/TIA-569-C - Telecommunications Pathways and Spaces

   d. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructure

   e. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications


   g. ANSI/TIA-942-A - Telecommunications Infrastructure Standard for Data Centers
h. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

i. NFPA 70 (NEC) - National Electrical Code (Current Edition)

j. UL 444 - Standard for Safety for Communications Cable

B. Refer to individual sections for additional Quality Assurance requirements.

C. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.

2. The installing Contractor shall be **certified** by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.

3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.

4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.

5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.

6. The Contractor shall obtain the services of a RCDD (Registered Communications Distribution Designer) for the project. The RCDD shall perform the following tasks on the project:

   a. Review contractor’s submittals and stamp the submittals with a current RCDD stamp stating the submittals compliance with the contract documents.

   b. Provide written and dated confirmation of an observation of the contractor’s installation activities no less than every [2 weeks] [month] during the construction period.

   c. Provide a final written and dated confirmation of a final construction review prior to testing.
d. Review final testing of system and provide current RCDD stamp on the
documented results or transmittal of the results stating the test results
compliance with the contract documents.

7. The Contractor shall have certified BICSI installation technicians on staff to
perform the following tasks on the project:
   a. Act as the field superintendent or job foreman with the responsibility of
      monitoring the daily work of each technician.
   b. Oversee all testing and termination of cabling.

8. A resume of qualification shall be submitted with the Contractor’s bid indicating
the following:
   a. Documentation of certification of This Contractor by the proposed
      structured cabling system manufacturer as required at the end of this
      specification section.
   b. A list of test equipment proposed for use in verifying the installed
      integrity of copper and systems on the project.
   c. Resume and certification of the RCDD for the project as required by the
      form at the end of this specification section.
   d. Resume and certification of the BICSI installation technician for the
      project.

D. Compliance with Codes, Laws, Ordinances:
   1. This Contractor shall conform to all requirements of the City of Dixon, Illinois
      Codes, Laws, Ordinances and other regulations having jurisdiction over this
      installation.
   2. This Contractor shall also conform to all published standards of the Sauk Valley
      Community College as related to this installation.
   3. In the event there are no local codes having jurisdiction over this job, the current
      issue of the National Electrical Code shall be followed.
   4. If there is a discrepancy between the codes and regulations having jurisdiction
      over this installation, and these specifications, the codes and regulations shall
      determine the method or equipment used.
   5. If the Contractor notes, at the time of bidding, any parts of the drawings and
      specifications which are not in accordance with the applicable codes or
      regulations, he shall inform the Architect/Engineer in writing, requesting a
      clarification. If there is insufficient time to follow this procedure, he shall submit
with the proposal, a separate price required to make the system shown on the
drawings comply with the codes and regulations.

6. All changes to the system made after the letting of the contract, in order to
comply with the applicable codes or the requirements of the Inspector, shall be
made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.

2. Abide by all applicable laws, regulations, ordinances, and other rules of the State
or Political Subdivision wherein the work is done, or as required by any duly
constituted public authority.

3. Pay all applicable charges for such permits or licenses that may be required.

4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other
regulatory bodies.

5. Pay all charges arising out of required inspections due to codes, permits, licenses
or as otherwise may be required 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 independent
agency/consultant.

7. Pay any charges by the service provider related to the service or change in
service to the project.

8. All equipment and materials shall be as approved or listed by the following
(unless approval or listing is not applicable to an item by all acceptable
manufacturers):

   a. Factory Mutual
   
   b. Underwriters’ Laboratories, Inc.

F. Examination of Drawings:

1. The drawings for the Communications Systems work are diagrammatic,
intended to convey the scope of the work and to indicate the general
arrangements and locations of equipment etc., and the approximate sizes of
equipment.

2. Contractor shall determine the exact locations of equipment and the exact
routing of cabling so as to best fit the layout of the job. Scaling of the drawings
will not be sufficient or accurate for determining this layout. Where a specific
route is required, such route will be indicated on the drawings.
3. 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.

4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.

5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.

6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

G. 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 KJWW.

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 KJWW 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 KJWW as to the accuracy or correctness of the information provided. KJWW accepts no responsibility or liability for the Contractor’s use of these documents.
H. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.

3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

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:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Submittal Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 05 26</td>
<td>Communications Bonding</td>
</tr>
<tr>
<td>27 05 28</td>
<td>Interior Communications Pathways</td>
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<td>27 05 53</td>
<td>Identification and Administration</td>
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<td>27 11 00</td>
<td>Communication Equipment Rooms</td>
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<td>27 15 00</td>
<td>Horizontal Cabling Requirements</td>
</tr>
<tr>
<td>27 17 10</td>
<td>Testing</td>
</tr>
</tbody>
</table>

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. Description of items submitted and relevant specification number
   e. Notations of deviations from the contract documents
   f. 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. Description of item submitted (using project nomenclature) and relevant specification number
   g. Notations of deviations from the contract documents
   h. Other pertinent data
   i. 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 th

5. e location thereof conform to the requirements of the contract documents.

6. 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 shall provide RCDD stamp on the submittal.
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.).

e. The Contractor shall review, stamp and approve all subcontractors’ submittals as described above.

f. 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.

7. 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.

8. Schedule submittals to expedite the project. Coordinate submission of related items.

9. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
10. Reproduction of contract documents alone is not acceptable for submittals.
11. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
12. Submittals not required by the contract documents may be returned without review.
13. 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.
14. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
15. 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: 27 XX XX.description.YYYYMMDD
   b. Transmittal file name: 27 XX XX.description.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.9 CHANGE ORDERS
A. A detailed material and labor take-off shall be prepared for each change order along with labor rates and mark-up percentages. Change orders with inadequate breakdown will be rejected.
B. Change order work shall not proceed until authorized.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.

B. Store materials on the site so as to prevent damage.

C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

1.11 WARRANTY

A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.

B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion 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 or their representative.

C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.12 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.13 MATERIAL

A. Where several manufacturers’ names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required to be used in this contract.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits 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 not later than ten (10) days prior to the bid opening date. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.

D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, 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. Should a voluntary alternate material be accepted, this Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on this Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.1 REFER TO INDIVIDUAL SECTIONS

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 GENERAL INSTALLATION REQUIREMENTS

A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor)
condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.

B. It is the Contractor’s responsibility to survey the site and include all necessary costs to perform the installation as specified.

C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor’s expense to pre-existing conditions, including final colors and finishes.

3.3 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 27 sections for further requirements.

2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.

3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.

4. In the event the results obtained in the tests are not satisfactory, The Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.

5. All telecommunications tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

B. Protection of 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 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.

2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component 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. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.

2. Refer to the end of this specification section for a “STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION.”

3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.

2. Submitted bound copies of approved shop drawings.

3. Record documents including edited drawings and specifications accurately reflecting field conditions, inclusive of all project revisions, change orders, and modifications.

4. Submitted a report stating the instructions given to the Owner's representative 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 representative as having received the instructions.

5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.

7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site submit receipt to Architect/Engineer prior to final payment being approved.

8. Provide System Assurance Warranty certificate for the telecommunications system.

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.div27.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div27.contractor.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as “1 of 2”, “2 of 2”, etc.
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. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.


7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

8. Dimensional drawings of equipment.

9. Capacities and utility consumption of equipment.

10. Detailed parts lists with lists of suppliers.

11. Operating procedures for each system.

12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.

13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.

15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER’S REPRESENTATIVE

A. Adequately instruct the Owner’s designated representative or 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 representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner’s representative so that their representative can be present if desirable.

D. Refer to the individual specification sections for minimum hours of instruction time for each system.

E. Operating Instructions:

1. The Contractor is responsible for all instructions to the Owner and/or Owner’s operating staff on the Communications Systems.

2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM COMMISSIONING

A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.

B. All operating conditions and control sequences shall be simulated and tested during the start-up period.

C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to insure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory 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 material basis for services rendered at the Architect/Engineer’s standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to 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. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

C. This Contractor shall maintain at the job site, a separate and complete set of Communications Drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Communications Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. 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. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.

E. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

A. Contractor shall thoroughly clean all equipment and systems prior to the Owner’s final acceptance of the project.

B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.

C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

END OF SECTION
STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

In order to assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor’s agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (ladder rack, conduit sleeves, etc) are installed and all cabling has been pulled through them.
2. All telecommunications jacks are installed in the faceplates.
3. All telecommunications cabling is pulled and at least 75% of all jacks have been terminated at the jack and at the telecom room.
4. Telecommunications testing is in progress and at least 25% of testing has been completed.
5. Telecommunications labeling has been provided on at least 25% of each type of component requiring a label.
6. All telecommunications related grounding is complete.

The project will be ready for final jobsite observation prior to the requested date of the observation, according to the above list of requirement.

Prime Contractor: _________________________  By: _____________________________

Requested Observation Date ____________  Today’s Date: _________________

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation. It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor’s retainage may be deducted for the same amount.
Telecommunications – Proof of Certification

There are specific Contractor qualification requirements for this project as defined in Section 27 05 00, which may include Manufacturer Certification and RCDD credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:

The named Contractor’s base bid is a structured cabling solution from the connectivity manufacturer _______________. Named Contractor is trained and certified, under the named manufacturer’s formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of ________, 20__.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: ______________________________________________________

Authorized Representative: (print) ________________________________________________

Date: ________________    Manufacturer Certification Number (if any): ________________

If this project requires RCDD certification, complete the following:

RCDD Name: ________________    RCDD #: __________    Expiration: __________

Submit the following with the bid:

- This form.
- Proof of Manufacturer Certification indicated above.
- Proof of RCDD status.
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Bonding Conductors
B. Bonding Connectors
C. Grounding Busbar (TMGB and TGB)

1.2 RELATED WORK

A. Section 26 05 33 – Conduit
B. Section 26 05 13 – Wire and Cable
C. Section 26 05 26 – Grounding and Bonding
D. Section 27 05 00 – Basic Communications Systems Requirements
E. Section 27 11 00 – Communication Equipment Rooms
F. Section 27 05 28 – Interior Communication Pathways
G. Section 27 05 53 – Identification and Administration

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for relevant standards.
B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.
C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

1.4 REFERENCES

A. ANSI/IEEE 1100 – Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
B. ANSI/TIA/EIA 568-C – Commercial Building Telecommunications Cabling Standard
C. ANSI/TIA/EIA 569-A – Commercial Building Standard for Telecommunications Pathways and Spaces
D. ANSI/TIA/EIA 606 – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
E. ANSI-J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

G. NFPA 70 – National Electrical Code

H. UL 467 – Grounding and Bonding Equipment

1.5 SUBMITTALS

A. Submit product data and shop drawings under provisions of Section 27.05.00 and Division 1.

B. Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:

1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.

2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

C. Provide CAD-generated, project-specific system shop drawings as follows:

1. Provide a system block diagram indicating system configuration, system components, interconnection between components, and conductor routing. The diagram shall clearly indicate all wiring and connections required in the system. When multiple devices or pieces of equipment are required in the exact same configuration (e.g., multiple identical equipment racks or sections of ladder tray), the diagram may show one device and refer to the others as “typical” of the device shown. The diagram shall list room numbers where system equipment will be located.

2. Installation details for all system components.

D. Provide system checkout test procedure to be performed at acceptance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under the provisions of Section 27.05.00.

B. Store and protect products under the provisions of Section 27.05.00.

C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.
1.7 SYSTEM DESCRIPTION

A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.

B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.

C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.

D. Basic System Requirements:

1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-A and NFPA 70 for complete information.

2. The bonding system shall include, but not be limited to, the following major components:
   a. Bonding Conductor for Telecommunications (BCT)
   b. Telecommunications Main Grounding Busbar (TMGB)
   c. Telecommunications Bonding Backbone (TBB)
   d. Telecommunications Grounding Busbar(s) (TGB)
   e. Bonding Conductor(s) (BC)
   f. Bonding Connectors
   g. Bonding system labeling and administration as defined in Section 27 05 53.

1.8 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 27 05 00.

B. Provide final system block diagram showing any deviations from approved shop drawing submittal.

C. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.

D. Complete all operation and maintenance manuals as described below.
1.9 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 27 05 00.

B. Submitted data shall include:

1. Approved shop drawings.

2. Descriptions of recommended system maintenance procedures, including:
   a. Inspection
   b. Periodic preventive maintenance
   c. Fault diagnosis
   d. Repair or replacement of defective components

PART 2 - PRODUCTS

2.1 BONDING CONDUCTORS

A. Bare Copper:
   1. Annealed uncoated stranded conductor.
   2. Minimum size 6 AWG.

B. Insulated Copper:
   1. Annealed uncoated stranded conductor.
   2. Insulation:
      a. PVC insulation with nylon outer jacket.
      b. Rated ≥ 600 volts.
      c. Green.
   3. Minimum size 6 AWG.

C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.

D. Bonding Conductor Sizing
   1. All Communications bonding system conductors shall be sized by length as follows:

<table>
<thead>
<tr>
<th>Length Linear ft (m)</th>
<th>Size (AWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 13 (4)</td>
<td>6</td>
</tr>
<tr>
<td>14 - 20 (4 - 6)</td>
<td>4</td>
</tr>
</tbody>
</table>
### 2.2 BONDING CONNECTORS

**A. Acceptable Types:**

1. Two-hole compression lug
2. Exothermic weld
3. Irreversible compression

**B. Connectors shall be provided in kit form and selected per manufacturer’s written instructions.**

**C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.**

### 2.3 GROUNDING BUSBAR (TMGB AND TGB)

**A. Features:**

1. Wall-mount configuration.
2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
4. Predrilled holes.
5. Integral insulators.

**B. Specifications:**

1. **Material:** Electrolytic tough pitch copper bar with tin plating.
2. **Minimum Dimensions:** 1/4” thick x 4” high x 12” long.
   
   a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
3. Hole pattern shall include:
   a. A minimum of 15 sets of 5/16” holes, 5/8” on center, to accommodate “A” spaced 2-hole compression lugs.
   b. A minimum of three (3) sets of 7/16” holes, 1” on center, to accommodate “C” spaced 2-hole compression lugs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Bonding Requirements:
   1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
   2. A licensed electrician shall perform all bonding.
   3. Comply with the manufacturer’s instructions and recommendations for installation of all products.

B. Telecommunications Main Ground Bar (TMGB) Requirements:
   1. Install TMGB such that it is insulated from its support with a minimum 2” standoff.
   2. Bond the TMGB to the electrical service ground via the BCT.
      a. A minimum of 1 foot (300 mm) separation shall be maintained between the BCT and any DC power cables, switchboard cable, or high frequency cables.
   3. TMGB shall be bonded to all electrical panels located in the same room or space as the TMGB or in an immediately adjacent space within 20 linear feet of the TMGB. TMGB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the TMGB.
   4. TMGB shall be bonded to accessible metallic building structure located within the same room or space as the TMGB.
   5. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the TMGB, shall be bonded to the TMGB.
6. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the TMGB, shall be bonded to the TMGB.

C. Telecommunications Ground Bar (TGB) Requirements:

1. Provide a TGB in each telecommunications equipment room.

2. Install TGB such that it is insulated from its support with a minimum 2” standoff.

3. Bond each TGB to the TMGB via the TBB.
   a. A minimum of 1 foot (300 mm) separation shall be maintained between the TBB and any DC power cables, switchboard cable, or high frequency cables.
   b. The TBB may be routed from TGB to TGB or as a radial feed to each TGB as the layout requires.

4. When there are multiple telecommunications equipment rooms on each floor in buildings containing more than five stories, the TGBs on the same floor shall be bonded together horizontally using a grounding equalizer (GE) on the first, last, and every third intermediate floor. GE conductors shall be the same size as the TBB.

5. If more than one (1) TGB is provided within the same room or space, they shall all be bonded together via a BC the same size as the TBB.

6. TGBs shall be bonded to accessible metallic building structure located within the same room or space as the TGBs.

7. TGBs shall be bonded to all electrical panels located in the same room or space as the TGB or in an immediately adjacent space within 20 linear feet of the TGB. TGBs shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the TGB.

8. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the TGB, shall be bonded to the TGB.

9. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the TGB, shall be bonded to the TGB.
D. Metallic Interior Communication Pathway Bonding Requirements:

1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.

E. Bonding Conductor Requirements:

1. Bonding conductors shall be green or marked with a distinctive green color.

2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.


4. All conductors, including, but not limited to, the BCT, TBB, GE(s), and BC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.

   a. Where documented permission to splice a conductor is granted:

   1) The number of splices shall be limited to as few as possible.

   2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.

   3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.

   4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.

5. All bonding conductors shall be labeled in accordance with the requirements of Section 27 05 53. In addition to the requirements of Section 27 05 53:

   a. Labels shall be nonmetallic.

   b. Labels shall be printer-generated.

   c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
Additionally, conductors shall be labeled as follows:

1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."

6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.

7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.

F. Bonding Connection Requirements:

1. Make all connections in accessible locations to facilitate future inspection and maintenance.

2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.

3. Thoroughly clean conductors before installing lugs and connectors.

4. Install and tighten all connectors in accordance with manufacturer’s instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer’s recommendations.

5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.

6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer’s recommendations and instructions.

7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor’s outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer’s recommendations and instructions.

3.2 FIELD QUALITY CONTROL

A. Field testing shall be performed under provisions of Section 27 05 00.
B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.

C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

3.3 ADJUSTING

A. Adjust work under provisions of Section 27 05 00.

B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

3.4 TESTING

A. Test installed system under provisions of Section 27 17 10.

B. Measure and document resistance to ground at TMGB, each TGB, each RTGB, and each electrical distribution panel bonded to the TMGB or a TGB.

1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.

2. Measured resistance to ground at TMGB, each TGB, and each RTGB must not exceed 2 ohms.

3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.

C. Include measurement documentation in test data submitted at completion of project under provisions of Section 27 17 10.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

   A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete conduits, sleeves, etc. for an interior cabling plant as shown on the drawings.

1.2 RELATED WORK

   A. Section 26 05 33 - Conduit
   B. Section 27 05 00 - Basic Communications Systems Requirements
   C. Section 27 05 26 - Communications Bonding

1.3 QUALITY ASSURANCE

   A. Refer to Section 27 05 00 for requirements.

1.4 REFERENCES

   A. ANSI/NFPA 70 - National Electrical Code

1.5 SUBMITTALS

   A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:

      1. Manufacturer’s data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

      2. Manufacturer’s installation instructions.

   B. Coordination Drawings:

      1. Include conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

1.6 DRAWINGS

   A. The drawings, which constitute a part of these specifications, indicate the general route of conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.
PART 2 - PRODUCTS

2.1 CONDUIT
A. Refer to Section 26 05 33 for conduit requirements for this project.

2.2 CABLE HANGERS AND SUPPORTS
A. Provide a non-continuous cable support system suitable for use with open cable.
B. Cable Hooks:
   1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8”. Hooks shall have 90-degree radius edges.
   2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
C. Cable Hangers:
   1. Adjustable, non-continuous cable support slings for use with low voltage cabling.
   2. Steel and woven laminate construction, rated for indoor non-corrosive use. Laminate material shall be suitable for use in plenum environments.
   3. Sling length shall be adjustable to a capacity of 425 4-pair UTP cables.
   4. Cabling hanger load limit shall be 100 lbs per foot.
   5. Manufacturer: Erico Caddy, CableCat CAT425, Arlington Fittings TI Series or approved equal.

PART 3 - EXECUTION

3.1 CABLE HOOK SUPPORT SYSTEM
A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.
B. Refer to manufacturer’s requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.
C. Cable hooks shall be securely mounted per manufacturer’s instructions. In no case shall the side-to-side travel of any cable hook exceed 6”.

D. Cable hooks shall be selected based on the contractors cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.

E. Support spans shall be based on the manufacturer’s load ratings. In no case shall a 5 foot span be exceeded.

F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.

G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

3.2 CONDUIT AND CABLE ROUTING

A. Refer to specification section 26 05 03 for additional requirements.

B. All conduits shall be reamed and shall be installed with a nylon bushing.

C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2” or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2”, maintain a bend radius of at least 10 times the internal diameter.

D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.

E. Any conduit exceeding 90’ in length or containing more than three (3) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.

1. A separate pull box is required for each 90’ (or greater) length section.

2. A separate pull box is required after any three (3) consecutive 90-degree bends.

3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.

F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.

G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor’s expense, after the conduit condition has been remedied.

3.3 ATTACHMENT TO METAL DECKING

A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hangar and a minimum
spacing of 2'-0” on center. This 25 lb. 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.

END OF SECTION
IDENTIFICATION AND ADMINISTRATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes the execution and administration requirements relating to the structured cabling system and its termination components and related subsystems.

B. Identification and labeling.

1.2 RELATED WORK

A. Section 27 05 00 – Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

A. Refer to section 27 05 00 for relevant standards.

1.4 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:

1. Documentation of labeling scheme.

PART 2 - PRODUCTS

2.1 LABELING

A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.

B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.

C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface an attachment method.

D. Labels incorporating bar codes shall be either Code 39 conforming to USS-39 or Code 128 conforming to USS-128.

1. All Code 39 bar codes shall have a ratio between 2.5:1 and 3.0:1. Provide a minimum “quite zone” of 0.25” on each side of the bar code.

2. A descriptive label for reading by personnel shall be provided with any bar code. Bar codes by themselves are not acceptable.
E. Color Code: Observe the following requirements for color coding:

1. Labels on each end of a cable shall be the same color for each termination.

2. Labels for cross-connects shall be two different colors at each termination fields, representative of the color of that field.

3. Orange (Pantone 15C) shall be used for the demarcation point.

4. Green (Pantone 353C) shall be used for the termination point of network connection on the facility side of the demarc.

5. Purple (Pantone 264C) shall be used to identify the termination of cables from common equipment (PBX, computers, LANS, etc.)

6. White shall be used to identify the first-level backbone termination in the main cross-connect.

7. Gray (Pantone 422C) shall be used to identify the second-level backbone termination in the main cross-connect.

8. Blue (Pantone 291C) shall be used to identify the termination of station cabling at the telecommunications closet and/or equipment room end of the cable.

9. Brown (Pantone 465C) shall be used to identify the termination of the interbuilding backbone cable terminations.

10. Yellow (Pantone 101C) shall be used to identify the termination of auxiliary circuits, alarms, maintenance, security, etc.

11. Red (Pantone 184C) shall be used to identify the termination of key telephone systems.

12. In facilities that do not contain a main cross-connect, the color white may be used to identify second-level backbone terminations.

F. Tag all CAT 6, cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:

1. (Room Number) - (Outlet Number) - (Jack Number) - (Use).

2. “Outlet Number” shall start with 1 in each room, with additional outlets in each room numbered sequentially.

3. “Jack Number” shall start with 1 for the upper left jack in each outlet, increasing sequentially from left to right and top to bottom across the outlet face.
4. “Use” shall be designated by the following:
   a. “V” for voice (RJ-45)
   b. “D” for data (RJ-45)

5. Example #1: “106-1-1-V” indicates the top left voice jack in outlet #1 in Room 106.

6. Example #2: “109-3-4-D” indicates the bottom right data jack (assuming a 4-port faceplate) in outlet #3 in Room 109.

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

   1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.

   2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

B. Record Drawings:

   1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

3.1 IDENTIFICATION AND LABELING

A. Cable Labeling: Horizontal cables shall be labeled at each end.

B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.

C. Termination Hardware Labeling:

   1. An identifier shall be provided at each termination hardware location or its label.

D. Grounding/Bonding Labeling:

   1. The TMGB shall be labeled “TMGB.” There shall be only one TMGB in the facility.

   2. Label all TBB conductors connecting to the TMGB with a unique label, located at both ends of the TBB.

   3. Each TGB shall be labeled with a unique label.
4. All TBB conductors connecting to the TGB shall be labeled uniquely at each end of the cable.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes the products and execution requirements related to furnishing and installing equipment for Communication Equipment Rooms. Communication Equipment Rooms include rooms for the Main Cross Connect (MC), Intermediate Cross Connect (IC), Horizontal Cross Connect (HC), Service Entrance Room (SER) and Equipment Room (ER) (such as data centers and main computer rooms housing servers, mainframes and other central equipment).

B. Definitions:

1. Horizontal Cross Connect (HC): Cross connect location between the horizontal cabling and the backbone cabling.

C. Refer to Specification Section 27 05 28 for cable pathway and support requirements.

1.2 RELATED WORK

A. Section 27 05 00 - Basic Communications Systems Requirements
B. Section 27 05 26 - Communications Bonding
C. Section 27 05 28 - Interior Communication Pathways
D. Section 27 15 00 - Horizontal Cabling Requirements

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for applicable standards.

1.4 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer’s data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

2. Manufacturer’s installation instructions.

B. Coordination Drawings:

1. Include ladder racking, equipment racks, and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.
PART 2 - PRODUCTS

2.1 EQUIPMENT GROUNDING

A. Refer to specification section 27 05 26 for grounding requirements.

B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

2.2 EQUIPMENT RACKS AND CABINETS

A. Utilize existing 2-post equipment rack where identified on the drawings in the existing Communication Equipment Rooms. Equipment racks and/or equipment cabinets shall house cable termination components (e.g., copper, optical fiber) and network electronics.

2.3 PATCH PANELS

A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.

B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 27 15 00. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.

C. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be designed to maintain the cables’ pair twists as closely as possible to the point of mechanical termination.

D. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

2.4 OPTICAL FIBER PANELS

A. Existing rack-mounted fiber cabinet.

2.5 TERMINATION BLOCKS

A. Existing wall mount 110-type termination block.

2.6 LADDER RACK

A. Provide complete ladder rack system including metallic ladder rack, splice connectors, fastening hardware and other miscellaneous materials as required for a complete installation per manufacturer’s recommendations.

27 11 00 - 2
2.7 D-RINGS
A. Rounded edge D-rings for support of cabling in vertical and horizontal configurations.
B. EIA 310D compliant, manufactured from materials meeting UL94-V0 specifications.
C. Provide ¼” screw holes for wall mounting.

2.8 POWER STRIPS
A. Provided and installed by Owner.

2.9 COPPER PATCH CORDS
A. 110-type Termination Block:
   1. Provided and installed by Owner.
B. Modular Patch Panel:
   1. Provided and installed by Owner.

2.10 FIBER PATCH CORDS
A. Optical Fiber Patch Cords (Multimode):
   1. Provided and installed by Owner.

PART 3 - EXECUTION

3.1 EQUIPMENT RACKS
A. Utilize existing 2-post equipment rack.
B. All hardware and equipment is to be mounted between 18” and 79” above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Architect/Engineer and Site Coordinator(s) prior to installation.
C. Equipment racks shall be equipped with cable management hardware as to allow an orderly and secure routing of optical fiber and/or copper cabling to the optical fiber...
distribution cabinets and/or modular patch panels. Additional Jumper Management panels may be required pending installation of other cable types on the equipment rack.

D. Each rack shall be grounded to the Telecommunications Ground Bar (GND) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket) directly or via an adjacent grounded equipment rack. Refer to grounding requirements below.

3.2 LADDER RACK
A. Provide support for ladder rack on 4 ft centers.
B. Maintain a 1.5 safety factor on all load limits specified herein.
C. Ladder rack support shall be by 5/8” diameter threaded rod when ceiling mounted. Ladder rack requiring wall mounting shall utilize accessories supplied by the ladder rack manufacturer specifically for the purpose of wall mounting ladder rack.

3.3 D-RINGS
A. Provide D-rings for cable routing and management in all areas where open cabling is routed along the wall in an Equipment Room.
B. Locate D-rings on 24” centers vertically and horizontally.
C. Securely attach D-rings to the wall as required by the manufacturer.

3.4 GROUNDING
A. Provide a complete grounding system in accordance with the requirements of Section 27 05 26.

3.5 CONDUITS AND CABLE ROUTING
A. Refer to Section 26 05 33 for additional requirements.
B. Where conduits enter a telecommunications room, conduits shall be terminated on the wall where shown on the contract documents. Conduits entering the room from the floor shall extend 3” above the floor slab.
C. All conduits shall be reamed and shall be installed with a nylon bushing.
D. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2” or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2”, maintain a bend radius of at least 10 times the internal diameter.

END OF SECTION
HORIZONTAL CABLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.2 RELATED WORK

A. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for relevant standards.

B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).

C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.

D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.4 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer’s data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

2. Manufacturer’s installation instructions.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE

A. CAT 6 Plenum Cable:

1. The horizontal cable requirements must be met, as well as the following channel requirements.
2. CAT 6 cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.

3. Performance tests shall be conducted at a maximum discrete test frequency of 250 MHz for the channel. All numbers given are dB per 100 meters.

4. Channel Requirements:

<table>
<thead>
<tr>
<th>Insertion Loss:</th>
<th>250 MHz</th>
<th>35.8 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEXT:</td>
<td>250 MHz</td>
<td>33.1 dB</td>
</tr>
<tr>
<td>PS NEXT:</td>
<td>250 MHz</td>
<td>30.2 dB</td>
</tr>
<tr>
<td>ACR:</td>
<td>250 MHz</td>
<td>1.5 dB</td>
</tr>
<tr>
<td>PS ACR:</td>
<td>250 MHz</td>
<td>-5.7 dB</td>
</tr>
<tr>
<td>ELFEXT</td>
<td>250 MHz</td>
<td>18.8 dB</td>
</tr>
<tr>
<td>PS ELFEXT:</td>
<td>250 MHz</td>
<td>12.3 dB</td>
</tr>
<tr>
<td>Return Loss:</td>
<td>250 MHz</td>
<td>10.0 dB</td>
</tr>
</tbody>
</table>

5. The jacket color for CAT 6 cable shall be blue for voice applications and blue for data applications.

6. Basis of Design:

   a. CommScope Systimax 2071E BL

2.2 FACEPLATES/JACKS

A. CAT 6 Jacks:

1. CAT 6 horizontal cable shall each be terminated at their designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.

2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.

3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

4. Where standalone CAT 6 only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is **NOT** part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.

6. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall (1) match the faceplate color used for other utilities in the building or (2) when installed in surface raceway (if applicable), match the color of that raceway.

7. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.

8. The CAT 6 modular jacks shall be non-keyed 8-pin modular jacks.

9. The interface between the modular jack and the horizontal cable shall be a 110-type termination block or insulation displacement type contact. Termination components shall be designed to maintain the horizontal cable’s pair twists as closely as possible to the point of mechanical termination.

10. CAT 6 modular jacks shall be pinned per TIA-568B.

11. CAT 6 termination hardware shall, as a minimum, meet all of the mechanical and electrical performance requirements of the following standards:
   b. ANSI/TIA/EIA-568A
   c. ISO/IEC 11801
   d. IEC 603-7
   e. FCC PART 68 SUBPART F

12. The color for CAT 6 jacks shall be ivory for voice applications and ivory for data applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6 modular jack.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

A. Horizontal Cabling:

1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.

3. Manufacturer’s minimum bend radius specifications shall be observed in all instances.

4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5’ between supports. Refer to the specifications for required cable supports.

5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10’ intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.

6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.

7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

8. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These “service loops” shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

9. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
   a. Twelve (12) inches from power lines of <5-kVa.
   b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
   c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
   d. Thirty-nine (39) inches from transformers and motors.

10. Information outlets shown on floor plans with the subscript “W” are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12” vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.
B. Horizontal Cabling in Modular Furniture:

1. This Contractor shall be responsible for providing and installing cable completely to the information outlet in the furniture. This Contractor's responsibility does not end at the furniture feed point.

2. Where furniture panels are installed to include contact with a wall, cabling shall be fed to the furniture panels via conduit.

3. Where modular furniture is installed without wall contact, the Contractor shall install cabling through floor fittings as shown on the drawings.

4. Cabling shall be protected in the transition from the floor or wall fittings to the modular furniture via a length of flexible plastic conduit or other approved protective means. Conduit fittings shall be compatible with the Floor and Wall Fittings proposed. There shall be no exposed cable in the transition to the modular furniture. Fill ratio (cable area vs. conduit area) in each feed shall not exceed 40%.

5. For purposes of bidding, it is to be assumed that the cable pathway shall be limited to the bottom panel of the modular furniture only. Communications cables would be run through these channels to the jack location.

6. For purposes of bidding, it is to be assumed that it will be the responsibility of the Contractor to punch and reinstall the bottom molding panels on the modular furniture as required to accommodate the communications cabling and information outlets. The panels shall be marked prior to installation by the Owner to identify the desired location of the information outlets.

7. The information outlet shall be secured to the panel via mounting tabs, pop-rivets, screws or other approved method. Use of adhesive tape is not acceptable. The method of securing the information outlet to the panel shall not result in sharp protrusions (e.g., sheet metal screw tip) into the channel behind the panel.

3.2 CABLE TERMINATION REQUIREMENTS

A. Cable Terminations - Data UTP:

1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.

2. If the “last” patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use.
3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

END OF SECTION
TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.2 RELATED WORK
A. Section 27 05 00 – Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE
A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS
A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work, the Contractor shall submit:
   1. Complete information on testing procedure as described herein.

PART 2 - PRODUCTS

2.1 TESTING COPPER
A. General Requirements:
   1. The Contractor is responsible to perform acceptance tests as indicated below for each sub-system (e.g., backbone, horizontal, etc.) as it is completed.
   2. The Contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor should provide a summary of the proposed test plan for each cable type including equipment to be used, setup, test frequencies or wavelengths, results format, etc. The method of testing shall be approved by the Architect/Engineer.
   3. The Contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The Contractor shall provide the Architect/Engineer with a written certification that this inspection has been made.
   4. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. The Contractor shall provide a minimum of one (1) week’s advance notice to the Architect/Engineer to
allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.

5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove the wiring connections are correct.

6. The Contractor shall provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, the Contractor shall provide copies of the original test results.

7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.

8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.

a. CAT 6 Cable:

1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.

2) Horizontal cable shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.

3) CAT 6 horizontal cable shall also be tested to 250 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Basic Link" including cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:

   a) Wire Map
   b) Length
   c) NEXT Loss (Pair-to-Pair)
   d) NEXT (Power Sum)
   e) ELFEXT (Pair-to-Pair)
f) ELFEXT (Power Sum)  
g) Return Loss 
h) Attenuation 
i) Propagation Delay 
j) Delay Skew 

4) The maximum length of horizontal cable shall not exceed 295 feet (90m), which allows 33 feet (10 m) for technology equipment and modular patch cords.

5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6 modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.

6) CAT 6 horizontal cable testing shall be performed using a test instrument designed for testing to 250 MHz or higher. Test records shall verify, “PASS” on each cable and display the specified parameters, comparing test values with standards based “templates” integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.

7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.

2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.

3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests
shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.

B. Copper Media Test Data:

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).

2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (CD-ROM). The CD-ROM shall contain the electronic equivalent of the test results as defined by the bid specification and be of a format readable by Microsoft Word (Version 6.0 or newer). The Contractor shall provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. The Contractor shall furnish one (1) copy of the Data and Display (if applicable) software.

C. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

1.2 RELATED WORK

A. Section 27 05 00 – Basic Technology Systems Requirements.

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for relevant standards.

PART 2 - PRODUCTS

2.1 MANUFACTURER REQUIREMENTS

A. The Basis of Design for all structured cabling components is listed in the individual Division 27 sections. Alternative acceptable manufacturers will be accepted for this project.

B. Additional acceptable manufacturers for horizontal cabling:

1. Belden/Mohawk
2. Hubbell
3. Berk-Tek Leviton

2.2 WARRANTY

A. A 20 year Product Installation Warranty shall be provided for the structured cabling system as described in the contract documents.

B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).

C. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate from the manufacturing company registering the installation.
PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire alarm and detection systems

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years’ experience.

B. Installer: A factory-authorized licensed electrical or security contractor with five years’ experience in the design, installation and maintenance of fire alarm systems by that manufacturer.

C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 3. This person’s name and certification number shall appear on the start-up and testing reports.

1.3 REFERENCES

A. ASME A17.1 - Safety Code for Elevators and Escalators

B. NFPA 20 - Standard for Centrifugal Fire Pumps

C. NFPA 70 - National Electrical Code

D. NFPA 72 - National Fire Alarm and Signaling Code


F. UL 2017 – General Purpose Signaling Devices and Systems

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00 and as noted below.

1. Failure to comply with all of the following and all of the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.

2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.
B. **Provide product catalog data sheets as shop drawings.**

1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings, but required for the operation of the system.

2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.

3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.

C. **Submit CAD floor plans as shop drawings:**

1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer’s wiring requirements shall be shown.

2. A legend or key shall be provided to show which symbols shown on the submittal floor plans correspond with symbols shown on the Contract Documents.

D. With regard to all fire alarm circuits, provide the following: manufacturer’s wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.

E. **Provide installation and maintenance manuals under provisions of Section 26 05 00.**

F. **Submit manufacturer’s certificate that system meets or exceeds specified requirements.**

G. **Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.**

H. **Voice Alarm Communication System:** Submit equipment rack or console layout, grounding schematic, amplifier power calculations, and wiring diagram.

I. **Submit photocopy proof of NICET certification of the person overseeing the preparation of drawings and installation/testing.**

J. **When required to comply with local or state regulatory reviews, the fire alarm submittal shall have a Professional Engineer’s stamp and signature of the state in which the project is completed. NOTE: The Architect/Engineer cannot stamp and seal submittal drawings not prepared under their supervision.**

1.5 **DELIVERY, STORAGE, AND HANDLING**

A. **Deliver products to site under provisions of Section 26 05 00.**

B. **Store and protect products under provisions of Section 26 05 00.**
1.6 REGULATORY REQUIREMENTS

A. System: UL or FM Global listed.

B. Conform to requirements of NFPA 101.

C. Conform to requirements of Americans with Disabilities Act (ADA).

D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

1.7 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, voice evacuation equipment, control panels, auxiliary control devices, annunciators, power supplies, and wiring as indicated on the drawings and specified herein.

C. Reworking the existing fire alarm system: Provide all items, components, devices, hardware, software, programming, expansion components, conduit, wiring etc. needed to rework the existing fire alarm system with the new fire alarm devices. This includes, but is not limited to, additional power supplies, initiating devices and circuits, signaling devices and circuits, monitoring devices and circuits, auxiliary control and related devices such as, door holders and their control, smoke damper control, fan shutdown, etc. The existing fire alarm system shall be reworked to add new devices such that the existing fire alarm system's functionality, integrity and annunciation shall be equivalent to pre-construction conditions unless noted otherwise. The functionality and integrity shall be maintained during construction. The entire system shall be able to be completely reset from any single reset location point. The entire system shall be annunciated at any annunciation location.

D. Extending the existing Simplex 4100 fire alarm system: The existing control panel shall remain and shall be operational throughout construction. The system shall only be disabled to make new connections and to modify the programming. A fire watch shall be provided for all areas affected during outages. All system outages must be scheduled with the Owner at least one week prior. Individual devices may be disabled as needed based on construction activities to reduce the potential for false alarms, but all devices must be
operational when the Contractor is not physically on site. New initiating devices may be connected to the existing signaling line circuits where capacity is available. Provide additional signaling line circuits as needed based on existing and new device quantity, including replacement of existing panel components. Provide new notification circuits to serve the new devices, including all necessary power supplies, amplifiers, batteries, and 120 volt input circuits. All new devices shall be programmed to provide the same sequence of operation as the existing devices of the same type, unless noted otherwise.

E. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.

F. Voice Communication: The facility shall have an emergency voice alarm communication system. The digitized recorded voice message shall notify occupants that a fire condition has been reported. Emergency manual voice override shall be provided.

G. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.

H. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.

I. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panels.

J. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

1.8 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 26 05 00.

B. Include location of end-of-line devices.

C. Provide a CAD drawing of each area of the building (minimum scale of 1/16” = 1’-0”) showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.

D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 26 05 00.
B. Include operating instructions, and maintenance and repair procedures.

C. Include results of testing of all devices and functions.

D. Include manufacturer’s representative’s letter stating that system is operational.

E. Include the CAD floor plan drawings.

F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

1.10 WARRANTY

A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.

B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Simplex

2.2 [FAP-#]: FIRE ALARM CONTROL PANEL (FAP)

A. Power Supply:

1. Input power shall be 120 VAC, 60 Hertz. Output power shall be as noted on the device specifications and drawings. Each component of the fire alarm system requiring 120 VAC input power shall be served from a dedicated emergency branch circuit. Provide two #12 conductors and one #12 ground in 3/4" conduit to a dedicated 20A/1P circuit breaker with a red handle and a manufacturer’s standard handle lock-on device. Identify/label breaker and branch circuit in accordance with NFPA requirements and Specification Section 26 05 53.

2. Adequate to supply 125% of all control panel and peripheral power needs as well as 125% of power required for all external audio-visual devices. The power supply may be increased as needed by adding additional modular expansion power supplies. Over-current protections shall be provided on all power outputs.

3. All power supplies shall be designed and installed to meet UL and NFPA requirements for power-limited operation on all external initiating and indicating circuits.

4. The power supply shall provide integral charger for use with internal batteries. Battery capacity shall be sufficient for operation of the entire system for 24 hours
in a non-alarm state followed by alarm mode for 15 minutes, plus 25% spare capacity for future devices.

B. Surge Protection:

1. All fire alarm control panels, NAC panels, etc. shall be provided with a surge protection device (SPD). The SPD shall be UL listed to Standard 1449 Rev 3. The unit should be clearly labeled in accordance with Identification Section 26 05 53. The SPD shall have thermal fuses to protect against fire in short circuit conditions. The unit shall provide visual indication that the unit is protecting and functioning.

2. Any communications or signaling circuits associated with the fire alarm system, which leave or enter a facility, shall be provided with a surge protection device. The devices shall be as recommended by the fire alarm system manufacturer.

2.3 SIGNALING LINE CIRCUIT DEVICES

A. [FA-120]: Smoke Detectors:

1. Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.

2. Each smoke detector shall connect directly to an SLC loop.

3. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided. Provide a two-piece head/base design.

4. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.

5. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. Remote indicator terminals shall be provided. Provide a remote LED indicator device if detector is not visible from a floor standing position.

6. A test means shall be provided to simulate an alarm condition.

7. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.
8. Audible sounder detector base for sleeping room applications:
   a. The audible base shall sound an alarm in the local room in UL2017 operation and UL484 for general evacuation. The unit shall be programmable by the main control panel for the duration of operation.
   b. The audible sounder base shall sound Temporal 3 (fire) or Temporal 4 (CO alarm) and be at 75 dB at 10 feet.

9. A subscript is used to identify the device with a specific sequence of operation as follows:  E=Elevator Recall, S=Sleeping/Patient Room, D=HVAC Control, A=Atrium, SW=Stairwell, CR=Computer Room, SD=Smoke Dampers, DH=Door Hold Release, FD=Fire Door Release, MP=Medical Procedure Room.

B. Manual Pull Stations:

1. Manual stations shall match the description on the drawings (refer to the General Electrical Equipment Schedule). The stations shall be mounted where shown on the drawings and be provided with all necessary mounting hardware.

2. [FA-130]: Addressable, double action with plastic breakrod, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering.

3. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.

4. Where operation is noted as required below 32ºF and/or above 120ºF, a conventional device shall be installed with a unique monitor module located in the nearest available location, with maintained temperatures between 32ºF and 120ºF.

C. Heat Detectors:

1. [FA-140]: Combination rate of rise and 135ºF fixed temperature analog thermal type sensor. Factory programmed to alarm at 135ºF and at 15ºF per minute rate-of-rise. Sensor shall measure heat level and send data to the control panel representing the analog level of thermal measurement and rate-of-rise.
   a. A subscript is used to identify the device with a specific sequence of operation as follows: E=Elevator Shutdown.

2. Provide a two-piece head/base design, with a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.

3. Heat detectors shall connect directly to SLC loops. Where fixed temperature or explosion proof detectors are used, one monitor module may be used to monitor all detectors in one room/area as shown on the drawings.
4. Detectors shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided.

5. Provide a remote LED indicator device if detector is not visible from a floor-standing position.

6. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. A connection for attachment of a remote indicator shall be provided.

7. A test means shall be provided to simulate an alarm condition.

8. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

D. [FA-160]: Monitor Modules:

1. Monitor Module shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit. It shall interface initiating devices with the control panel using Style D or Style B circuits. Contractor option: Use an interface module (2-wire operation) for Style B circuits connected to normally-open dry contacts, such as a flow switch.

2. The module shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being monitored, or where shown on the drawings. All mounting hardware shall be provided.

3. The module shall supply the required power to operate the monitored device(s).

4. The module shall provide address setting means using rotary decimal or DIP switches.

E. [FA-161]: Addressable Relays:

1. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional slave relay(s), as required, rated for the electrical load being controlled (contractor to match voltage, amps, etc.).

2. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.

3. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
4. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

2.4 NOTIFICATION APPLIANCE DEVICES

A. Device Color:
   1. Wall Mounted: Red housing with white lettering or pictogram.
   2. Ceiling Mounted: Red housing with white lettering or pictogram.

B. Visual Alarm Devices:
   1. [FA-200]: Wall mounted.

C. [FA-210]: Audio (Speaker) Alarm Devices - Wall Mounted:
   1. Sound rating shall be dependent on the tap (wattage) setting. Tap settings shall be available in 3 dBA increments. A minimum of four (4) tap settings should be available to allow field adjustment of the sound output across a minimum range of 78 to 87 dBA, 400Hz to 4KHz (6 dBA cutoff) frequency range.
   2. Speakers shall operate on a 25V RMS system, unless otherwise noted on drawings.
   3. Speakers shall clearly reproduce a signal consisting of a live or prerecorded human voice with voice intelligibility.
   4. Speaker, housing, and backbox shall be UL listed for fire alarm/emergency applications.

D. Combination Audio (Voice) and Visual Notification Device:
   1. [FA-211]: Wall mounted.
   2. [FA-231]: Ceiling mounted.
   3. Combine speaker and visual components into a single device. Refer to the corresponding paragraphs above for requirements of each component.

2.5 [NEP-#]: NAC EXTENDER PANELS (NEP)

A. As shown on the plans or as a Contractor’s option if not shown, furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NEP on the shop drawing submittals.

B. Each NEP shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 24 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity
for future devices. Each NEP provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.

C. Power for each NEP shall be from a local 120 VAC emergency circuit. Provide two #12 conductors and one #12 ground in 1/2” conduit to each NEP from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer’s standard handle lock-on device. Coordinate panel and circuit number with Architect/Engineer prior to installation.

D. NAC extender panels may be installed only in locations coordinated with the Architect/Engineer.

E. Mounting: Surface.

2.6 CONNECTIONS TO AUXILIARY DEVICES PROVIDED BY OTHERS

A. [FA-260]: Flow Switch:
   1. Connection to flow switch to monitor fire protection flow switch or discharge output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed and MC; wired by EC.

B. [FA-261]: Monitor Switch:
   1. Connection to monitor switch to monitor fire protection system supervisory switches or output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.

2.7 WIRING

A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in accordance with the manufacturer’s recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with NFPA 70, Article 760 for power-limited fire alarm signal service.

B. Approved manufacturers of fire alarm cable:
   1. Comtran Corp.
   2. Helix/HiTemp Cables, Inc.
   3. Rockbestos-Suprenant Cable Corp.
   4. West Penn Wire/CDT.
PART 3 - EXECUTION

3.1 SEQUENCES OF FIRE ALARM OPERATION

A. General:
   1. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:
   1. Appropriate system Alarm, Trouble, or Supervisory LED shall flash at the control panel, transponder, and annunciator locations.
   2. A local signal in the control panel shall sound.
   3. The LCD display shall indicate all information associated with the condition, including the name of the item, type of device and its location within the protected premises.
   4. Printing and history storage equipment shall log the information associated with the fire alarm control panel (FAP) condition, along with the time and date.
   5. Transmit the appropriate signal (supervisory, trouble, alarm) to the central station via the digital communicator.
   6. Transmit the appropriate signal (supervisory, trouble, alarm) to the building automation system via addressable relays tied to contact monitors on the system.

C. Audible Alarms Sequence:
   1. Audible alarms throughout the building shall sound.

D. Visual Alarms Sequence:
   1. Visual alarms throughout the building shall flash.

E. Fire Protection Electric Sprinkler Bell Sequence:
   1. The fire alarm shall utilize an addressable relay to energize the electric sprinkler bell upon activation of the flow switch.

F. Kitchen Hood Fire Suppression System Sequence:
   1. The fire alarm system shall utilize an addressable relay to de-energize the hood supply fan controller.
2. The fire alarm system shall utilize an addressable monitor module to monitor the fire suppression system.

G. Smoke Damper Control Sequence:

1. The fire alarm system shall utilize an addressable relay to open the power connection to smoke or fire/smoke dampers and allow them to close. Coordinate other requirements with damper installer.

2. Where a damper is located in a main air duct, where closure of that single damper will entirely block airflow in the duct system, the smoke damper sequence shall also initiate the AHU shutdown sequence for the affected unit.

3. The AHU shutdown sequence shall be initiated only when ALL of the dampers associated with that unit are closed. Otherwise, the AHU shall continue to serve other areas.

4. All smoke and fire/smoke dampers shall be closed throughout the building.

H. AHU Shutdown Sequence:

1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers. Coordinate other requirements with HVAC installer.

2. The fire alarm system shall directly shut down the AHU through the local HVAC control device (i.e., variable frequency drive or motor starter).

3. All AHUs shall be shutdown simultaneously throughout the building.

I. Fire Door Release Sequence:

1. The fire alarm system shall utilize an addressable relay to signal the fire door or curtain to close. Once the alarm is cleared, the addressable relay shall allow the door to open.

2. Where a facility has more than one fire door, each shall release individually based on input from initiation devices in the vicinity of each door and noted specifically for door closure.

J. Door Holder Release Sequence:

1. The fire alarm system shall utilize an addressable relay to open the power connection to integral and magnetic door holders.

2. The fire alarm system shall utilize an addressable relay to open the 'hold' switch circuitry, integral to the power door.

3. All door holders throughout the floor building shall release simultaneously.
K. Elevator Recall Sequence:

1. Elevator recall sequences shall meet the requirements of ASME/ANSI A17.1 and NFPA 72.

2. Upon signal from a smoke detector in the machine room, hoistway, or any elevator lobby other than the “designated level” the fire alarm shall utilize an addressable relay to signal the elevator to recall to the designated level as determined by the Authority Having Jurisdiction.

3. Upon signal from a smoke detector in the elevator lobby of the “designated level,” the fire alarm system shall utilize an addressable relay to signal the elevator to recall to the “alternate level” as determined by the Authority Having Jurisdiction.

4. All elevators, throughout the building, shall be recalled simultaneously.

L. Firefighter's Cab Visual Alarm Sequence:

1. Upon signal from a detector in the machine room or elevator hoistway, the fire alarm system shall utilize an addressable relay to signal the elevator controller to illuminate and flash the firefighters cab visual alarm.

M. Elevator Shutdown Sequence:

1. Elevator shutdown shall meet the requirements of ASME/ANSI A17.1.

2. All elevators that share the same hoistway, machine room, or lobby shall be shut down simultaneously. Elevators served by different machine rooms, hoistways, and lobbies shall continue to operate.

3. The fire alarm system shall utilize an addressable relay to energize the shunt trip of the main elevator breaker, disconnecting power to the elevator.

3.2 INSTALLATION

A. Install system in accordance with manufacturer’s instructions and referenced codes.

B. Devices:

1. General:

   a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.

   b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.

d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall adjust location of device so that new location meets all requirements in NFPA 72 and all applicable building codes.

2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.

3. Analog Smoke and Heat Detectors:
   a. In elevator shafts and elevator equipment rooms, provide a heat detector for elevator shutdown within 2' of every sprinkler head. Coordinate with fire protection contractor.

4. Manual Pull Stations:
   a. Stations shall be located where shown and at the height noted on the drawings.

5. Addressable Relays and Monitor Modules:
   a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.
   b. All modules shall be mounted in or on a junction box in an accessible location.
   c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.

6. Notification Appliance Devices:
   a. Devices shall be located where shown on the drawings.
   b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.
C. Wiring:

1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer’s recommendations and pursuant to National Fire Codes.

2. Wiring shall be installed in conduit from device to above accessible ceilings. Exposed plenum-rated cable (FPLP) shall be used above accessible ceilings supported every 4 feet or run in cable trays (if applicable) maintaining a minimum of 5-inches clearance from all lighting ballasts. Fire alarm cabling shall not be installed in the same bridle rings or cable trays designated for the cabling of other systems.

3. All junction boxes shall be painted red with SLC and NAC circuits identified on cover.


5. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.
   a. Fire alarm temporal audible notification for all audio appliances.
   b. Synchronization of all visual devices where two or more devices are visible from the same location.
   c. Ability to silence audible alarm while maintaining visual device operation.


7. Signal line circuits connecting devices shall not span floors.

8. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with “E-Z Markers” or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.

D. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows, or using colored tape at each conductor termination and in each junction box.

1. Power branch circuit conductors: In accordance with Section 26 05 53.
2. Signaling line circuit: Overall red jacket with black and red conductors.
3. DC power supply circuit: Overall red jacket with violet and brown conductors.
4. Notification appliance circuit: Overall red jacket with blue and white conductors.
7. Central station fire alarm loop: Black and white conductors.

E. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device shall not have visible knockouts.

F. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 00.

B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.

C. Contractor shall test and adjust the fire alarm system as follows:

1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:
   a. 70dBA.
   b. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.
   c. 15 dBA above measured ambient. 5 dBA above the maximum measured sound level with duration of more than 60 seconds.
   d. As specified on the drawings.

2. Sound level measurement procedure shall meet the following requirements:
   a. All measurements shall use the ‘A’ weighted, dBA, sound measurement scale.
   b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
   c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.
   d. Final ambient sound measurements shall be taken during occupancy and the units shall be re-adjusted at that time, if necessary.
e. All sound level measurements shall be taken at a height of 5’ above the finished floor level.

f. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of 2 rooms shall be tested. The results from the rooms tested shall be averaged and the remaining rooms may be adjusted per the average.

g. Measurements shall be taken on a 20’ x 20’ grid and the results for all points taken shall be averaged. If the room is smaller than 20’ x 20’ a minimum of two measurements are required.

h. Measurements shall be taken halfway between speakers or halfway between a speaker and the wall. No measurements shall be taken at the extreme edges of the room, nor directly under speakers.

3.4 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services under provisions of Section 26 05 00.

B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

C. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. The Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.

3.5 SYSTEM TRAINING

A. System training shall be performed under provisions of Section 26 05 00.

B. Minimum on-site training times shall be:

1. System Operators: One (1) day.
2. Emergency Communication System: Four (4) hours.

END OF SECTION