Project Manual

April 10, 2023

New Hampton Elementary School Daycare

206 W Main St.
New Hampton, Iowa 50659

align

architecture & planning

SECTION 000101
PROJECT TITLE PAGE

PROJECT NAME & LOCATION:

NEW HAMPTON COMMUNITY SCHOOL DAYCARE
206 WEST MAIN ST. NEW HAMPTON, IA 50659

OWNER: **NEW HAMPTON SUPERINTENDENT**
CONTACT: JAY JURRENS
PHONE: (641)394-2134
EMAIL: J_JURRENS@NEW-HAMPTON.K12.IA.US

ARCHITECT: **ALIGN ARCHITECTURE & PLANNING**
327 E. 4TH ST., SUITE 204
WATERLOO, IA 50703
CONTACT: JACOB BAUER
PHONE: (319) 233-1163
EMAIL: JBAUER@ALIGNPLC.COM

MECHANICAL/ELECTRICAL ENGINEER

MODUS ENGINEERING
214 E. 4TH ST. WATERLOO, IA 50703
CONTACT: ALEX MATHESON
PHONE: (319) 235-0650
EMAIL: AMATHESON@MODUS-ENG.COM

STRUCTURAL ENGINEER: **HOOTING COYOTE LLC**

END OF SECTION

SECTION 000102
PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

A. The Owner, hereinafter referred to as Owner: New Hampton Community Schools

1.02 PROJECT DESCRIPTION

A. Summary Project Description: A remodel project at New Hampton Community Schools in New Hampton, Iowa. Work area will be will be renovating an existing weight room into two daycare classrooms. This project will involve adding three adjacent restrooms along with a new roof top unit to serve both classrooms. There is light finish work required including a new wall and floor finishes and casework. Initial cost estimate for propsoed basework is $225,000.

1.03 PROCUREMENT TIMETABLE

A. Last Request for Information Due: 3 days prior to due date of qualifications statements.

B. Last Request for Substitution Due: 3 days prior to due date of bids.

C. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.04 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:
   1. From Owner at the Project Manager's address listed above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 000110
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END OF SECTION

SECTION 000115
LIST OF DRAWING SHEETS

AT	**TITLE PAGE / SITE LOCATION / INDEX**
AD100	**DEMOLITION FLOOR PLAN & CEILING PLAN**
A100	**PROPOSED FLOOR PLAN & CEILING PLAN, ELEVATIONS**
A200	**SCHEDULES AND FLOORING PLAN**
S100	**STRUCTURAL PLAN, DETAILS**
ME000	**MEPT SYMBOLS LIST**
PD100	**PLUMBING DEMOLITION PLAN**
P100	**PLUMBING UNDERFLOOR PLAN**
P101	**PLUMBING PLAN**
MD100	**MECHANICAL DEMOLITION PLAN**
M101	**MECHANICAL PLAN**
M501	**MECHANICAL SCHEDULES AND DETAILS**
ED101	**ELECTRICAL DEMOLITION PLAN**
E101	**ELECTRICAL POWER PLAN**
E102	**OVERALL LOW VOLTAGE PLAN**
E201	**ELECTRICAL LIGHTING PLAN**
E501	**ELECTRICAL DETAILS**

END OF SECTION

SECTION 001113
ADVERTISEMENT FOR BIDS

FROM:

1.01 NEW HAMPTON COMMUNITY SCHOOLS (HEREINAFTER REFERRED TO AS OWNER):

AND THE ARCHITECT:

Align Architecture & Planning, PLC

Address:
327 E. 4th Street
Suite 204
Waterloo, IA 50703

DATE: APRIL 10, 2023

2.01 TO: POTENTIAL BIDDERS

A. Your firm is invited to submit an offer under seal to Owner for construction of a shop expansion at the existing school facility located at:
Superindent Office
710 W Main St.
New Hampton, Iowa, 50659

Before 4:00 p.m. am local daylight time on April 24, 2023

B. Pre-Bid meeting is scheduled at the project site from 11:00 a.m. on Monday, April 17th 2023. All potential general and subcontractors are encouraged to attend. Attendance is not required.

C. Receipt of Bids:
1. Sealed bids will be received in the business office of the school at the same address.
   a. Bids may be submitted electronically. Electronic bids will only be accepted in accordance with the following procedures:
      1) Submit a scan in readable PDF format of the fully-executed bid form with attendant signatures and attachments to j_jurrens@new-hampton.k12.ia.us and jbauer@alignplc.com at or before the specified bid date and time.
      2) Electronic Bids received after bid time or missing required information may be rejected.
2. Bids will be opened and read aloud immediately following the bid receipt time.

D. Contract Type:
1. Single lump sum stipulated price as described in Document 00 52 00 - Agreement Form

E. Project Description: See Spec Section 00 01 02 Project Information.

F. The Work is may commence as soon as Project is awarded.

G. Substantial Completion Date: All worked to be completed to level sufficient for owner occupation on or prior to August 15, 2023 (Pending final install of Roof Top Equipment 12.31.2023).
1. Final completion to be September 1, 2023.

H. Bid Forms
All bids shall be official bid form furnished within the specification and must be enclosed in separate envelope identified with Project Name, and addressed and delivered to:
Jay Jurrens
Superintendent
New Hampton Community Schools
710 West Main Street
New Hampton, Iowa 50659

I. Bid Security:
1. Bid Bond of a sum no less than 5 percent of the total Bid Amount on AIA A310 Bid Bond Form or standard surety company form, or certified bank check for 5 percent of bid

amount made payable to Owner.

2. If awarded a Contract by the Owner, the Bidder will enter into a Contract at the price of Bid and furnish the required Performance and Payment Bond and Certificates of Insurance. The Certified Check or Cashier's Check may be cashed, or the Bid Bond forfeited, and the proceeds retained as penalty if the bidder fails to execute a Contract or file acceptable Performance and Payment Bond s) and provide an acceptable Certificate of Insurance, within thirty (30) days after notice of acceptance of bid by Owner's Representive.

J. Additional Bidding Requirements
   1. An out-of-state bidder, if awarded a contract, will be required to submit evidence of authorization to do business in the State of Iowa.
   2. This is a sales tax-free construction project. Bidders shall not include state sales taxes in their proposals. The Owner will issue a state tax exemption certificate for all materials purchased for the project and authorization letters to the Contractors and all subcontractors performing work on the project. Tax exemption certificates are applicable only for the specific project for which the certificates are issued. The Contractors shall provide a listing to the Owner of all appropriate subcontractors which are qualified to use tax exemption certificate. The Contractors and subcontractors may make copies of the tax exemption certificate and may provide a copy to each supplier providing construction material. materials for this contract may then be purchased free from sales tax.
   3. Bidders shall be prepared to submit a performance and payment bond for the project. Out of State bidders shall be prepared to submit and Out of State Contractor Bond to the Iowa Division of Labor in accordance with Chapter 91C of the Code of Iowa

K. Available Bid Document:
   1. General Contractors may obtain (2) printed sets. Subcontractors and suppliers may obtain one printed set.
   2. Bid Documents (Hard Copy) may be obtained from the following locaitons
      a. Align Architeture Office: 327 E. 4th St. Waterloo, IA 50703
         Call Office prior to picking up drawings to assure adequate number of copies are prepped for.
         Upon receipt of a refundable deposit, by certified check and current MBI Card in the amount of $50 for one set.
   3. Bidding Documents are available for viewing and on file at the following locations:
      a. Master Builders of Iowa (electronic-online)
         221 Park Street, Des Moines, Iowa 50309 (electronic)
         www.mbionline.com
         515-288-7339
      b. Align Architecture & Planning, 327 E 4th St. Waterloo IA 50703, 319-233-1163
   4. Superintendent Office: 710 West Main St. New Hampton, IA 50659

L. Your offer will be required to be submitted under a condition of irrevocability for a period of 30 days after submission.

END OF SECTION

SECTION 002113
INSTRUCTIONS TO BIDDERS

SUMMARY

1.01 DOCUMENT INCLUDES

A. Invitation to Bid, with relevant information and requirements

INVITATION

BID DOCUMENTS AND CONTRACT DOCUMENTS

1.02 DEFINITIONS

A. Bid Documents: Contract Documents supplemented with Invitation to bid, instructions to bidders, information available to bidders, bid form, supplements to bid forms and addenda identified.

B. Contract Documents: Defined in AIA A201 in Article 1 including issued Addenda

C. Upon receipt of Bid Documents, verify that documents are complete. Notify Construciton Manager should the documents be incomplete.

D. Immediately notify Architect upon finding discrepancies or omissions in the Bid Documents

1.03 INQUIRES/ADDENDA

A. Submit all questions not less than seven (7) days before bid date.

B. Direct mechanical questions to Alex Matheson, Modus Engineering

(amatheson@modus-eng.com)

C. Direct Archiectural questions to Jacob Bauer, Align Architecture & Planning

(jbauer@alignplc.com)

D. All bidders shall be registered with Align Architecture & Planning to recieve project updates and addenda. Registration to be on the plan holder's list can be done by contacting Align Architrecurte & Planning. They can be contact at:

Email: jbauer@alignplc.com

327 East 4th ST.

Waterloo, IA

319-233-1163

E. Addenda may be issued during the bidding period. All Addenda become part of the Contract Documents. Include resultant cost in the Bid Amount.

F. Verbal answers are not binding on any party.

G. Clarifications requested by bidders must be submitted not less than 7 days before date set for receipt of bids. The reply will be in the form of an Addendum.

BID DOCUMENTS AND CONTRACT DOCUMENTS

2.01 DEFINITIONS

A. Bid Documents: Contract Documents supplemented with Invitation To Bid, Instructions to Bidders, Information Available to Bidders, Bid Form Bid securities identified.

B. Contract Documents: Defined in AIA A105 - 2017 (Short Form agreement between Owner and Contractor) including issued Addenda.

C. Bid, Offer, or Bidding: Act of submitting an offer under seal.

D. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

2.02 CONTRACT DOCUMENTS IDENTIFICATION

A. Contract Documents are identified as New Hampton Community School Daycare - Project Number 22-039, as prepared by Architect who is located at 327 E. 4th Street, Suite 204, Waterloo, IA 50703, and with contents as identified in the Project Manual.

B. Contract Documents are identified as Construction work releated to the remodel of the existing weight room into 2 daycare classrooms at New Hampton Elementary. .

2.03 AVAILABILITY

A. Bid Documents may be obtained from Align Architecture & Planning upon receipt of a refundable deposit, by certified check, current MBI Card, or ABC care in the amount of $50 for one set and a $20.00 non-refundable mailing/shipping check Separate checks shall be addressed to Align Architecture & Planning..

Jacob Bauer, Architect, email: jbauer@alignplc.com

Align Architecure & Planning

327 E 4th St. Ste. 204

Waterloo, IA 50703

B. Deposit will be refunded if Bid Documents are returned complete, undamaged, unmarked and reusable, within 7 days of bid submission. Failure to comply will result in forfeiture of deposit.

C. PDF versions of drawings and project manual are availible upon request from the Architect directly or through email at jbauer@alignplc.com

D. If requested, documents may be mailed upon receipt of a separate, non-refundable check in the amount of $20 for shipping and handling.

E. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes.

2.04 EXAMINATION

A. Bid Documents may be viewed at the office of the Architect which is located at 327 E. 4th Street, Suite 204, Waterloo, IA 50703.

B. Upon receipt of Bid Documents verify that documents are complete. Notify Architect should the documents be incomplete.

C. Immediately notify Architect upon finding discrepancies or omissions in the Bid Documents.

2.05 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS

A. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 7 days before receipt of bids.

B. When a request to substitute a product is made, Architect may approve the substitution and will issue an Addendum to known bidders.

C. The submission shall provide sufficient information to determine acceptability of such products.

D. Provide complete information on required revisions to other work to accommodate each proposed substitution.

E. Provide products as specified unless substitutions are submitted in this manner and accepted.

F. See Section 016000 - Product Requirements for additional requirements.

SITE ASSESSMENT

3.01 SITE EXAMINATION

A. Examine the project site before submitting a bid.

B. Call John Bear , Maintendance DIrector, New Hampton Community School Community School District, 641.330.5978 to scheudle a site visit if unable to attend the Pre-Bid Conference. Please call and arrange a time to view project area.

3.02 PREBID CONFERENCE

A. All general contract bidders and suppliers are invited.

B. Representatives of Architect will be in attendance.

C. Summarized minutes of this meeting will be circulated to attendees. These minutes will not form part of Contract Documents.

D. Information relevant to the Bid Documents will be recorded in an Addendum, issued to Bid Document recipients.

E. Additional site examination may be granted upon request. Contact Owner in order to arrange a a date and time to visit the project site.

BID SUBMISSION

4.01 SUBMISSION PROCEDURE

A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.

B. Submit one copy of the executed offer on the Bid Forms provided, signed and sealed in a closed opaque envelope, clearly identified with bidder's name, project name and Owner's name on the outside.

C. Improperly completed information, irregularities in security deposit, may be cause not to open the Bid Form envelope and declare the bid invalid or informal.

D. An abstract summary of submitted bids will be made available to all bidders following bid opening.

4.02 BID INELIGIBILITY

A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may at the discretion of the Owner, be declared unacceptable.

B. Bid Forms, Appendices, and enclosures that are improperly prepared may, at the discretion of Owner, be declared unacceptable.

BID ENCLOSURES/REQUIREMENTS

5.01 SECURITY DEPOSIT

A. Bids shall be accompanied by a security deposit as follows:
   1. Bid Bond of a sum no less than 5 percent of the Bid Amount on AIA A310 Bid Bond Form.

B. Endorse the Bid Bond in the name of the Owner as obligee, signed and sealed by the principal (Contractor) and surety.

C. The security deposit will be returned after delivery to the Owner of the required Performance and Payment Bond(s) by the accepted bidder.

D. Include the cost of bid security in the Bid Amount.

E. If no contract is awarded, all security deposits will be returned.

5.02 PERFORMANCE ASSURANCE

A. Accepted Bidder: Provide a Performance bond as described in 007300 - Supplementary Conditions.

B. Include the cost of performance assurance bonds in the Bid Amount.

5.03 BID FORM REQUIREMENTS

A. Complete all requested information in the Bid Form and Appendices.

B. All bids shall be official on Bid Form furnished within the specifications and must be enclosed in separate envelope identified with Project Name, and addressed and delivered to

Jay Jurrens

New Hampton Community Schools

710 W Main St.

New Hampton, Iowa 50659

C. Submit two copies of the executed offer on the Bid Forms provided, signed and sealed with the required security in a separate closed opaque envelope, clearly identified with bidder's name and project name.

5.04 SALES AND USE TAXES

A. This is a sales tax-free construction project. Bidders shall not include state sales taxes in their proposals. The Owner will issue a state tax exemption certificate for all materials purchased for the project and authorization letters to the Contractors and all subcontractors performing work on the project. Tax exemption certificates are applicable only for the specific project for which the certificates are issued. The Contractors shall provide a listing to the Owner of all appropriate subcontractors which are qualified to use tax exemption certificate. The Contractors and subcontractors may make copies of the tax exemption certificate and may provide a copy to each supplier providing construction material. materials for this contract may then be purchased free from sales tax.

5.05 ADDITIONAL BID INFORMATION

A. The lowest bidder will be requested to complete the Supplements To Bid Forms within 24 hours after submission of bids.

B. Bid Form: Submit with bid submission.

C. Form of Payment Bond: Prior to completion of Contract for Construction.

D. Form of Performance Bond: Prior to completion of Contract for Construction.

5.06 SELECTION AND AWARD OF ALTERNATES

A. Indicate variation of bid price for Alternates listed on the Bid Form. Unless otherwise indicated, indicate Alternates as a difference in bid price by adding to or deducting from the base bid price.

B. Bids will be evaluated on the base bid price. After determination of a successful bidder, consideration will be given to Alternates and bid price adjustments.

OFFER ACCEPTANCE/REJECTION

6.01 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of sixty (60) days after the bid closing date.

6.02 ACCEPTANCE OF OFFER

A. Owner reserves the right to accept or reject any or all offers.

B. After acceptance by Owner, Architect on behalf of Owner, will issue to the successful bidder, a written Bid Acceptance.

END OF SECTION

SECTION 004100
BID FORM

THE PROJECT AND THE PARTIES

TO:

Jay Jurrens

New Hampton Communty Schools (Owner)

710 West Main Street

New Hampton, Iowa 50659

FOR:

Project: New Hampton Elementary Daycare

DATE: _____ (BIDDER TO ENTER DATE)

SUBMITTED BY: (BIDDER TO ENTER NAME AND ADDRESS)

Bidder's Full Name _____
Address _____
City, State, Zip_____
1. Phone_____

OFFER

Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Bid Documents prepared by the Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

Base Bid_____
_____ dollars
($_____), in lawful money of the United States of America.

Alternate 1 (): Replace existing water heaters near project area with a single tankless type water heater. See MEP plans for additional information.

_____
_____ dollars
($_____), in lawful money of the United States of America.

B. We have included the required performance assurance bonds in the Bid Amount as required by the Instructions to Bidders.

C. Bid shall not include state sales tax. Federal taxes, if applicable, are included in the Bid Sum.

1.02 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for 30 days from the bid closing date.

B. If this bid is accepted by Owner within the time period stated above, we will:
1. Execute the Agreement within fourteen days of receipt of Notice of Award.
2. Furnish the required bonds within seven days of receipt of Notice of Award.
3. Commence work within seven days after written Notice to Proceed of this bid.

C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.03 CONTRACT TIME

A. If this Bid is accepted, we will meet the following schedule:
   1. Substantial Completion of all work work except final install of roof top unit: August 15, 2023. (Roof Top Unit to be installed no later than 12.31.23).
   2. Final Completion: Septemer 1, 2023

1.04 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.
   1. Addendum # _____ Dated _____.
   2. Addendum # _____ Dated _____.
   3. Addendum # _____ Dated _____.

1.05 BID FORM SUPPLEMENTS

A. A bid security in the amount of 5% of the bid amound shall be included in bid submission.

B. The bidder is prepared to submit a financial and experience statement upon request,

1.06 BID FORM SIGNATURE(S)

A. The Corporate Seal of

_____

(Bidder - print the full name of your firm)

B. was hereunto affixed in the presence of:

_____

(Authorized signing officer, Title)

END OF SECTION

SECTION 004323
ALTERNATES FORM

ALTERNATES LIST

1.01 Replace existing water heaters near project area with a single tankless type water heater. See MEP plans for additional information.

ALTERNATE # 1: ADD / (DEDUCT) $ _____

END OF SECTION

SECTION 005200
AGREEMENT FORM

PART 1 GENERAL

1.01 FORM OF AGREEMENT

A. AIA Document A105 - Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

1.02 THE AGREEMENT TO BE EXECUTED IS ATTACHED FOLLOWING THIS PAGE.

1.03 RELATED REQUIREMENTS

A. Section 007200 - General Conditions.

B. Section 007300 - Supplementary Conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 007200
GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 THE GENERAL CONDITIONS APPLICABLE TO THIS CONTRACT IS AIA A201-2017, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

1.02 A COPY IS AVAILABLE FOR VIEWING AT THE OFFICE OF THE ARCHITECT.

1.03 COPIES MAY BE PURCHASED FROM:

AIA Iowa
400 Locust Street, Suite 100
Des Moines, IA 50309
Phone: 515.244.7502
info@aiaiowa.org

RELATED REQUIREMENTS

2.01 SECTION 007300 - SUPPLEMENTARY CONDITIONS.

SUPPLEMENTARY CONDITIONS

3.01 REFER TO DOCUMENT 007300 - SUPPLEMENTARY CONDITIONS FOR AMENDMENTS TO THESE GENERAL CONDITIONS.

END OF SECTION

SECTION 007300
SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 007200 - General Conditions and other provisions of Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.

B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 RELATED SECTIONS

A. Section 005000 - Contracting Forms and Supplements.

1.03 DEFINITIONS

A. To obtain brevity, such phrases as "The Contractor shall," "furnish all labor and material necessary to install," and similar qualifiers have generally been omitted from the specifications and drawings.

B. Where the word "provide" appears, it shall be interpreted to mean, "The Contractor shall furnish all labor and material necessary to install..."

C. The words "arrived," "equal to," "as directed," etc., shall be interpreted as "to the satisfaction of the Architect." Where the term "product" is used, it shall be taken to include materials, systems, and equipment.

D. Where the word "Owner" appears in these documents, it shall refer to XYZ Corporation .

E. Align Architecture & Planning, PLC is the designated Architect of this project. Where the word "Architect" is used in these specifications, it shall mean any member of the above firm or its authorized representatives.

F. PRIME CONTRACTOR: A firm, corporation, or individual with whom the Owner makes direct contract for the construction of any or all portions of the project.

1.04 MODIFICATIONS TO GENERAL CONDITIONS

A. The Contract Documents: (Supplementing Article 1). The boundary conditions and utility survey, topo survey and legal description information is as provided to the Architect by the Owner. If all or part of the above is shown on the drawings it is shown merely for the Architect's convenience and is hereby exluded from the Contract Documents. The Architect assumes no responsibility for the correctness of the same.

B. Execution, Correlation, Intent and Interpretations: (Supplementing Article 1). Drawings and Specifications are complementary and what is called for on either shall be as binding as if called for by both. Portions of the work that can be best illustrated by the Specifications may not be depicted on the drawings and vice versa.

C. In case of disagreement between Drawings and Specifications or within either document itself, the better quality or greater quantity shall be included in contract Work, unless the matter is brought to the Architect's attention for decision and an Addendum is issued to correct the discrepancy.

D. Owner's Right to Occupy during Construction: (Supplementing Article 2). "Occupancy by the Owner shall not be construed by the Contractor as being an acceptance of that part of the project to be occupied. The Contractor shall not be held responsible for any damage to the occupied part of the Project resulting from the Owner's occupancy. Occupancy by the Owner shall not be deemed to constitute a waiver of existing claims in behalf of the Owner or Contractor against each other.

E. Warranty: (Supplementing Article 3). If substitution for specified materials result in testing or investigation to determine acceptability or if the substitution requires extensive revisions to the Contract Document, the Owner shall pay the Architect for additional services and the

Contractor shall reimburse the Owner an equal amount.

F. Whenever, within one (1) year of final acceptance of the work, the Contractor is notified in writing by either the Architect or Owner that any item of equipment, materials, and/or workmanship has proved defective or does not conform to Specification requirements, the Contractor shall immediately replace, repair, or otherwise correct the defect without cost to the Owner and warrant the corrective work for one (1) year from date of completed repair.

G. Permits, Fees, and Notices: (Supplementing Article 3). The Building Permit for the entire project shall be purchased and paid for by the General Contractor.

H. General Conditions §3.6 Taxes with the following: This is a sales tax-free construction project. Bidders shall NOT include state sales taxes in their proposals. The Owner will issue a state sales tax exemption certificate for all materials purchased for the project and will issue the appropriate tax exemption certificates and authorization letters to the Contractors and all subcontractors performing work on the project. Tax exemption certificates are applicable only for the specific project for which the certificates are issued. The Contractor shall provide a listing the Owner of all appropriate subcontractors which are qualified to use the tax exemption certificate. The Contractors and subcontractors may make copies of the tax exemption certificate and may provided a copy to each supplier providing construction material. Materials for the contract may then be purchased free from sales tax. Suppliers shall retain this certificate for at least three years.

I. Submittal Schedule: (Supplementing Article 3.10.2). The Contractor's Submittal Schedule shall not unduly congest or front-load the review and approval process for work that is does not reasonably impact Construction Schedule through lead times, logistical preparation, or actual labor. Architect may request revision or clarification of the Contractor's Submittal Schedule where it appears this has occurred.

J. Reasonable Promptness: (Clarify Article 3.10.2 & 3.12 & 4.2.7). In the absence of a Submittal Schedule approved by the Architect, "reasonable promptness" for review of submittals shall mean 15 days excluding delivery time to and from the Contractor. Architect may extend review period for reasonable cause by notifying the Contractor in writing within 3 business days of receipt of the Submittal.

K. Schedule of Values: (Supplements Article 9). The Contractor shall submit Schedule of Values based on bid form in duplicate within 15 days after date of Owner-Contractor Agreement.

L. Application and Certificates for Payment: (Supplementing Article 9). Contractor shall present estimate of work for which he desires payment on or about the first of each month, based on cost of labor and material incorporated in the work and value of materials suitably stored on the site. Estimate shall be in same form as schedule of values and shall show proportionate amount of each item completed. Architect will, within seven (7) days after receipt of contractor's estimate issue a certificate for payment to the Owner with a copy to the Contractor. Payment of net amount less sums previously paid will be made within 30 days.
    1. In making said payments, there shall be retained five percent (5%) of each said monthly estimate by the Owner.

M. Upon substantial completion of the work, the Architect will issue a certificate for the contract price less retained percentage. Final payment of retained percentage will be made thirty (30) days after final completion of the work by then fully completed and accepted and the Contract fully performed.

N. Payment made for the materials suitably stored on site but not incorporated in the work shall, if required by the Architect, be conditional upon submission by the Contractor of bills of sale or such other procedures as will establish the Owner's title to such material or otherwise adequately protect the Owner's interest.
    1. To qualify for payment under this clause, Contractors and Subcontractors shall take measures necessary to store and safeguard such materials and equipment from damage, deterioration, theft, fire, vandalism and malicious mischief.

O. Final Completion and Final Payment: (Supplementing Article 9.10). The Contractor shall submit a final waiver of lien with his estimate for final payment on forms approved by the Architect covering all work performed by the Contractor. In addition, the Contractor shall submit like

waivers of lien from each Subcontractor and supplier involved in their portion of the contract.

P. General Conditions: Add new paragraph §10.2.8: All contractors, suppliers, sub-contractors, personnel, agents or representatives: Per Iowa Code Section 282.9; Person(s) on the sex offender registry, or having been known to commit crimes against children, shall not be permitted on the school property or campus unless granted per Iowa Code procedures.

Q. General Conditions §11.2: Add the following subparagraph §11.2.1 - Contractor to provide Performance and Payment Bonds at 100% bid value. Use standard surety forms or AIA versions (A311 & A312).

R. Insurance maintained by Contractor
   1. Bodily Injury and Property Damage Liability: The Contractor shall maintain during the life of this Contract bodily injury and property damage liability insurance under a comprehensive general form and automobile bodily injury and property damage insurance under a comprehensive form.
   2. Workmen's Compensation and Employer's Liability: The Contractor shall maintain during the life of this Contract the statutory Workmen's Compensation and Employer's Liability Insurance for all of its employees to be engaged in work on the project under this Contract.
   3. Provide Accord Certificate of Insurance acceptable to the Owner specifying all insurance limits prior to beginning any site mobilization or work on site. The insurance shall be provided through a company A or better as determined by the A.m> Best Company. The Owner and the Architect (Align Architecture & Planning) shall be named as additional insured.
   4. Minimum limits for liability insurance required to be carried by the contractor are as follows:
      a. General Liability- $1,000,000 Combined Single Limit per occurrence; $2,000,000 Aggregate.
      b. Products-Complete Operations Aggregate limit: $2,000,000
      c. Personal & Advertising Injury Limit: $1,000,000 Each occurrence limit: $1,000,000
      d. Automobile Liability:$1,000,000 Combined Single Limit
      e. Worker's Compensation: Statutory Limits, Employers Liability: 500,000 / 500,000 / $500,000
      f. Umbrella Liability: minimum Limit; $2,000,000

S. Insurance maintained by Owner
   1. Builder's Risk Insurance: The Owner shall effect and maintain all Builder's Risk Insurance.
   2. Property Insurance: The Owner shall purchase and maintain fire, extended coverage, vandalism and malicious mischief insurance on the completed value form or monthly reporting form of policy upon the entire structure on which the work of this Contract is to be done. The amount of this insurance shall be 100% of the bid value, including items of labor and materials connected there with, whether in or adjacent to the structure insured materials in place or to be used as part of the permanent structure.
   3. Prime Contractor shall be named as insured jointly with the Owner in all policies. Certificates of Insurance shall be filed with the Contractor and Architect. If the Owner fails to effect or maintain insurance as above, the Contractor may insure its own interest and charge the cost thereof to the Owner. If the Contractor is damaged by failure of the Owner to maintain such insurance or to so notify the Contractor, the Contractor may recover as stipulated in the Contract for recovery of damages. The Owner shall furnish satisfactory proof that the insurance herein described has been obtained and that the policy or policies have been written by a company or companies authorized to do business in the State of Iowa.

T. The Contractor and all Subcontractors waive all rights, each against the other, for damages caused by fire or other perils covered by insurance provided for under terms of this Contract, except in such rights as they may have proceeds of insurance held by the Owner or Trustees

U. Certificates of Insurance: Certificates (2 of each) evidencing insurance coverage required by the Contractor and Owner shall be filed with the Architect before the commencement of

construction. All certificates shall contain a clause stating that the policy will not be cancelled without ten (10) days written notice having first been sent to the Owner and Architect. Use AIA Form Acord 25-S Certificate of Insurance and AIA G715 Acord Certificate of Insurance Instruction Sheet.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: New Hampton Elementary Daycare

B. Owner's Name: New Hampton Community School

C. Architect's Name: Align Architecture & Planning, PLC.

D. The Project consists of the See Spec Section 00 01 02 Project Information.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 52 00 - Agreement Form.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.

B. HVAC: Alter existing system and add new construction, keeping existing in operation.

C. Electrical Power: Alter existing system and add new construction, keeping existing in operation.

D. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.

1.04 WORK BY OWNER

A. Owner will remove or relocate non-fixed equipment as required. Flooring will be removed back to exisitng concrete substrate.

1.05 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Due to known lead times for Roof Top Mechanical Equipment. Owner is permitted to occupy the space with the exisitng mechanical equipment running up unitl 12.31.2023. Once unit is recieved, Contractor will cooridinate final equuipment install with Owner's schedule.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations. The existing shop area would conintue to be used during the spring term of school year.

D. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

1.07 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 005200 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.

B. Document 007200 - General Conditions and Document 007300 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.

C. Section 012100 - Allowances: Payment procedures relating to allowances.

1.03 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.

E. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work (i.e. "Unit Masonry") coinciding with Item Number.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

E. Execute certification by signature of authorized officer.

F. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

G. Submit one electronic and three hard-copies of each Application for Payment.

H. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 013000.

2. Current construction photographs specified in Section 013000.

I. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.

D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

E. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:
      a. Quantities of products, labor, and equipment with taxes as applicable.
      b. Overhead and profit.
      c. Justification for any change in Contract Time.
      d. Credit for deletions from Contract, similarly documented.

F. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 002113 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 013000 - Administrative Requirements: Submittal procedures, coordination.

C. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

D. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

1.04 REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage) Current Edition.

B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase) Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. No specific form is required. Contractor's Substitution Request documentation must include the following:

a. Project Information:
    1) Official project name and number, and any additional required identifiers established in Contract Documents.
b. Substitution Request Information:
    1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
    2) Indication of whether the substitution is for cause or convenience.
    3) Issue date.
    4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
    5) Description of Substitution.
    6) Reason why the specified item cannot be provided.
    7) Differences between proposed substitution and specified item.
    8) Description of how proposed substitution affects other parts of work.
c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
    1) Physical characteristics.
    2) In-service performance.
    3) Expected durability.
    4) Warranties.
    5) Other salient features and requirements.
    6) Include, as appropriate or requested, the following types of documentation:
        (a) Product Data:
        (b) Samples.
        (c) Certificates, test, reports or similar qualification data.
        (d) Drawings, when required to show impact on adjacent construction elements.
d. Impact of Substitution:
    1) Savings to Owner for accepting substitution.
    2) Change to Contract Time due to accepting substitution.

D. Limit each request to a single proposed substitution item.
    1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
    1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.03 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

END OF SECTION

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Mock-ups.

G. Tolerances.

H. Manufacturers' field services.

I. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 003100 - Available Project Information: Soil investigation data.

B. Document 007200 - General Conditions: Inspections and approvals required by public authorities.

C. Section 013000 - Administrative Requirements: Submittal procedures.

D. Section 016000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2019).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.

C. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.

D. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.

E. IAS AC89 - Accreditation Criteria for Testing Laboratories 2021.

1.04 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.

g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Compliance with Contract Documents.
k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

E. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

B. Contractor's Quality Control (CQC) Plan:

1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
   a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.

1.07 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

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 Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner shall employ and pay for services of an independent testing agency to perform specified testing. Contractor to coordinate with testing agencies for access and schedule.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Owner Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM C1021, ASTM C1077, and ASTM D3740.
2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.

3. Laboratory: Authorized to operate in the State in which the Project is located.
4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Pour, stamp, stain and seal a 6' long mock-up of the stamped 12' wide concrete park path. See detail 1/L109 for reference.

B. Accepted mock-up shall be a comparison standard for the remaining Work, and may be included in finished Work.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.

4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work .
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 014100
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

A. Regulatory requirements applicable to this project are the following:

B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

C. 29 CFR 1910 - Occupational Safety and Health Standards Current Edition.

D. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

E. ICC (IFC) - International Fire Code; 2021.

F. ICC (IBC) - International Building Code; 2021.

G. ICC (IPC) - International Plumbing Code; 2021.

H. NEC (NFPA) - National Electric Code; 2021.

I. Iowa Administrative Code

1.02 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Project identification sign.

1.02 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

1.03 TEMPORARY UTILITIES - SEE SECTION 015100

A. Owner will provide the following as required:
   1. Electrical power, consisting of connection to existing facilities
   2. Water supply, consisting of connection to existing facilities.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities is not permitted.

C. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

1.06 INTERIOR ENCLOSURES

A. Provide temporary partitions as needed to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. STC rating of 35 in accordance with ASTM E90.

1.07 SECURITY - SEE SECTION 013553

A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.

1.08 VEHICULAR ACCESS AND PARKING - SEE SECTION 015500

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Existing parking areas may be used for construction parking. Owner will help designate a portion of the parking lot for Contractor's use.

1.09 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

1.10 PROJECT IDENTIFICATION

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Document 002113 - Instructions to Bidders: Product options and substitution procedures prior to bid date.

B. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

C. Section 014000 - Quality Requirements: Product quality monitoring.

D. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

E. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content Current Edition.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

C. Where other criteria are met, Contractor shall give preference to products that:
   1. If wet-applied, have lower VOC content, as defined in Section 016116.
   2. Are extracted, harvested, and/or manufactured closer to the location of the project.
   3. Have longer documented life span under normal use.
   4. Result in less construction waste. See Section 017419
   5. Are made of vegetable materials that are rapidly renewable.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

B. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period and the documents required. Comply with requirements specified in Section 002113.

C. Substitutions will be considered when a product, through no fault of the Contractor, becomes unavailable or unsuitable due to regulatory change.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

F. 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 the Contract Documents.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

F. For exterior storage of fabricated products, place on sloped supports above ground.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

J. Prevent contact with material that may cause corrosion, discoloration, or staining.

K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

L. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete for composite floor construction.

C. Concrete curing.

1.02 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.

C. ACI 301 - Specifications for Concrete Construction 2020.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

F. ACI 308R - Guide to External Curing of Concrete 2016.

G. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).

H. ACI 347R - Guide to Formwork for Concrete 2014 (Reapproved 2021).

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022a.

L. ASTM C150/C150M - Standard Specification for Portland Cement 2022.

M. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.

N. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

O. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2023.

P. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete 2019.

Q. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

R. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type) 2011 (Reapproved 2022).

1.03 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

1.04 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Slabs with Porosity Inhibiting Admixture (PIA) or Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of the concrete.

1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

2.02 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C33/C33M.

C. Fly Ash: ASTM C618, Class C or F.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.03 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. Moisture Vapor Reducing Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs). Closes capillary systems formed during concrete curing to reduce moisture vapor emission and transmission. Reduces concrete shrinkage with no adverse effect on concrete properties or applied flooring.
   1. Provide admixture in slabs to receive adhesively applied flooring.
   2. Products:
      a. ISE Logik Industries, Inc; MVRA 900: www.iselogik.com/#sle.

2.04 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

C. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch (20.7 MPa).
   2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
   3. Water-Cement Ratio: Maximum 40 percent by weight.
   4. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
   5. Maximum Slump: 3 inches (75 mm).
   6. Maximum Aggregate Size: 5/8 inch (16 mm).

2.05 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

C. Do not use shrinkage-reducing admixture (SRA) in same concrete batch with MVRA or PIA.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.

D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Notify Architect not less than 24 hours prior to commencement of placement operations.

C. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.04 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

3.05 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Place concrete floor toppings to required lines and levels.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
   2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
   3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

A. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.

B. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting and resilient flooring.
   2. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

C. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.09 DEFECTIVE CONCRETE

END OF SECTION

SECTION 054000
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud interior wall framing.

1.02 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies: Cold-formed steel nonstructural framing.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing 2015, with Errata (2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.

F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2020.

G. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.

C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.

D. Design Data:

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:
   1. CEMCO; _____: www.cemcosteel.com/#sle.
   2. ClarkDietrich; _____: www.clarkdietrich.com/#sle.
   3. Jaimes Industries; ____: www.jaimesind.com/#sle.
   4. MarinoWARE; ____: www.marinoware.com/#sle.
   5. SCAFCO Corporation; _____: www.scafco.com/#sle.
   6. Steel Construction Systems; _____: www.steelconsystems.com/#sle.
   7. The Steel Network, Inc; _____: www.SteelNetwork.com/#sle.
   8. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI

S240.

B. Design Criteria: In accordance with applicable codes.
   1. Live load deflection meeting the following, unless otherwise indicated:
   2. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   3. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.
   1. Thickness and Depth: As indicated on drawings.

2.05 CONNECTIONS

A. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

B. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
   1. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).
   2. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet (3660 mm).

2.06 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with AISI S240.

3.03 INSTALLATION OF STUDS

A. Install wall studs plumb and level.

B. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

C. Install intermediate studs above and below openings to align with wall stud spacing.

D. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

3.04 INSTALLATION OF WALL SHEATHING

A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
   1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.

3.05 TOLERANCES

A. Studs - Maximum Variation from True Position: 1/8 inch (3.2 mm) in accordance with ASTM C1007.

END OF SECTION

SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 123600 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. BHMA A156.9 - Cabinet Hardware 2020.

D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

E. WI (CCP) - Certified Compliance Program (CCP) Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
   2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

B. Product Data: Provide data for hardware accessories.

C. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.07 MOCK-UPS

A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.09 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Single Source Responsibility. Provide and install this work from single fabricator..

2.02 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade. Coordinate decorative laminate color with Architect

C. Cabinets:
   1. Finish - Exposed Exterior Surfaces: Decorative laminate.
   2. Finish - Exposed Interior Surfaces: Decorative laminate.
   3. Finish - Concealed Surfaces: Manufacturer's option.
   4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   5. Door and Drawer Front Retention Profiles: Fixed panel.
   6. Casework Construction Type: Type B - Face-frame.
   7. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
   8. Cabinet Design Series: As indicated on drawings.
   9. Adjustable Shelf Loading: 50 psf (24.4 gm/sq cm).
   10. Cabinet Style: Reveal overlay on face frame.
   11. Cabinet Doors and Drawer Fronts: Flush style.
   12. Drawer Side Construction: Multiple-dovetailed.

2.03 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.04 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation: www.formica.com/#sle.
   2. Wilsonart LLC: www.wilsonart.com/#sle.

B. Provide specific types as indicated.
   1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, Color to be coordinated with Architect.
   2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, Color to be coordinated with Architect
   3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch (1.0 mm) nominal thickness, Color to be coordinated with Architect
   4. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness

2.05 COUNTERTOPS

A. Solid Surface Counter tops:
   1. Substrate:
      a. At all cabinetry with a sink: Exterior grade substrate. Provide integral back splash with round pencil edge where called out. Provide integral side backsplash where indicated on the drawings.
      b. At all cabinetry not in item "a" above: Medium density fiberboard substrate covered with HPDL, post-formed. Provide integral back splash with eased edge where called out. Provide integral side backsplash where indicated on the drawings.

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
   1. Color: As selected by Architect from manufacturer's standard range.
   2. Use at all exposed plywood edges.
   3. Use at all exposed shelf edges.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

2.07 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

C. Drawer and Door Pulls: 6" Stainless Steel Bar-Style Cabinet Pull.

D. Cabinet Catches: Magnetic

E. Drawer Slides:
   1. Type: Full extension with overtravel.
   2. Static Load Capacity: Extra Heavy Duty grade.
   3. Mounting: Bottom mounted.
   4. Stops: Positive type.
   5. Features: Provide self closing/stay closed type.
   6. Manufacturers:
      a. Accuride International, Inc; Light-Duty Drawer Slides: www.accuride.com/#sle.
      b. Knape & Vogt Manufacturing Company; Medium-Duty Drawer Slides: www.knapeandvogt.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

F. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
   1. Manufacturers:
      a. Blum, Inc; CLIP top BLUMOTION: www.blum.com/#sle.
      b. Blum, Inc; COMPACT BLUMOTION: www.blum.com/#sle.
      c. Grass America Inc; ____: www.grassusa.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

2.08 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
   1. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

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

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

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

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2019.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2022.

D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2020.

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.

G. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   4. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
1. Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 087100.

D. Touch up damaged factory finishes.

3.03 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 081416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 081213 - Hollow Metal Frames.

B. Section 087100 - Door Hardware.

1.02 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ITS (DIR) - Directory of Listed Products Current Edition.

D. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2021, with Errata (2022).

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door veneer, 4 by 4 inches (___ by ___ mm) in size illustrating wood grain, stain color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.04 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Haley Brothers: www.haleybros.com/#sle.
   2. Horton Automatics, a division of Overhead Door Corporation; FlexBarn: www.overheaddoor.com/#sle.
   3. Krieger Specialty Products: www.kriegerproducts.com/#sle.
   4. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.
   5. Oregon Door: www.oregondoor.com/#sle.
   6. VT Industries, Inc: www.vtindustries.com/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

2.02 DOORS AND PANELS

A. Doors: 1 3/4 inch thck; solid core construction, 5 ply construciton .

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that 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.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

END OF SECTION

SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood and aluminum doors.

B. Electrically operated and controlled hardware.

C. Gate locks.

1.02 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 081416 - Flush Wood Doors.

C. Section 084313 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

D. Section 281000 - Access Control: Electronic access control devices.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. BHMA A156.1 - Standard for Butts and Hinges 2021.

C. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.

D. BHMA A156.3 - Exit Devices 2020.

E. BHMA A156.4 - Door Controls - Closers 2019.

F. BHMA A156.7 - Template Hinge Dimensions 2016.

G. BHMA A156.8 - Door Controls - Overhead Stops and Holders 2021.

H. BHMA A156.16 - Auxiliary Hardware 2018.

I. BHMA A156.18 - Materials and Finishes 2020.

J. BHMA A156.22 - Standard for Gasketing 2021.

K. BHMA A156.25 - Electrified Locking Devices 2018.

L. BHMA A156.26 - Standard for Continuous Hinges 2021.

M. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.

N. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.

O. DHI (KSN) - Keying Systems and Nomenclature 2019.

P. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.

Q. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.

R. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

S. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

U. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

V. UL (DIR) - Online Certifications Directory Current Edition.

W. UL 437 - Standard for Key Locks Current Edition, Including All Revisions.

X. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Verify that specified hardware matches the owners current hardware manufacturer, finish, and lever style. Contact Architect if specified hardware differs.

C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

D. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Access control requirements.
      b. Key control system requirements.
      c. Schematic diagram of preliminary key system.
      d. Flow of traffic and extent of security required.
   5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
   6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Provide complete description for each door listed.
   3. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   4. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
   2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
   3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

F. Installer's qualification statement.

G. Supplier's qualification statement.

H. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

B. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Five years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Applicable provisions of NFPA 101.
   4. Auxiliary Hardware: BHMA A156.16.
   5. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   6. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   7. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
   1. See Section 281000 for additional access control system requirements.

E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.

F. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
      a. Self-drilling (Tek) type screws are not permitted.
   3. Fire-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.

b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

4. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.02 HINGES

A. Manufacturers:
   1. Ives, an Allegion comapny: www.allegion.com
   2. Substitutions: See Section 016000 - Product Requirements.

B. Hinges: Comply with BHMA A156.1, Grade 1.
   1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
      a. Provide hinge width required to clear surrounding trim.
   2. Continuous Hinges: Comply with BHMA A156.26.
   3. Provide hinges on every swinging door unless noted otherwise.
   4. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
   5. Provide ball-bearing hinges at each door.
   6. Provide non-removable pins on exterior outswinging doors.
   7. Provide non-removable pins on interior outswinging doors at doors with access control.
   8. Provide power transfer hinges where electrified hardware is mounted in door leaf.
   9. Provide following quantity of butt hinges for each door:
      a. Doors up to 60 inches (1.5 m) High: Two hinges.
      b. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.

2.03 CYLINDRICAL LOCKS

A. Manufacturers:
   1. Schlage, an Allegion brand: www.allegion.com/us/#sle.

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 2, 4000 Series.
   1. Bored Hole: 2-1/8 inch (54 mm) diameter.
   2. Latchbolt Throw: 1/2 inch (12.7 mm), minimum.
   3. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.
   4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
      a. Finish: To match lock or latch.
   5. Provide a lock for each door, unless otherwise indicated that lock is not required.

2.04 CLOSERS

A. Manufacturers; Surface Mounted:
   1. LCN, an Allegion brand; _____: www.allegion.com/us/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

B. Closers: Comply with BHMA A156.4, Grade 1.
   1. Type: Surface mounted to door.
   2. Provide door closer on each exterior door.
   3. At corridor entry doors, mount closer on room side of door.

2.05 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
   1. Glynn-Johnson, an Allegion brand; _____: www.allegion.com/us/#sle.

B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
   1. Provide overhead stop for every swinging door that is not near enough to a wall for a wall stop, unless otherwise indicated.
   2. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.

2.06 WALL STOPS

A. Manufacturers:
   1. Basis of Design: Ives.

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
   1. Provide wall stops to prevent damage to wall surface upon opening door.
   2. Type: Bumper, concave, wall stop.
   3. Material: Aluminum housing with rubber insert.

2.07 SILENCERS

A. Manufacturers:
   1. Ives, an Allegion brand; _____: www.allegion.com/us/#sle.

B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
   1. Single Door: Provide three on strike jamb of frame.
   2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
   3. Material: Rubber, gray color.

2.08 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
   2. Exceptions:
      a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
      b. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
      c. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.
      d. Hardware for Aluminum Entrance Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Do not install surface mounted items until application of finishes to substrate are fully completed.

D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
   2. For Aluminum-Framed Storefront Doors and Frames: See Section 084313.
   3. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
   4. Mounting heights in compliance with ADA Standards:
      a. Locksets: 40-5/16 inch (1024 mm).
      b. Exit Devices: 40-5/16 inch (1024 mm).

E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel

countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.

3.04 ADJUSTING

A. Adjust work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.

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

END OF SECTION

SECTION 087113
POWER DOOR OPERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operators for swinging doors.

B. Controllers, actuators, and safety devices.

C. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware: Balance of door hardware.

1.03 DEFINITIONS

A. Activation Device: Device that sends an electrical signal to door operator to open door when actuated.

B. Knowing Act: Consciously initiating the opening of a power-operated door using acceptable methods, including wall-mounted switches such as push plates and controlled access devices such as keypads, card readers, and key switches.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. BHMA A156.10 - Power Operated Pedestrian Doors 2017.

C. BHMA A156.19 - Power Assist and Low Energy Power Operated Swinging Doors 2019.

D. ITS (DIR) - Directory of Listed Products Current Edition.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL (DIR) - Online Certifications Directory Current Edition.

H. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate power door operators with balance of door hardware and electrical work required for each affected door opening.
   1. Templates: Check other sections' shop drawings to confirm that adequate provisions are in place for locating and installing power door operators.
   2. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to power supplies, remote activation devices, and electric door latching hardware.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings:
   1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
   2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

D. Installer's qualification statement.

E. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

F. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience, and a member of AAADM.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience and approved by manufacturer.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for components of power door operators. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Operators for Swinging Doors:
   1. ASSA ABLOY Entrance Solutions; Besam SW200i: www.besam-usa.com/#sle.
   2. Horton Automatics; _____: www.hortondoors.com/#sle.
   3. record-usa; 8100 Series Swing Door: www.recorddoors.com/#sle.
   4. Stanley Access Technologies; Magic Access LE (Low Energy): www.stanleyaccess.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

2.02 POWER DOOR OPERATORS - GENERAL

A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.

B. Comply with ADA Standards for egress requirements.

C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for light pedestrian traffic unless otherwise indicated.

D. Exterior and Vestibule Doors: Provide equipment suitable for ambient operating temperature range of minus 20 to plus 140 degrees F (minus 29 to plus 60 degrees C).

E. Exterior Doors: Provide units capable of operating, closing, and holding doors closed under positive and negative differential pressure; if necessary, provide power closing.

2.03 OPERATORS FOR SWINGING DOORS

A. Door Operator, Type ____: Hydraulic.
   1. Applications: Include operators for single and double doors.
   2. Hydraulic Operators: ____ hp (____ W) minimum, self-contained, electrically driven.
   3. Speed Control: Variable, field-adjustable opening and closing cycles.
   4. Functionality: Full-power open, spring close operation.
      a. Full-Power Operators: Comply with BHMA A156.10; safeties required.
         1) Comply with UL 325; acceptable evidence of compliance includes UL (DIR) or ITS (DIR) listing or test report by testing agency acceptable to authorities having jurisdiction.
      b. Low-Energy Power Operators: Comply with BHMA A156.19; operator activated by pushing or pulling the door or by manual actuator, not a sensor; safeties not required.
   5. Mounting: Surface mounted overhead.
   6. Components:
      a. Header Case: Manufacturer's standard extruded aluminum profile containing door operator and door mounting components.

7. Power Supply Units: Self-contained, electrically operated, and independent of door operator.
8. Actuators: Manufacturer's standard.
    a. Push-Side Actuator: Push plate. Wireless wall mounted unit
    b. Pull-Side Actuator: Push plate. Wireless wall mounted unit

2.04 FINISHES

A. Aluminum Finishes: Manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify installation conditions including, but not limited to the following: opening sizes, floor conditions, plumb and level mounting surfaces.

B. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.

C. Verify that electric power is available, in the correct location, and of the correct characteristics.

3.02 INSTALLATION

A. Coordinate installation of components with related and adjacent work.

B. Install equipment in accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate to Owner's representative equipment operation, operating components, adjustment features, and lubrication requirements.

3.06 MAINTENANCE

A. Provide service and maintenance of operating equipment for one year from Date of Substantial Completion, at no extra charge to Owner.

END OF SECTION

SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Samples: Submit two full size samples illustrating material and finish of acoustical units.

1.04 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Acoustic Ceiling Products, Inc; ____: www.acpideas.com/#sle.
   2. Acoustics First Corporation; ____: www.acousticsfirst.com/#sle.
   3. CertainTeed Corporation; ____: www.certainteed.com/ceilings-and-walls/#sle.
   4. Rockfon; _____: www.rockfon.com/#sle.
   5. TECHLITE; _____: www.techlite.com/#sle.
   6. USG Corporation; ____: www.usg.com/ceilings/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Panels, Type A: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
      a. Form: 2, water felted.
      b. Pattern: CD. Field Verify Existing
   2. Size: 24 by 24 inches (610 by 610 mm).
   3. Thickness: 5/8 inch (16 mm).
   4. Panel Edge: Tegular.
   5. Color: White.
   6. Composition: Wet Felted
   7. Product: "Cortega" No 704 by Armstrong World Industries, or approved equivilent
   8. NRC RangeL 0.50 to 0.55, determined as specified in ASTM E1264
   9. Suspension System: Exposed 15/16" grid.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings and splices as required.

B. Exposed Suspension System: Hot-dip galvanized steel grid and cap.

1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16" inch (____ mm) face width. (Verify Existing)
3. Finish: Baked enamel.
4. Color: White.
5. Products: "Prelude ML" by Armstrong World Industries;"DX" by Donn; or approved equal.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

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

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Use longest practical lengths.

C. Suspension System, Non-Seismic: 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.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

F. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

G. Do not eccentrically load system or induce rotation of runners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
1. Make field cut edges of same profile as factory edges.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 CLEANING

END OF SECTION

SECTION 096500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).

D. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Verification Samples: Submit two samples, 6" by 36" inch (___ by ___ mm) in size illustrating color and pattern for each resilient flooring product specified.

C. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Luxery Vinyl Composition Tile Scheduled as LVT.

B. Color, size, thickness
   1. Manufacturers:
      a. Shaw Floors
   2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   3. Size: 6" x 48"
   4. Thickness: 2.5mm
   5. Pattern: In the Grain II
   6. Color: English Grey

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.
   1. Height: 4 inches (100 mm). Or as indicated on the drawings.
   2. Thickness: 0.125 inch (3.2 mm).
   3. Finish: Satin.
   4. Length: Roll.
   5. Color: Verify with Architect. Color from standard color selections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

3.03 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

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

3.05 CLEANING

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

B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

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

END OF SECTION

SECTION 096813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.

C. CRI 104 - Standard for Installation of Commercial Carpet 2015.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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

C. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:

2.02 MATERIALS

A. Tile Carpeting. See finish schedule and finish floor plan for carpet color and install method.
   1. Product: Mohawk/Aladdin manufactured by Mohawk.
   2. Tile Size: 24" X24", nominal.
   3. Color: Instant Replay 949.
   4. Pattern: Syndicated Buzz QA198

2.03 ACCESSORIES

A. Edge Strips: Rubber, color as selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

END OF SECTION

SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES - ASI

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grab bars.

B. Mirrors.

C. Toilet tissue dispensers.

1.02 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM C1036 - Standard Specification for Flat Glass 2021.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Samples: Submit two samples of each accessory, indicating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: American Specialties, Inc: www.americanspecialties.com/#sle.

B. Other Acceptable Manufacturers:
   1. A & J Washroom Accessories Inc. www.ajwashroom.com .
   2. American Specialties, Inc. www.americanspecialties.com .
   3. Bradley Corporation: www.bradleycorp.com.
   4. Approvecd Substitutions to be coordinated with Architect

2.02 GRAB BARS

A. Grab Bars: Type 304 stainless steel.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 lbf (1112 N), minimum.
      b. Clearance: 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated in product listing.

2.03 MIRRORS

A. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass, ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.

2. Size: 24"X36".
3. Angle Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No. 4 finish.
4. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.

2.04 TOILET TISSUE DISPENSERS

A. Toilet Tissue Dispenser: Surface-mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.

2.05 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

E. Adhesive: Two component epoxy type, waterproof.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamperproof; security type.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.06 FINISHES

A. Stainless Steel: No. 4 finish, unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 123600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.02 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

B. PS 1 - Structural Plywood 2019.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet, Type ___: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
      a. Finish: Matte or suede, gloss rating of 5 to 20.
   2. Integral Back and End Splashes: Same material, same construction.

2.02 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

END OF SECTION

SECTION 22 0050
BASIC PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Plumbing Requirements specifically applicable to Mechanical Division Specification Sections.

B. Division 22 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

1.02 OWNER OCCUPANCY

A. The owner will occupy the premises during the construction period.

B. Limit use of site and premises to allow owner occupancy.

C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.

D. Schedule the work to accommodate this requirement.

1.03 REGULATORY REQUIREMENTS

A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.

B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.

C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.

E. All work shall comply with the applicable recommendations of:
   1. The National Board of Fire Underwriters
   2. The American Gas Association
   3. The National Fire Protection Association (NFPA)
   4. The Occupations Safety and Health Act (OSHA)
   5. Current IBC Building Code
   6. Current applicable city building codes

F. Mechanical: Conform to current mechanical code.

G. Plumbing: Conform to current plumbing code.

H. Obtain permits and request inspections from authority having jurisdiction.

I. Safe Drinking Water Act and Senate Bill S.3874: All products must meet the lead-free requirements of the SDWA and NSF/ANSI 372 certification.

1.04 PROJECT/SITE CONDITIONS

A. Install work in locations shown on the drawings unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.

C. This contractor, before submitting their bid, shall visit the site of the project to familiarize themselves with locations and conditions affecting their work.

D. It is the intent of this specification that the contractor furnishes all labor and material required completing the installation as outlined in the drawings and specifications. No additions to the contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.

E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing piping, ductwork, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.

F. This contractor shall provide holes as necessary for the installation of their work and in accordance with other specification sections in materials other than the structure.

1.05 SEQUENCING AND SCHEDULING

A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.

B. This contractor shall be kept informed as to the work of other trades engaged in the project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.

C. Where space for mechanical and electrical lines and piping is limited, it is imperative that all such trades coordinate their work so as to ensure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.06 GUARANTEE

A. This contractor shall guarantee all of the apparatus, materials, equipment furnished and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.

B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.07 ENGINEER APPROVED EQUAL PRODUCTS

A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.

B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.

C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".

D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.08 OWNER'S RIGHT OF SALVAGE

A. Before beginning construction, this contractor shall check and verify with the owner each item of existing equipment that must be removed.

B. The owner will designate which items of material or equipment not reused that they may wish to keep. This contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.

C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from site.

1.09 PROTECTION AND MAINTENANCE

A. Where necessary to connect to any existing utility service, this contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.

B. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.

C. This contractor shall protect existing equipment in finished areas from dirt, dust and damage as a result of their work.

D. Coordinate protection requirements with department heads before beginning construction.

E. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.10 DEMOLITION

A. This contractor shall be responsible for the demolition and removal of all existing mechanical elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be relocated".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.
   4. All elements to be removed are subject to the Owner's Right of Salvage.

B. Preserve services to the existing facility. Extend/reroute/reconnect existing systems as required providing for the continued function of these systems.

1.11 CUTTING AND PATCHING

A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.

B. This contractor shall arrange for openings in the building as required for the installation of equipment furnished under this contract.

C. Where sewers must be extended or changed, patching with concrete will be done in the building. Patching shall be at both the top and bottom of sleeves where above grade.

D. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, contractor shall be responsible to patch and/or seal openings as necessary to maintain/return fire separation to rating as required by applicable codes.

E. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.12 CLEANING AND RUBBISH

A. This contractor shall upon completion of his work, remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.

B. In so far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.

C. This contractor shall maintain the work area each day to prevent hazardous accumulation of waste from their work.

1.13 SEALING AND PENETRATION

A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.

B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.

C. Manufacturer offering products to comply with the requirements include the following:
   1. Dow Corning "Silicone RTV Foam"
   2. 3-M Corporation "Fire Barrier Caulk and Putty"
   3. Thomas & Betts "Flame Safe Fire Stop System"

D. Installation of these products to be in strict accordance with manufacturer's recommendations and architectural specification sections or equivalent fire stopping architectural specification section.

E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.14 ELECTRICAL CONNECTIONS

A. This contractor shall turn over all magnetic starters, thermal protective switches and speed changing switches furnished under this contract for all motor driven equipment to the electrical contractor who will install such starters and switches and wire them to their respective motors as a part of the electrical contract.

1.15 UTILITY COMPANY

A. Any fees by the utility company are to be billed directly to the owner.

B. The contractor is required to assist the owner in the preparation of all utility company rebate forms that deal with equipment furnished and/or installed as a part of this contractor.

1.16 HAZARDOUS MATERIALS

A. If the contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them on the site. The contractor shall inform the owner and all employed of any potential exposure to this material.

B. At no time shall any product containing asbestos be incorporated into the work.
   1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.17 RECORD DRAWINGS

A. This contractor shall provide, at the conclusion of the project, one clean, non-torn, neat, and legible "as-built" set of drawings to the owner. These drawings shall show the routing of pipes, ductwork and equipment drawn in at scaled locations. All dimensions indicated shall be referenced to a column line. A set of construction blue prints will be furnished for this work.

B. All mechanical systems installed shall be shown on the "as-built" drawings.

C. Refer to respective architectural specification section for additional information.

D. This contractor shall update these drawings during the project at least every week.

1.18 REVIEW OF MATERIALS

A. This contractor shall submit to the engineer for review one (1) electronic copy of a brochure giving a complete list of materials and equipment they propose to furnish. The brochure shall contain complete information as to the make of equipment, type, size, capacities, dimensions and illustration. One of the returned copies shall be kept on the job at all times.

B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless the contractor notifies engineer in writing of such deviation at time such drawings are furnished.

C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.

D. This contractor shall mark the date and sign each set that they have checked each of them in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the contractor.

1.19 SCOPE OF WORK

A. All work shall be performed by well-qualified and licensed mechanics with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their mechanics are familiar with all the various codes and tests applicable to this work.

B. All equipment shall be new and of the type as specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.

C. The intent of the drawings and specifications is for complete installation of the systems outlined in the drawings and specifications so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation.

D. This contractor shall be required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type. The drawings and specifications cannot deal individually with the many minute items that may be required by the nature of the systems.

E. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer’s attention and an addendum is issued for clarification.

F. The Plumbing Contractor shall establish system elevations prior to fabrication and installation. The Plumbing Contractor shall coordinate elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation. When a conflict between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:
   1. Lighting Fixtures
   2. Gravity flow piping, including steam and condensate.
   3. Electrical bus duct.
   4. Sheet metal.
   5. Cable trays, including access space.
   6. Other piping.
   7. Conduits and wireway.

1.20 VERIFICATION OF ELEVATION OF EXISTING LINES

A. This contractor, before starting any new work, shall verify the elevations of all existing piping to which they must connect under this contract. The contractor shall report any discrepancies between drawing elevations and actual elevations to the engineer before proceeding with the work. Failure of the contractor to do so shall make them liable for the cost of extra work involved.

1.21 DAILY HOUSEKEEPING

A. At the end of each working day, this contractor shall remove all of their debris, rubbish, tools and surplus materials from the project work area. The work area shall be broom clean and left in a neat and orderly condition. The contractor for the removal of debris from the project shall not use the owner’s waste disposal facility.

B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.22 CLEANING OF MECHANICAL SYSTEMS

A. The mechanical contractor shall clean and passivate all plumbing systems. Flush systems with water until free from all sand, grit, gravel, oil, etc. Provide Babcock/Wilcox Millipore and biological testing on the flush water. The flush will be considered a success when the water exiting the system contains less than 100 ppb of total suspended solids and less than 100 RLUs.

B. Where connections are made to existing piping systems, this contractor shall provide isolation valves, threaded tees, etc., as required to facilitate the cleaning and testing of all new piping.

C. This contractor shall thoroughly clean all rust, grease, plaster, cement, etc., from all equipment and piping furnished and installed by them as required to leave surfaces suitable for finish painting.

D. This contractor shall keep all pipes, traps, waste lines, ducts, etc., plugged, drained or otherwise protected during construction. All items of mechanical equipment shall be suitably protected and upon completion of project shall be equal to new condition.

1.23 TRENCHING AND BACKFILLING

A. Each contractor is responsible for their own individual trenching and backfilling unless otherwise noted in the drawings or addendum.

B. All underground utilities, piping, etc shall be located exactly before digging. This contractor shall be held responsible for all damages caused by failure to do so.

C. Any backfill shall be tamped and compacted to prevent future settling. The backfill shall be installed to a smooth and level grade and installed in accordance with local codes.

D. All excess dirt shall be cleared from the area and disposed of as directed by the owner.

E. Refer to architectural specification sections for additional requirements.

1.24 ALTERNATES

A. Refer to General Specification Sections for alternate bid description.

1.25 DIGITAL MEDIA AGREEMENT

A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.

B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is $100.00 per CAD sheet.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 22 0050

SECTION 22 0080

PLUMBING SCHEDULE OF VALUES

PART 1 GENERAL

1.01 FORM COMPLETION

A. The successful mechanical contractor shall complete this form in its entirety within 30 days of receipt of the signed contract from the general contractor, and submit directly to MODUS.

B. This information is confidential and will not be disclosed to any individual outside of MODUS. Data collected will be used in evaluating pay applications.

1.02 OVERALL CONTRACT

Basic Plumbing Bid	$
Add or deduct accepted alternates, negotiated changes, or other modifications to the contract	$
Total Plumbing Bid	$

1.03 SCHEDULE OF VALUES

Domestic Plumbing Insulation - Material	$
Domestic Plumbing Piping - Material	$
Domestic Plumbing Specialties - Material	$
Plumbing Equipment - Material	$
Plumbing Fixtures - Material	$
Plumbing Installation - Labor	$
Plumbing Insulation - Material and Labor	$
Total Plumbing Bid (Sum of Schedule of Values)	$

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 22 0080

SECTION 22 0090
MINOR PLUMBING DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 22 0050 - Basic Mechanical Requirements "General Provisions" apply to this section.

1.02 SCOPE

A. This contractor shall be responsible for the demolition and removal of all existing mechanical elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be relocated".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.

B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.

C. This contractor shall be responsible for the cutting and capping of all existing gas, water, sewer, and any other utility service.

D. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.

E. This contractor shall remove all abandon equipment, piping, ductwork, supports, equipment curbs, and bases associated with the remodeled areas unless noted otherwise.

F. This contractor is responsible to provide temporary plumbing protection during this project.

1.03 MATERIALS

A. All elements to be removed are subject to the Owner's Right of Salvage.

B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.

C. The owner may designate and have salvage rights to any material herein demolished by this contractor. The contractor shall coordinate with the owner prior to start of demolition.

1.04 WORK BY OTHERS

A. Unless specifically noted under other contracts, this mechanical contractor shall assume they will perform all required work. In general, the following will be performed by others:
   1. The electrical contractor will disconnect all electrical service and remove conduit back to behind finished surfaces, close and cap ends of conduits.

1.05 EXISTING CONDITIONS

A. If any piping serving existing fixtures or equipment (that are to remain) are disturbed by operations under this contract, this contractor shall provide pipe and insulation required to re-establish continuity of such piping systems.

B. This contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to the removal of equipment, piping, and ductwork.

C. This contractor shall furnish all required labor and material, where required, to extend new work to connect to similar work for extension of existing systems.

D. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 22 0090

SECTION 22 0519
METERS AND GAUGES FOR PLUMBING PIPING (ALTERNATE #1)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges
B. Pressure gauge tappings
C. Stem type thermometers
D. Thermometer supports
E. Test plugs

1.02 REFERENCES

A. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element
B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi
C. ASTM E1 - Standard Specification for ASTM Thermometers
D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers
E. UL 393 - Indicating Pressure Gauges for Fire-Protection Service
F. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service
G. NSF/ANSI 61 - Drinking Water System Components - Health Effects
H. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.03 SUBMITTALS

A. Product Data: Provide manufacturers data and list, which indicates use, operating range, total range, accuracy, and location for manufactured components.
B. Project Record Documents: Record actual locations of components and instrumentation.
C. Operation and Maintenance Data: Include instructions for calibrating instruments.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not install instruments when areas are under construction, except for required rough in, taps, support, and test plugs.

1.05 REGULATORY REQUIREMENTS

A. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. Ametec/US Gauge Series 1980
   2. Trerice
   3. Miljaco Corp.
   4. Weiss Instruments
   5. Dwyer
   6. Winters Instruments
   7. Engineer approved equal.
B. Gauge: Install where indicated on the drawings, 4.5 inch dial size pressure gauge, phenolic solid front pressure relieving case, Grade 2A, +/-0.5% accuracy with range approximately twice working pressure.
C. All gauges to be fitted with gauge cocks.

2.02 PRESSURE GAUGE TAPPINGS

A. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.

B. Ball Valve: Brass 1/4 inch NPT for 250 psi.

C. Pulsation Damper: Pressure snubber brass with 1/4 inch NPT connections.

D. Siphon: Steel, Schedule 40, 1/4 inch NPT angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Weiss #9VU35
   2. Trerice
   3. Miljaco
   4. Engineer approved equal.

B. Thermometer: ASTM E1, blue organic-filled glass tube, lens front tube, cast aluminum case with enamel finish.

C. Size: Six inch (6") scale where less than six foot (6') above floor, nine inch (9") scale where higher than six inch (6") above floor.

D. Window: Polyester/glass mixture or acrylic.

E. Stem: Aluminum, 3/4 inch NPT, 3-1/2 inch

F. Accuracy: Two percent.

G. Calibration: Degree F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stem with or without extensions as required.

2.05 TEST PLUGS

A. Test Plug: Brass 1/4 inch fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 deg F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install one pressure gauge per pump with taps before strainers and on suction and discharge of pump; pipe to gauge.

B. Install gauge taps in piping.

C. Install pressure gauges with pulsation dampers. Provide ball valve to isolate each gauge. Extend nipples and siphons to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Coil and conceal excess capillary on remote element instruments.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degree off vertical.

H. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

I. Locate test plugs adjacent thermometers and thermometer sockets adjacent to pressure gauges and pressure gauge taps.

J. Refer to schematics and details on drawings for additional locations.

END OF SECTION 22 0519

SECTION 22 0529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe hangers and supports

B. Accessories

C. Flashing

D. Equipment bases

E. Sleeves

1.02 RELATED SECTIONS

A. Specification Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment

B. Specification Section 22 1116 - Domestic Water Piping

1.03 REFERENCES

A. ASME B31.9 - Building Services Piping

B. ASTM F708 - Design and Installation of Rigid Pipe Hangers

C. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer

D. MSS SP69 - Pipe Hangers and Supports - Selection and Application

E. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.04 SUBMITTALS

A. Product Data: Provide manufacturers catalog data including load capacity.

B. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

C. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for support of piping.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Anvil International
   2. Tolco/Cooper B-Line
   3. Engineer approved equal.

B. Plumbing Piping - Drain, Waste and Vent:
   1. Conform to ASME B31.9; ASTM F708
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inch: Carbon steel adjustable swivel, split ring. Figure 104.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis. Anvil International Figure 260.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron bracket. Anvil International Figure 213.
   6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp. Anvil International Figure 195.
   7. Vertical Support: Steel riser clamp. Anvil International Figure 261.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support. Anvil International Figure 264.

9. Copper Pipe Support: Carbon steel ring, adjustable, and copper plated. Anvil International Figure 97.
10. Provide zinc coated hangers and supports for all non air conditioned areas.
11. Provide zinc coated (hot dipped galvanized) hangers and supports for all exterior applications.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9; ASTM F708.
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel adjustable swivel, split ring. Anvil International Figure 104.
3. Hangers for Cold Pipe Sizes 2 Inch and Over: Carbon steel, adjustable, clevis. Anvil International Figure 260.
4. Hangers for Hot Pipe Sizes 2 Inch to 4 Inch: Carbon steel, adjustable, clevis. Anvil International Figure 260.
5. Hangers for Hot Pipe Sizes 6 Inch and Over: Adjustable steel yoke, cast iron roll, single hanger. Anvil International Figure 181.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll. Anvil International Figure 175.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron bracket. Anvil International Figure 213.
9. Wall Support for Pipe Sizes 4 Inches Over: Welded steel bracket and wrought steel clamp. Anvil International Figure 195.
10. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll. Anvil International Figure 195 and 181.
11. Vertical Support: Steel riser clamp. Anvil International Figure 261.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support. Anvil International Figure 264.
13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support. Anvil International Figure 264.
14. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support. Anvil International Figure 274.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated. Anvil International Figure 97.
16. Provide zinc coated hangers and supports for all non air conditioned areas.
17. Provide zinc coated (hot dipped galvanized) hangers and supports for all exterior applications.

2.02 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end or continuous threaded.

2.03 FLASHING

A. Metal Flashing: 26 gauge galvanized steel.

B. Metal Counter Flashing: 22 gauge galvanized steel.

C. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.

D. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.04 EQUIPMENT BASES

A. Provide housekeeping pads of concrete, minimum four inch (4") thick and extending six inches (6") beyond supported equipment.

2.05 SLEEVES

A. Sleeves for pipes through non-fire rated floors shall be 18 gauge galvanized steel.

B. Sleeves for pipes through non-fire rated beams, walls, footings, and potentially wet floors shall be Schedule 40 steel pipe or 18 gauge galvanized steel.

C. Sleeves for pipes through fire rated and fire resistive floors and walls, and fire proofing to be a fire rated sleeve assembly including seals, UL listed.

D. Stuffing and Firestopping Insulation: Fiberglass type, non-combustible per UL tested assembly type.

E. Sealant Manufacturers:
   1. Dow Corning Silicone RTV Foam.
   2. 3-M Fire Barrier Caulk and Putty.
   3. Thomas & Betts Flame Safe Fire Stop System.
   4. Engineer approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.02 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inch of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub with 5 foot maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.03 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum four inch (4") thick and extending six inches (6") beyond all floor supported equipment.

B. Provide templates, anchor bolts and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.04 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting three inch (3") minimum above finished roof surface with 24" x 24" sheet size. Turn flanges back into wall and caulk, metal counterflash, and seal for pipes through outside walls. Refer to architectural drawings and specifications for additional information.

C. Flash floor drains in floors with topping over finished areas with waterproof membrane ten inch (10") clear on sides with minimum 36" x 36" sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower, and mop sink drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.05 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floor one inch above finished floor level. Caulk sleeves.

D. Provide sleeves where piping penetrates floor, ceiling or wall fire rated assemblies. Close off space between pipe and adjacent work with fire stopping insulation and caulk.

E. Provide close fitting metal collar or escutcheon covers at both sides of penetration. Install chrome plated steel escutcheons at finished surfaces and within cabinets.

3.06 SCHEDULES

HANGER ROD PIPE SIZE	MAX. HANGER SPACING FEET	DIAMETER INCHES
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10.0	3/8
2-1/2 to 3	10.0	1/2
4 to 6	10.0	5/8
PVC (all sizes)	6.0	3/8
C.I. Bell & Spigot (or No-Hub) and at Joints	5.0	5/8

END OF SECTION 22 0529

SECTION 22 0553
IDENTIFICATION FOR PLUMBING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tags

B. Pipe markers

C. Labels

1.02 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems

1.03 SUBMITTALS

A. Submit list of wording, symbols, letter size, and color-coding for mechanical identification.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Manufacturer's Instructions: Indicate installation instructions, special procedures, and installation.

D. Project Record Documents: Record actual locations of tagged valves, include valve tag numbers.

PART 2 PRODUCTS

2.01 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Information Tags: Clear plastic with printed "Danger, "Caution" or "Warning" and message; size 3-1/4" x 5-5/8" with grommet and self-locking nylon ties.

2.02 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings indicating flow direction arrow and identification of fluid being conveyed.

2.03 LABELS

A. Description: Laminated Mylar, size 1.9" x 0.75" adhesive backed with printed identification.

PART 3 EXECUTION

3.01 PREPARATION

A. De-grease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. Apply paint primer before applying labels for unfinished canvas covering.

C. Install tags using corrosion resistant chain. Number tags consecutively by location.

D. Install underground plastic pipe markers six inch (6") to eight inch (8") below finished grade, directly above buried pipe.

E. Identify pumps, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify valves in main and branch piping with tags.

H. Tag automatic controls, instruments, and relays. Key to control schematic.

I. Identify piping, concealed or exposed with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 foot on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure and at each obstruction. Identify on both sides of any wall.

J. Conform to owner's existing identification scheme. Verify with owner prior to bid.

END OF SECTION 22 0553

SECTION 22 0719
DOMESTIC PLUMBING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass

1.02 RELATED SECTIONS

A. Specification Section 22 0553 - Identification for Plumbing Piping and Equipment

1.03 REFERENCES

A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement

E. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block

F. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

G. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

I. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

J. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation

K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation

L. ASTM C578 - Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation

M. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation

N. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation

O. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

P. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

Q. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

R. ASTM D1667 - Standard Specification for Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers

S. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

T. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics

U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

V. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials

W. NAIMA National Insulation Standards

X. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials

Y. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials, and thickness for each service and location.

1.05 QUALITY ASSURANCE

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

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site, labeled with manufacturer's identification, product density and thickness.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 FIBERGLASS

A. Manufacturers:
   1. Johns Manville Micro-Lok HP
   2. Owens Corning
   3. Knauff
   4. Engineer approved equal.

B. Insulation: ASTM C547 rigid molded, noncombustible.

C. "K" Value: ASTM C335, 0.23 at 75 deg F.

D. Minimum Service Temperature: 0 deg F.

E. Maximum Service Temperature: 800 deg F.

F. Maximum Moisture Absorption: <5% by weight.

G. Vapor Barrier Jacket: ASTM C1136, white Kraft paper with fiberglass yarn, bonded to aluminized film.

H. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.

I. Secure with self-sealing longitudinal laps and butt strips.

J. Surface Burning: ASTM E84; Flame Spread-25, Smoke Developed-50

K. VOC Content: ASTM D5116; 0.15 g/l

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry with foreign material removed.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated Dual Temperature Pipes or Cold Pipes Conveying Fluids Below Ambient Temperature:

1. Provide vapor barrier jackets, factory applied or field applied.
2. Insulate fittings, joints and valves with molded insulation of like material and thickness as adjacent pipe.
3. Provide PVC fitting covers.
4. Continue insulation through walls (unless in firewall sleeves), pipe hangers and other pipe penetrations.
5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
6. Vapor seal insulation ends every 20 feet.

D. Insulated Pipes Conveying Fluids Above Ambient Temperature:
1. Provide standard jackets with vapor barrier, factory applied.
2. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe.
3. Provide PVC fitting covers.
4. Continue insulation through walls (unless in firewall sleeves) pipe hangers and other pipe penetrations.

E. Inserts and Shields:
1. Manufacturers:
   a. Jeff Company/Buckaroo
   b. Amacell
   c. Cooper/Eaton
   d. TPS
   e. Engineer approved equal.
2. Shields: Galvanized saddle with flared edges between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the vapor barrier and finish jacket.
4. Insert Configuration: Minimum six inch (6") long of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Type:
   a. Polystyrene and Fiberglass Insulation: 360 degree polyisocyanurate or phenolic foam cylindrical insert capable of supporting piping system. Pre-fabricated, insulated and jacketed supports are acceptable. Blocks, plugs, or wood material are not acceptable.
   b. Flexible Elastomeric Foam Insulation: Pre-fabricated 360 degree insulated pipe hanger with polyethylene inserts (Armacell "Armafix" or equal). Match thickness of pipe insulation. Hanger shall have PVC or aluminum jacket. Provide friction tape on inside of pipe clamp/support to avoid slipping.

F. Insulation shall be continuous at all hangers. Hanger shall not be in direct contact with pipe.

3.03 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10% at normal conditions, as materials indicate.

3.04 SCHEDULE

FIBERGLASS INSULATION

PIPING SYSTEMS	PIPE SIZE	THICKNESS
Domestic Hot Water and Re-Circulation	Less than 1.5"	1"
Domestic Hot Water and Re-Circulation	1.5" and Larger	1.5"
Plumbing Vents within 10' of Exterior	All	1"
Domestic Cold Water	All	1"
PVC Piping Installed in a Return Air Plenums (including Mechanical Rooms)	All	1.5"

END OF SECTION 22 0719

SECTION 22 1116
DOMESTIC PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewer piping (below grade)
B. Sanitary sewer piping (above grade)
C. Water piping (above grade)
D. Water piping (press fittings)
E. Ball valves
F. Fire stop systems
G. Pipe accessories
H. Equipment drains and overflows

1.02 RELATED SECTIONS

A. Specification Section 22 0553 - Identification for Plumbing Piping and Equipment

1.03 REFERENCES

A. ASME B31.1 - Power Piping
B. ASME B31.9 - Building Service Piping
C. ASME Section 9 - Welding and Brazing Qualifications
D. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
E. ASME B16.3 - Malleable Iron Threaded Fittings
F. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250
G. ASME B16.18 - Cast Bronze Solder - Joint Pressure Fittings
H. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings
I. ASME B16.23 - Cast Copper Alloy Solder-Joint Drainage Fittings – DWV
J. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes
K. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings - DWV
L. ASME B16.32 - Cast Copper Alloy Solder-Joint Fittings for Solvent Drainage Systems
M. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
N. ASTM A74 - Cast Iron Soil Pipe and Fittings
O. ASTM B32 - Solder Metal
P. ASTM B43 - Seamless Red Brass Pipe
Q. ASTM B88 - Seamless Copper Water Tube
R. ASTM B306 - Copper Drainage Tube (DWV)
S. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
T. ASTM D1785 - Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120
U. ASTM D2683 - Socket type Polyethylene fillings for outside diameter controlled polyethylene pipe
V. AWS A5.8 - Brazing Filler Metal
W. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
X. AWWA C110 - Ductile Iron Gray Iron Fittings three inch (3") through 48 inch for Water and Other Liquids

Y. AWWA C111 - Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings

Z. AWWA C651 - Disinfecting Water Mains

AA. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems

AB. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems

AC. NSF/ANSI 61 - Drinking Water System Components - Health Effects

AD. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Provide schedule of all system types and piping and fitting types provided, clearly indicating which submitted piping and fittings are associated to each system on the project. Schedule shall be at the beginning of piping submittal

1.05 PROJECT RECORD DOCUMENTS

A. Record actual locations of valves.

1.06 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include installation instructions, spare parts list and exploded assembly views.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with the State of Iowa.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, material classification, specification, potable water certification and water pressure rating.

D. Maintain one copy of each document on site.

E. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or be prior approved by engineer.

F. All cast iron soil pipe and fittings shall be installed according to the latest edition of the Cast Iron Soil Pipe and Fittings Handbook.

1.08 REGULATORY REQUIREMENTS

A. Perform work in accordance with local jurisdiction plumbing code.

B. Conform to applicable code for installation of back flow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of back flow prevention devices.

D. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

1.09 DELIVERY, STORAGE AND PROTECTION

A. Deliver, store, protect and handle products to site.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

1.10 WARRANTY

A. Provide a 25-year non-prorated warranty on PEX tubing.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING (BELOW GRADE)

A. Cast Iron Pipe:
   1. ASTM A74 service weight.
   2. Fittings: Cast iron.
   3. Joints: ASTM C564, neoprene gasket system.
   4. Minimum Size: Three inches.
   5. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or be prior approved by engineer.

B. PVC Pipe: Schedule 40
   1. ASTM D2665.
   2. Fittings: PVC.
   3. Joints: ASTM D2855 solvent weld with ASTM D2564 solvent cement.

2.02 SANITARY SEWER PIPING (ABOVE GRADE)

A. Cast Iron Pipe:
   1. CISPI 301 hubless service weight three inch (3") and larger.
   2. Fittings: Cast iron.
   3. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies conforming to CISPI 310.
   4. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or be prior approved by engineer.

B. Copper Tube:
   1. ASTM B306, type #M.
   2. Fittings: ASME B16.29 wrought copper.
   3. Joints: ASTM B32 solder Grade 50B.

C. PVC Pipe:
   1. ASTM D1785 Schedule 40 for not less than 150 psi pressure rating.
   2. Fittings: ASTM D2665, PVC.
   3. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.03 WATER PIPING (ABOVE GRADE)

A. Copper Tubing:
   1. ASTM B88, type #L hard drawn.
   2. Fittings: ASME B16.22, wrought copper and bronze.
   3. Joints: ASTM B32, solder, Grade 95TA.

B. Cross-Linked Polyethylene (PEX) (2" AND SMALLER) (STICKS OF PEX)
   1. ASTM F876, SDR 9 polyethylene PEX-a or PEX-b tubing
      a. Rated for continuous operation by the Plastic Pipe Institute (PPI) at the following conditions: 160 psi @ 73.4 deg F, 100 psi @ 180 deg F, 80 psi @ 200 deg F.
      b. Minimum bend radius for cold bending of the pipe shall not be greater than 6 times the outside diameter of the pipe. Provide bend supports supplied by the tubing manufacturer for all bends with a radius tighter than this requirement.
      c. Plenum Rating: Pipe shall not exceed a maximum flame spread/smoke emission rating of 25/50 in compliance ASTM E84. Provide metal shields clipped to bottom side of piping or fully insulate piping as necessary to meet this requirement.
      d. Fittings: ASTM F2080 or ASTM F1960 cold-expansion, compression sleeve fittings. Provide specific fitting types as required to maintain warranty of piping manufacturer.

2. Manufacturer shall provide components of the PEX tubing system including all plastic piping, fittings, manifolds, supports, and any other ancillary items required for a complete installation.
3. Warranty: Plastic piping shall carry a 25-year non-prorated warranty against failure due to defect in material and workmanship. Manifolds, headers, thermostats, actuators, and other ancillary components shall be warranted for 12 months from date of substantial completion.

2.04 WATER PIPING (PRESS FITTINGS)

A. Manufacturers:
1. Viega (Propress)
2. Nibco
3. Engineer approved equal.

B. Material:
1. Tubing Standard:
a. Copper tubing shall conform to ASTM B75 or ASTM B88.
2. Fitting Standard:
a. Copper fittings shall conform to ASME B16.18, ASME B16.22 or ASME B16.26
3. Press Fitting:
a. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed and of the same manufacturer.

2.05 BALL VALVES (UP TO AND INCLUDING 2 INCHES)

A. Manufacturers:
1. Apollo #77CLF-140/240
2. Watts #LFB 6080/6081 G2-SS
3. Nibco #S/T-585-66-LF
4. Milwaukee #UPBA-400S/450S
5. Engineer approved equal.

B. Bronze two piece full port body, stainless steel ball and stem, RPTFE seats and thrust washer, lever handle, solder or threaded ends.

2.06 FIRE STOP SYSTEMS

A. Manufacturers:
1. 3M
2. Engineer approved equal.

B. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours per ASTM E814 and UL 1479.

C. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for three hours per ASTM E814 and UL 1479.

D. DWV Plastic Pipe Systems Fire Stopping Sealant: Silicone based, premixed sealant with intumescent properties, vibration and moisture resistant, rated for three hours per ASTM E814 and UL 1479 with metal collars.

2.07 PIPE ACCESSORIES

A. Fittings:
1. All fittings shall be of the same material as the pipe. Material joining the fitting to the pipe shall be free from cracks and shall adhere tightly to each joining surface.
2. All fittings shall be capped with a plug of the same material as the pipe, and gasketed with the same gasket material as the pipe joint or be of material approved by the engineer. The plug shall be able to withstand all test pressures involved without leakage.

2.08 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, type #M, hard drawn.
   1. Fittings: ASME B16.18 cast brass.
   2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony or tin and silver with melting range 430 deg F to 535 deg F.

B. PVC Pipe:
   1. ASTM D2665, Schedule 40
   2. Fittings: Schedule 40 PVC
   3. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

PART 3 EXECUTION

3.01 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. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

I. Where pipe support members are welded to structural building frame, scrape, brush clean and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports and accessories not pre-finished, ready for finish painting.

L. Install bell and spigot pipe with bell end upstream.

M. Install valves with stems upright or horizontal, not inverted.

N. Install water piping to ASME B31.9.

O. Sleeve pipes passing through partitions, walls and floors.

P. Clean out all sanitary sewers to remove any debris prior to substantial completion.

Q. All cast iron soil pipe shall be installed in accordance with cast iron soil pipe institute handbook (latest edition).

R. All cast iron soil pipe shall be marked with the trademark of the soil pipe institute.

3.03 PRESS FITTING INSTALLATION

A. The installing contractor shall examine the copper tubing and fittings for defects, sand holes or cracks. There shall be no defects of the tubing or fittings. Any damaged tubing or fittings shall be rejected.

B. The installing contractor shall ensure that sealing elements are properly in place and free from damage. For sizes 2-1/2” to 4”, installer should ensure that the stainless steel grip ring is in place.

C. Copper tubing shall be cut with a wheeled tubing cutter or approved copper tubing cutting tool. The tubing shall be cut square to permit proper joining with the fittings.

D. Remove scale, slag, dirt, and debris from inside and outside of tubing and fittings before assembly. The tubing end shall be wiped clean and dry. The burrs on the tubing shall be reamed with a deburring or reaming tool.

E. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fittings. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tools approved by the manufacturer.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.05 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot 1% minimum. Maintain gradients.

B. Slope water piping minimum 0.25% and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. The plumbing contractor is responsible for providing disinfection of domestic water piping system as outlined in this section.

B. Prior to starting work, verify system is complete, flush and clean.

C. The plumbing contractor is to make sure sanitary sewer lines are running smooth by running a snake through the sanitary sewer lines prior turning the facility over to the owner.

D. 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).

E. Inject disinfectant, free chlorine in liquid, powder or tablet form throughout system to obtain 50-to 80 mg/L residual.

F. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15% of outlets.

G. Maintain disinfectant in system for 24 hours.

H. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

I. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

J. Take samples no sooner than 24 hours after flushing from 10% of outlets and from water entry and analyze in accordance with AWWA C651. Submit written report to owner.

K. Work in this section shall be by a pre-approved water treatment contractor.

3.07 TESTING

A. This contractor shall, before concealing, test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.

B. This contractor shall be held responsible for all damage resulting from defects in the system.

C. Domestic Water Testing:

1. At conclusion of construction (before any covering up, painting, or finishing) each portion of the piping or of the entire hot and cold water supply system, it shall be initially tested to be proved tight under 50 psi air pressure. All piping shall withstand test pressures without leaking for a period of time not less than 15 minutes.
2. The system shall not be filled with water until immediately prior to disinfection. A hydrostatic test to a water pressure of 1.5x working pressure up to a maximum of 150 psi shall be performed. All piping shall withstand test pressures without leaking for a period of time not less than 4 hours.

D. Sanitary and Storm Testing:
1. A hydrostatic test to a water pressure of 10 feet shall be performed. All piping shall withstand test pressures without leaking for a period of time not less than 4 hours.

E. No covering or backfilling of sewer lines shall be done until inspected by the architect or local inspector. Test T's shall be provided on all waste and vent stacks 4'-6" above each floor as required for testing the plumbing system.

F. After completion of installation, the systems shall be given tests under full operating conditions and pressures and all adjustments shall be made to make the system operative as required. All safety devices shall be tested for correct operation.

3.08 SCHEDULES

A. See the drawings.

END OF SECTION 22 1116

SECTION 22 1119
DOMESTIC PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor drain

B. Clean out

C. Roof hydrant

1.02 RELATED SECTIONS

A. Specification Section 22 1116 - Domestic Plumbing Piping

B. Specification Section 22 3000 - Plumbing Equipment

C. Specification Section 22 4000 - Plumbing Fixtures

1.03 REFERENCES

A. ASME A113.6.3; Floor and Trench Drains

B. ASME A113.6.4 - Roof, Deck and Balcony Drains

C. ASSE 1010-01; Water Hammer Arrestors

D. ASSE 1011 - Hose Connection Vacuum Breakers

E. ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent

F. ASSE 1013 - Backflow Preventers, Reduced Pressure Principle

G. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types

H. ASTM C478 - Precast Reinforced Concrete Manhole Sections (ASTM C478M - Precast Reinforced Concrete Manhole Sections

I. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types

J. PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data

K. PDI WH-201 - Water Hammer Arrestors

L. NSF/ANSI 61 - Drinking Water System Components - Health Effects

M. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.04 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes and finishes.

B. Shop Drawings: Indicate dimensions, weights and placement of openings and holes.

C. Certificates: Certify that grease interceptors meet or exceed specified requirements.

D. Manufacturer's Instructions: Indicate assembly and support requirements.

E. Project Record Documents: Record actual locations of equipment, clean out, backflow preventers, water hammer arrestors.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE AND PROTECTION

A. Accept specialties on site in original factory packaging. Inspect for damage.

1.07 REGULATORY REQUIREMENTS

A. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

PART 2 PRODUCTS

2.01 FLOOR DRAIN (FD-1)

A. Manufacturers:
   1. Watts #FD-1002
   2. Smith
   3. Zurn
   4. Josam
   5. Wade
   6. Engineer approved equal.

B. Assembly: ASME A112.6.3.

C. Epoxy coated cast iron floor drain with anchor flange, reversible clamping collar with primary and secondary weepholes and adjustable strainer.

D. Accessories:
   1. Provide with membrane clamp on all floor drains installed above slab ongrade.
   2. Provide with strainer extension to accommodate thick fills as required.

E. Strainer: Five inch (5") diameter nickel bronze strainer.

F. Contractor shall select outlet type.

G. Outlet size: As noted on drawings.

2.02 CLEAN OUT

A. Manufacturers:
   1. Watts
   2. Smith
   3. Josam
   4. Wade
   5. Sun Drainage
   6. Engineer approved equal.

B. Interior Finished Sub or On Grade Floors:
   1. Watts #C0-200-R
   2. Lacquered cast iron bodies with integral anchor flange, neoprene "O" ring secondary test seal and adjustable combined access cover and plug with gasket seal. Nickel-bronze scoriated cover in service area and round with depressed cover to accept floor finish in finished floor areas.

C. Interior Finished Membrane Floor Areas:
   1. Watts #CO-200-C-R
   2. Lacquered cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar and adjustable nickel-bronze strainer round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas.

D. Interior Finished Wall Areas:
   1. Watts #CO-380-RD
   2. Line type with lacquered cast iron body and round epoxy coated gasket cover and round stainless steel access cover secured with machine screw.

E. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack clean out on vertical rainwater leaders and on horizontal accessible pipes.

F. Cleanout size shall be equal to pipe size up to 4 inches.

2.03 ROOF HYDRANT, SANITARY

A. Manufacturers:
   1. Woodford #SRH-MS
   2. Engineer approved equal.

B. ASSE 1052 backflow prevention, ASSE 1057 sanitary, freeze proof, self-draining, anti-siphon, vacuum breaker roof hydrant.

C. Drainage assembly: Sealed reservoir located below roof. Draining of the reservoir shall not be required.

D. Mounting system: Cast iron adjustable bracket support with above and under deck flange, well seals and EDPM boot cover.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate cutting and forming of roof and floor construction to receive drains to require invert elevations.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend clean out to finished floor or wall surface. Lubricate threaded clean out plugs with mixture of graphite and linseed oil. Ensure clearance at clean out for rodding of drainage system. Coordinate all cleanout locations with the architect.

C. Furnish and install cleanouts at locations as specified and required by local plumbing code.

D. Encase exterior clean out in concrete flush with grade.

E. Install floor clean out at elevation to accommodate finished floor.

F. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior hose bibbs and exterior wall hydrants.

G. Install air gap fittings at all equipment drains when equipment is connected to domestic water.

H. Provide floor drains installed above slab on-grade with membrane clamp and 3' x 3' vinyl membrane. Membrane is by the mechanical contractor.

I. Coordinate all floor drain locations with associated equipment.

J. Coordinate all wall mounted device locations with architect.

END OF SECTION 22 1119

SECTION 22 3000
PLUMBING EQUIPMENT (ALTERNATE #1)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tankless gas water heater-condensing

1.02 REFERENCES

A. ASHRAE 90A - Energy Conservation in New Building Design
B. ASME Section 8D - Pressure Vessels
C. NFPA 30 - Flammable and Combustible Liquids Code
D. NFPA 54 - National Fuel Gas Code
E. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases
F. NFPA 70 - National Electrical Code
G. UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters
H. UL 174 - Household Electric Storage Tank Water Heaters
I. ASME Section VIIID - Pressure Vessels; Boiler and Pressure Vessel Codes
J. ANSI/NEMA 250 - Enclosure for Electrical Equipment (1000 volts max.)
K. NSF/ANSI 61 - Drinking Water System Components - Health Effects
L. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.03 SUBMITTALS

A. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements, and affected adjacent construction.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

B. Shop Drawings:
   1. Indicate heat exchanger dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

1.04 OPERATION AND MAINTENANCE DATA

A. Include operation, maintenance and inspection data, replacement part numbers, availability, service depot location, and telephone number.

1.05 QUALITY ASSURANCE

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

B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
   1. American Gas Association (AGA)
   2. National Sanitation Foundation (NSF)
   3. American Society of Mechanical Engineers (ASME)
   4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI)
   5. National Electrical Manufacturers' Association (NEMA)
   6. Underwriters Laboratories (UL)

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation; operate within 25% of midpoint of published maximum efficiency curve.

1.06 REGULATORY REQUIREMENTS

A. Conform to NSF, NBBPVI, and ANSI/NFPA requirements for water heaters.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver, store, protect and handle products to site under provisions of Architectural Specification Sections.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. Provide five-year manufacturer warranty under provisions of Architectural Specification Sections.

PART 2 PRODUCTS

2.01 TANKLESS GAS WATER HEATER - CONDENSING

A. Manufacturers:
   1. Bradford White
   2. Laars
   3. Intellihot
   4. Rheem
   5. A.O. Smith
   6. Tagaki
   7. Rinnai
   8. Engineer approved equal.

B. General: High efficiency, low NOx, direct vent, condensing tankless water heater.

C. Heat Exchanger:
   1. Primary: Copper Fin Tube
   2. Secondary (Condensing): 316L stainless steel

D. Safety Controls: Air-fuel sensor, hi-limit temperature switch, modulating gas valve.

E. Ignition: Electronic spark. Pilots are unacceptable.

F. Venting: Powered direct vent compatible with PVC, CPVC or ABS Pipe.

G. Controls: Solid-state circuit board capable of monitoring incoming and outgoing temperatures with factory installed thermistors, sensing and controlling flow rate to meet the temperature set point. Provide an easily adjustable set point adjustment control panel.

H. Warranty: 10 year limited warranty on heat exchanger. Five (5) year limited warranty on all parts.

I. Trim components:
   1. Tankless Water Heater Valve Kit: Bronze and brass construction, stainless steel ball valve shut-off, union, ASME pressure relief valve, drain valve.
   2. Concentric intake/exhaust termination kit
   3. Condensate neutralizer kit

PART 3 EXECUTION

3.01 WATER HEATER INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate with plumbing piping and related fuel piping, gas venting, and, electrical work to achieve operating system.

C. Install unit with clearance for removal without disturbing other installed equipment or piping.

D. Pipe relief valves and drains to nearest floor drain.

E. Install flue vent system as indicated on the drawings and in accordance to manufacturer's recommendations.

F. Install power vent as per manufacturer's instructions.

G. Insulate vent and intake piping in attic space in accordance to manufacturer's recommendations.

END OF SECTION 22 3000

SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. See plumbing fixture schedules on drawings.

1.02 RELATED SECTIONS

A. Specification Section 22 0529 - Hangers and Supports for Plumbing Piping and Equipment

B. Specification Section 22 1116 - Domestic Plumbing Piping

C. Specification Section 22 1119 - Domestic Plumbing Specialties

D. Specification Section 22 3000 - Plumbing Equipment

1.03 REFERENCES

A. ANSI Z124.1 - Gel-Coated Fiberglass Reinforced Polyester Resin Bathtub Units

B. ANSI Z124.2 - Gel-Coated Fiberglass Reinforced Polyester Resin Shower Receptor and Shower Stall Units

C. ANSI Z358.1 - Emergency Eye Wash and Shower Equipment

D. ARI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers

E. ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use

F. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings

G. ASME A112.19.1 - Enameled Cast Iron Plumbing Fixtures

H. ASME A112.19.2 - Vitreous China Plumbing Fixtures

I. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use)

J. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures

K. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals

L. NFPA 70 - National Electrical Code

M. NSF/ANSI 61 - Drinking Water System Components - Health Effects

N. NSF/ANSI 372 - Drinking Water System Components - Lead Content

1.04 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough in dimensions, utility sizes, trim, and finish.

B. Manufacturer's Instructions: Indicate installation methods and procedures.

C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

D. Warranty: Submit manufacturer's warranty and ensure forms have been completed in owner's name and registered with manufacturer.

E. The mechanical contractor shall coordinate all fixtures with general construction and cabinetry prior to submitting for review.

1.05 QUALITY ASSURANCE

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

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. Wetted surfaces of brass and bronze components shall contain <0.25% weighted average lead content (lead free) as defined by NSF/ANSI Standards 61 and 372.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

A. Provide manufacturer's standard warranty for electric water cooler.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks prior to ordering.

D. Confirm that hole drillings are of appropriate number and spacing for trim.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide chrome plated rigid or flexible supplies to fixtures with 1/4 turn loose key stops, reducers and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall supports or wall carriers and bolts.

F. Seal fixtures to wall and floor surfaces with sealant. Color to match fixture.

G. Solidly attach water closets to floor with lag screws. Flashing is not intended to hold fixture in place.

H. Coordinate electronic faucet under deck mixing valve and control module installation such that they do not extend passed the footprint of the plumbing fixture. The control module shall be installed over the low voltage junction box.

I. Water Coolers: Confirm mounting height of all water coolers with the architect and AHJ prior to rough in.

J. Water Coolers: Power source shall be a GFCI circuit breaker. A GFCI receptacle is not permissible. Coordinate with the electrical contractor.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

END OF SECTION 22 4000

SECTION 23 0050
BASIC HVAC REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic HVAC Requirements specifically applicable to Mechanical Division Specification Sections.

B. Division 23 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

1.02 OWNER OCCUPANCY

A. The owner will occupy the premises during the construction period.

B. Limit use of site and premises to allow owner occupancy.

C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.

D. Schedule the work to accommodate this requirement.

1.03 REGULATORY REQUIREMENTS

A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.

B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.

C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.

E. All work shall comply with the applicable recommendations of:
   1. The National Board of Fire Underwriters
   2. American Gas Association
   3. The National Fire Protection Association (NFPA)
   4. The Occupations Safety and Health Act (OSHA)
   5. Current IBC Building Code
   6. Current applicable city building codes.
   7. Current International Energy Conservation Code

F. Mechanical: Conform to current mechanical code.

G. Plumbing: Conform to current plumbing code.

H. Obtain permits and request inspections from authority having jurisdiction.

1.04 PROJECT/SITE CONDITIONS

A. Install work in locations shown on the drawings unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.

C. This contractor, before submitting thier bid, shall visit their the site of the project to familiarize themselves with locations and conditions affecting their work.

D. It is the intent of this specification that the contractor furnishes all labor and material required completing the installation as outlined in the drawings and specifications. No additions to the

contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.

E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing piping, ductwork, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.

F. This contractor shall provide holes as necessary for the installation of their work and in accordance with other specification sections in materials other than the structure.

1.05 SEQUENCING AND SCHEDULING

A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.

B. This contractor shall be kept informed as to the work of other trades engaged in the project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.

C. Where space for mechanical and electrical lines and piping is limited, it is imperative that all such trades coordinate their work so as to ensure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.06 GUARANTEE

A. This contractor shall guarantee all of the apparatus, materials, equipment furnished and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.

B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.07 ENGINEER APPROVED EQUAL PRODUCTS

A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.

B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.

C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".

D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.08 OWNER'S RIGHT OF SALVAGE

A. Before beginning construction, this contractor shall check and verify with the owner each item of existing equipment that must be removed.

B. The owner will designate which items of material or equipment not reused that they may wish to keep. The contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.

C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from site.

1.09 PROTECTION AND MAINTENANCE

A. Where necessary to connect to any existing utility service, this contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.

B. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.

C. This contractor shall protect existing equipment in finished areas from dirt, dust and damage as a result of their work.

D. Coordinate protection requirements with department heads before beginning construction.

E. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.10 DEMOLITION

A. This contractor shall be responsible for the demolition and removal of all existing mechanical elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be relocated".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.
   4. All elements to be removed are subject to the Owner's Right of Salvage.

B. Preserve services to the existing facility. Extend/reroute/reconnect existing systems as required providing for the continued function of these systems.

1.11 TEMPORARY HEATING, VENTILATION, AND AIR CONDITIONING

A. Coordinate provisions for temporary heating, cooling, ventilation, and/or dehumidification with the general contractor as required in Division 01.

B. Coordinate construction heating gas requirements with the utility company prior to the start of construction.

C. If permanent HVAC units are to be operated prior to substantial completion, the mechanical contractor shall take steps as necessary to prevent construction dust and debris from entering the HVAC system and preserve the manufacturer’s warranty.
   1. The general and mechanical contractors shall receive permission from the owner and architect in writing prior to operating the permanent HVAC equipment.
   2. At no point shall the permanent HVAC system be in operation during installation and sanding of drywall, grinding of floors, or any other construction activities that generate dust.
   3. Install temporary filters with a minimum efficiency of MERV 8 on all return and/or exhaust grilles and louvers. Check filters on a weekly basis and replace as necessary and as directed by the owner or architect.
   4. Install temporary MERV 8 filters in all air handling equipment. Check filters on a weekly basis and replace as necessary and as directed by the owner or architect. Replace all filters after substantial completion with new filters.
   5. This contractor shall be responsible for any maintenance or warranty items prior to substantial completion if equipment is used for temporary space conditioning.

1.12 CUTTING AND PATCHING

A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.

B. This contractor shall arrange for openings in the building as required for the installation of equipment furnished under this contract. Where ductwork and piping must be extended or changed, patching with concrete will be done in the building. Patching shall be at both the top and bottom of sleeves where above grade.

C. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, contractor shall be responsible to patch and/or seal openings as necessary to maintain/return fire separation to rating as required by applicable codes.

D. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.13 CLEANING AND RUBBISH

A. This contractor, upon completion of their work, shall remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.

B. In so far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.

C. This contractor shall maintain the work area each day to prevent hazardous accumulation of waste from their work.

1.14 SEALING AND PENETRATION

A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.

B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.

C. Manufacturer offering products to comply with the requirements include the following:
   1. Dow Corning "Silicone RTV Foam"
   2. 3-M Corporation "Fire Barrier Caulk and Putty"
   3. Thomas & Betts "Flame Safe Fire Stop System"

D. Installation of these products to be in strict accordance with manufacturer's recommendations and architectural specification sections or equivalent fire stopping architectural specification section.

E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.15 ELECTRICAL CONNECTIONS

A. This contractor shall turn over all magnetic starters, thermal protective switches, and speed changing switches furnished under this contract for all motor driven equipment to the electrical contractor who will install such starters and switches and wire them to their respective motors as a part of the electrical contract.

1.16 UTILITY COMPANY

A. Any fees by the utility company are to be billed directly to the owner.

B. The contractor is required to assist the owner in the preparation of all utility company rebate forms that deal with equipment furnished and/or installed as a part of this contractor.

1.17 HAZARDOUS MATERIALS

A. If the contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them on the site. The contractor shall inform the owner and all employed of any potential exposure to this material.

B. At no time shall any product containing asbestos be incorporated into the work.
   1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.18 RECORD DRAWINGS

A. This contractor shall provide at the conclusion of the project one clean, non-torn, neat, and legible "as-built" set of drawings to the owner. These drawings shall show the routing of pipes, ductwork and equipment drawn in at scaled locations. All dimensions indicated shall be referenced to a column line. A set of construction blue prints will be furnished for this work.

B. All mechanical systems installed shall be shown on the "as-built" drawings. This includes all addendum items and change orders.

C. Refer to respective architectural specification section for additional information.

D. This contractor shall update these drawings during the project at least every week.

1.19 REVIEW OF MATERIALS

A. This contractor shall submit to the engineer for review one (1) electronic copy giving a complete list of materials and equipment they propose to furnish. The brochure shall contain complete information as to the make of equipment, type, size, capacities, dimensions and illustration. One of these returned copies shall be kept on the job at all times.

B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless the contractor notifies engineer in writing of such deviation at time such drawings are furnished.

C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.

D. This contractor shall mark the date and sign each set that they have checked each of them in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the contractor.

1.20 TEST OF SYSTEMS

A. This contractor, before concealed, shall test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.

B. This contractor shall be held responsible for all damage resulting from defects in the system.

C. At the conclusion of construction (before any covering up, painting or finishing) each element of the system shall be thoroughly tested against leakage, with appropriate pressure tests, as outlined herein and in appropriate sections of the specifications. All testing shall be hydrostatic unless permission is granted otherwise.
   1. Water: 100 psi maintained 8 hours
   2. Under Floor Pipes: 200 psi maintained 8 hours

D. Fluid lines other than the above 1.5 times operating with a minimum pressure of 60 psig.

E. After completion of installation, the systems shall be given tests under full operating conditions and pressures and all adjustments shall be made to make the system operative as required. All safety devices shall be tested for correct operation.

1.21 SCOPE OF WORK

A. All work shall be performed by well-qualified and licensed mechanics with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their mechanics are familiar with all the various codes and tests applicable to this work.

B. All equipment shall be new and of the type as specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.

C. The intent of the drawings and specifications is for complete installation of the systems outlined in the drawings and specifications so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation.

D. This contractor shall be required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type. The drawings and specifications cannot deal individually with the many minute items that may be required by the nature of the systems.

E. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer's attention and an addendum is issued for clarification.

F. The HVAC Contractor shall establish system elevations prior to fabrication and installation. The HVAC Contractor shall coordinate elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation. When a conflict between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:
   1. Lighting Fixtures
   2. Gravity flow piping, including steam and condensate
   3. Electrical bus duct
   4. Sheet metal
   5. Cable trays, including access space
   6. Other piping
   7. Conduits and wireway

1.22 VERIFICATION OF ELEVATION OF EXISTING LINES

A. This contractor shall before starting any new work, verify the elevations of all existing piping to which they must connect under this contract. The contractor shall report any discrepancies between drawing elevations and actual elevations to the engineer before proceeding with the work. Failure of the contractor to do so shall make them liable for the cost of extra work involved.

1.23 DAILY HOUSEKEEPING

A. At the end of each working day, this contractor shall remove all of their debris, rubbish, tools and surplus materials from the project work area. The work area shall be broom clean and left in a neat and orderly condition. The contractor for the removal of debris from the project shall not use the owner's waste disposal facility.

B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.24 CLEANING OF MECHANICAL SYSTEMS

A. The mechanical contractor shall clean and passivate all piping systems. Flush hydronic systems with water until free from all sand, grit, gravel, oil, etc. Provide Babcock/Wilcox Millipore and biological testing on the flush water. The flush will be considered a success when the water exiting the system contains less than 100 ppb of total suspended solids and less than 100 RLUs.

B. Where connections are made to existing piping systems, this contractor shall provide isolation valves, threaded tees, etc., as required to facilitate the cleaning and testing of all new piping.

C. This contractor shall thoroughly clean all rust, grease, plaster, cement, etc., from all equipment, ductwork and piping furnished and installed by them as required to leave surfaces suitable for finish painting.

D. This contractor shall keep all pipes, ducts, etc., plugged, drained or otherwise protected during construction. All items of mechanical equipment shall be suitably protected and upon completion of project shall be equal to new condition.

1.25 ALTERNATES

A. Refer to General Specification Sections for alternate bid description.

1.26 DIGITAL MEDIA AGREEMENT

A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.

B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is $100.00 per CAD sheet.

1.27 SECURE NETWORKABLE DEVICES

A. Update network devices to the most current software/firmware.

B. Change default password of all networkable devices.
   1. Passwords shall have at least eight characters.
   2. Include uppercase and lowercase letters, numerals, and special characters

C. Supply MAC address and serial number of all networkable devices.

D. Work with the Owner's IT department to align to existing IT standards.

E. Provide to the owner a printed and/or electronic spreadsheet log of all network information including, IP addresses, MAC addresses, logins and password information during system training.

1.28 SYSTEM CONFIGURATION AND PROGRAMMING FILES

A. Supply system configuration and programming files where export is available.

B. Supply uncompiled programming for systems applicable.

C. All configuration and programming shall be property of the owner at conclusion of the project.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 23 0050

SECTION 23 0080

HVAC SCHEDULE OF VALUES

PART 1 GENERAL

1.01 FORM COMPLETION

A. The successful mechanical contractor shall complete this form in its entirety within 30 days of receipt of the signed contract from the general contractor, and submit directly to MODUS.

B. This information is confidential and will not be disclosed to any individual outside of MODUS. Data collected will be used in evaluating pay applications.

1.02 OVERALL CONTRACT

Basic HVAC Bid	$ _____
Add or deduct accepted alternates, negotiated changes, or other modifications to the contract	$ _____
Total HVAC Bid	$ _____

1.03 SCHEDULE OF VALUES

HVAC Equipment - Material	$ _____
HVAC Equipment Installation - Labor	$ _____
HVAC Ductwork and Accessories - Material	$ _____
HVAC Ductwork Installation - Labor	$ _____
HVAC Piping and Accessories - Material	$ _____
HVAC Piping Installation - Labor	$ _____
HVAC Insulation - Material and Labor	$ _____
HVAC Control Systems - Material and Labor	$ _____
Testing, Adjusting, and Balancing - Material and Labor	$ _____
HVAC Power Ventilators - Labor	$ _____
Total HVAC Bid (Sum of Schedule of Values)	$ _____

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 23 0080

SECTION 23 0090

MINOR HVAC DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 23 0050 - Basic Mechanical Requirements "General Provisions" apply to this section.

1.02 SCOPE

A. This contractor shall be responsible for the demolition and removal of all existing mechanical elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be relocated".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.

B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.

C. This contractor shall be responsible for the cutting and capping of all existing gas, water, sewer, and any other utility service.

D. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.

E. This contractor shall remove all abandon equipment, piping, ductwork, supports, equipment curbs, and bases associated with the remodeled areas unless noted otherwise.

F. This contractor is responsible to provide temporary HVAC protection during this project.

1.03 MATERIALS

A. All elements to be removed are subject to the Owner's Right of Salvage.

B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.

C. The owner may designate and have salvage rights to any material herein demolished by this contractor. The contractor shall coordinate with the owner prior to start of demolition.

1.04 WORK BY OTHERS

A. Unless specifically noted under other contracts, this mechanical contractor shall assume they will perform all required work. In general, the following will be performed by others:
   1. The electrical contractor will disconnect all electrical service and remove conduit back to behind finished surfaces, close and cap ends of conduits.

1.05 EXISTING CONDITIONS

A. If any piping serving existing fixtures or equipment (that are to remain) are disturbed by operations under this contract, this contractor shall provide pipe and insulation required to re-establish continuity of such piping systems.

B. This contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to the removal of equipment, piping, and ductwork.

C. This contractor shall furnish all required labor and material, where required, to extend new work to connect to similar work for extension of existing systems.

D. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 23 0090

SECTION 23 0529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories

B. Equipment curbs

1.02 RELATED SECTIONS

1.03 REFERENCES

A. ASME B31.1 - Power Piping

B. ASME B31.2 - Fuel Gas Piping

C. ASME B31.5 - Refrigeration Piping

D. ASME B31.9 - Building Services Piping

E. ASTM F708 - Design and Installation of Rigid Pipe Hangers

F. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer

G. MSS SP69 - Pipe Hangers and Supports - Selection and Application

H. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.04 SUBMITTALS

A. Product Data: Provide manufacturers catalog data including load capacity.

B. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

C. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for support of piping.

PART 2 PRODUCTS

2.01 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end or continuous threaded.

2.02 EQUIPMENT CURBS

A. Manufacturers:
   1. ThyCurb
   2. Engineer approved equal.

B. Fabrication: Welded 18 gauge galvanized steel shell and base, mitered three inch (3") cant, variable step to match roof insulation, 1-1/2 inch thick, 3 lb/ft3 insulation, factory installed wood nailer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION 23 0529

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Curb mounted base

1.02 PERFORMANCE REQUIREMENTS

A. Provide minimum static deflection of isolators for equipment as specified or scheduled on drawings.

1.03 SUBMITTALS

A. Shop Drawings: Indicate inertia bases and curb bases. Locate vibration isolators with static and dynamic load on each.

B. Product Data: Provide schedule of vibration isolator type with location and load on each.

C. Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

D. Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

1.04 PROJECT RECORD DOCUMENTS

A. Record actual locations of hangers including attachment points.

PART 2 PRODUCTS

2.01 CURB MOUNTED BASE

A. Manufacturers:
   1. Mason Industries, Inc.
   2. Kinetics Noise Control
   3. Vibro-Acoustics
   4. Thycurb
   5. Engineer approved equal.

B. Curb mounted rooftop vibration bases shall fit over the roof curb and under the isolated equipment.

C. The extruded aluminum top and bottom members shall contain cadmium plate springs having a two inch (2") minimum deflection with 50% additional travel to solid.

D. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4 inch so as not to interfere with the spring action except in high winds.

E. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof flexible duct like neoprene connection joining the outside perimeter of the aluminum members. Foam or other contact seals are unacceptable at the spring cavity closure.

F. Caulking shall be kept to a minimum.

G. Submittals shall include spring deflections, spring diameters, compressed spring height and solid spring height as well as seal and wind resistance details.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install isolation for motor driven equipment.

C. Bases:
   1. Set steel bases for one inch (1") clearance between housekeeping pad and base.
   2. Set concrete inertia bases for two inch (2") clearance between housekeeping pad and base.

3. Adjust equipment level.

D. Provide a neoprene pad below all base mounted pumps unless otherwise noted.

E. Install spring hangers without binding.

F. Closed Spring Isolators: Adjust so side stabilizers are clear under normal operating conditions.

G. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

H. Provide pairs of horizontal thrust restraints on fans when air thrust exceeds 10% of fan weight. Install on axial and centrifugal fans.

I. Connect wiring to isolated equipment with flexible hanging loop.

J. Housekeeping pads are by the mechanical contractor unless otherwise noted.

K. Pad mounted equipment deflection shall be .25 inches.

L. Spring mounted equipment deflection shall be two inches.

M. Refer to schedule and details on the drawings.

3.02 MANUFACTURER'S FIELD SERVICES

A. Inspect isolated equipment after installation and submit report. Include static deflections.

3.03 EQUIPMENT ISOLATION SCHEDULE

A. Refer to equipment schedules in specifications and/or on the drawings.

3.04 PIPE ISOLATION SCHEDULE

PIPE SIZES (INCHES)	ISOLATED DISTANCE FROM EQUIPMENT
1	120 diameters
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters
8	60 diameters
10	54 diameters
12	50 diameters
16	45 diameters
24	38 diameters

END OF SECTION 23 0548

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tags

B. Labels

1.02 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems

1.03 SUBMITTALS

A. Submit list of wording, symbols, letter size, and color-coding for mechanical identification.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Manufacturer's Instructions: Indicate installation instructions, special procedures, and installation.

D. Project Record Documents: Record actual locations of tagged valves, include valve tag numbers.

PART 2 PRODUCTS

2.01 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Information Tags: Clear plastic with printed "Danger, "Caution" or "Warning" and message; size 3-1/4" x 5-5/8" with grommet and self-locking nylon ties.

2.02 LABELS

A. Description: Laminated Mylar, size 1.9" x 0.75" adhesive backed with printed identification.

PART 3 EXECUTION

3.01 PREPARATION

A. De-grease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. Apply paint primer before applying labels for unfinished canvas covering.

C. Install tags using corrosion resistant chain. Number tags consecutively by location.

D. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with labels. Small devices, such as in-line pumps, may be identified with tags.

E. Identify valves in main and branch piping with tags.

F. Identify air terminal units and radiator valves with numbered tags.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Identify piping, concealed or exposed with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure and at each obstruction. Identify on both sides of any wall.

I. Conform to owner's existing identification scheme. Verify with owner prior to bid.

END OF SECTION 23 0553

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems

B. Measurement of final operating condition of HVAC systems

1.02 REFERENCES

A. AABC - National Standards for Total System Balance

B. ADC - Test Code for Grilles, Registers, and Diffusers

C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems

D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems

E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing

1.03 SUBMITTALS

A. Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.

B. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

C. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.

D. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

E. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

F. Test Reports: Indicate data on AABC National Standards for Total System Balance Forms.

1.04 PROJECT RECORD DOCUMENTS

A. Record actual locations of flow measuring stations, balancing valve, and rough setting.

1.05 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Independent agency specializing in the testing, adjusting and balancing of systems specified in this section with minimum three years experience.

B. Perform work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

1.07 SEQUENCING

A. Sequence work to commence after completion of systems and schedule completion of work before substantial completion of project.

1.08 SCHEDULING

A. Schedule and provide assistance in final adjustment and test of life safety system with the fire authority.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire, smoke, and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Proper strainer baskets are clean and in place.
   14. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services that prevents system balance.

C. Beginning of work means acceptance of existing conditions.

3.02 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the engineer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.03 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within +/- 5% of design for supply systems and +/- 10% of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within + 10% and - 5% of design to space. Adjust outlets and inlets in space to within +/- 10% of design.

C. Hydronic Systems: Adjust to within +/- 10% of design.

3.04 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the owner.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Affect the volume control by duct internal devices (such as dampers and splitters).

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inch positive static pressure.

M. Set volume controller to airflow setting indicated for variable air volume system powered units. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

N. Adjust airflow switches for proper operation for water applications.

3.06 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Packaged Roof Top Heating/Cooling Units
   2. Air Coils
   3. Fans
   4. Air Filters
   5. Air Terminal Units
   6. Air Inlets and Outlets

B. Report Forms
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone number of Testing, Adjusting, and Balancing Agency
      d. Project Name
      e. Project Location
      f. Project Architect
      g. Project Engineer
      h. Project Contractor

i. Project Altitude
j. Report Date

2. Summary Comments:
   a. Design versus final performance.
   b. Notable characteristics of system.
   c. Description of systems operation sequence.
   d. Summary of out door and exhaust flows to indicate amount of building pressurization.
   e. Nomenclature used throughout report.
   f. Test conditions.
3. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Range
   f. Calibration date
4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP
   d. Phase, voltage, amperage; nameplate, actual, no load
   e. RPM
   f. Service factor
   g. Starter size, rating, heater elements
   h. Sheave Make/Size/Bore
5. Cooling Coil Data:
   a. Identification/Number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Entering air DB temperature, design and actual
   g. Entering air WB temperature, design and actual
   h. Leaving air DB temperature, design and actual
   i. Leaving air WB temperature, design and actual
   j. Saturated suction temperature, design and actual
   k. Air pressure drop, design and actual
6. Heating Coil Data:
   a. Identification/Number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Entering air temperature, design and actual
   g. Leaving air temperature, design and actual
   h. Air pressure drop, design and actual
7. Air Moving Equipment:
   a. Location
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Arrangement/Class/Discharge
   f. Air flow, specified and actual

g. Return air flow, specified and actual
h. Outside air flow, specified and actual
i. Total static pressure (total external), specified and actual
j. Inlet pressure
k. Discharge pressure
l. Sheave make/size/bore
m. Number of belts/make/size
n. Fan RPM

8. Return Air/Outside Air Data:
   a. Identification/Location
   b. Design air flow
   c. Actual air flow
   d. Design return air flow
   e. Actual return air flow
   f. Design outside air flow
   g. Actual outside air flow
   h. Return air temperature
   i. Outside air temperature
   j. Required mixed air temperature
   k. Actual mixed air temperature
   l. Design outside/return air ratio
   m. Actual outside/return air ratio
9. Exhaust Fan Data:
   a. Location
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Air flow, specified and actual
   f. Total static pressure (total external), specified and actual
   g. Inlet pressure
   h. Discharge pressure
   i. Sheave Make/Size/Bore
   j. Number of Belts/Make/Size
   k. Fan RPM
10. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/location
    c. Terminal type
    d. Terminal size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow

END OF SECTION 23 0593

SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass (flexible duct wrap)

B. Fiberglass (duct liner)

1.02 RELATED SECTIONS

A. Specification Section 23 3100 - HVAC Ducts and Casings

B. Specification Section 23 3300 - Air Duct Accessories

1.03 REFERENCES

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

B. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

D. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

E. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Fiberglass, Duct Lining Material)

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

G. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials

H. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

J. ASTM C612: Standard Specification for Mineral Fiber Block and Board Thermal Insulation

K. ASTM C1290: Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts

L. ASTM E2336: Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems

M. ASTM C1338: Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings

N. NAIMA National Insulation Standards

O. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials

P. SMACNA - HVAC Duct Construction Standards - Metal and Flexible

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, and list of materials and thickness for each service and locations.

B. Manufacturer's Installation Instructions: Indicate procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

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

B. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer.

1.06 REGULATORY REQUIREMENTS

A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

B. Identification: External duct insulation and factory insulated flexible duct shall be legibly printed or identified at intervals not greater than 36 inch with name of manufacturer, the thermal resistance R-value at the specified thickness; and the flame spread and smoke developed indexes of the composite material.

1.07 DELIVERY, STORAGE AND PROTECTION

A. Deliver, store, protect and handle products to site.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 FIBERGLASS (FLEXIBLE DUCT WRAP)

A. Manufacturers:
   1. Owens Corning
   2. Knauff
   3. Johns Manville
   4. CertainTeed
   5. Engineer approved equal.

B. Insulation: ASTM C1290; flexible, noncombustible blanket.
   1. "K" Value: ASTM C518, 0.27 at 75 deg F.
   2. Installed R-value (compressed to 25%) for 1-1/2": 4.5
   3. Maximum Service Temperature: ASTM C411; 250 deg F.
   4. Maximum Moisture Absorption: ASTM C1104; 5% by weight
   5. Density: 1.0 lb./cu. ft. (0.75 lb/cu ft for attic insulation)
   6. Microbial Growth: ASTM C1338; does not support the growth of mold, fungi and bacteria.
   7. Maximum Flame Spread/Smoke Developed Index: ASTM E84; 25/50

C. Vapor Barrier Jacket:
   1. Kraft paper reinforced with fiberglass yarn and bonded to aluminized film.
   2. Maximum Moisture Vapor Transmission: ASTM E96; 0.02 perm.

D. Vapor Barrier Tape Pressure sensitive tape approved by the manufacturer.

2.02 FIBERGLASS (DUCT LINER)

A. Manufacturers:
   1. Johns Manville Permacote Linacoustic
   2. Owens Corning
   3. CertainTeed Ultralite
   4. Knauff
   5. Engineer approved equal.

B. Insulation:
   1. ASTM C1071, flexible noncombustible blanket air surface coated with acrylic coating treated with ASTM G21 and G22 anti-microbial agent to resist growth.
   2. "K" Value: ASTM C518, 0.25 at 75 deg F.
   3. Maximum Service Temperature: 250 deg F.

4. Maximum Velocity on Coated Air Side: 5,000 FPM
5. Noise Reduction Coefficient: 0.50 or higher in accordance with ASTM C423. (1/2" thickness)
    a. Noise reduction coefficient will drive density for each manufacturer may vary by manufacturer to achieve.
6. Maximum Flame Spread/Smoke Developed Index: ASTM E84; 25/50

C. Adhesive: Adhesive: ASTM C916 adhesive as recommended by manufacturer.

D. Liner Fasteners: Galvanized steel welded with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ductwork has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated Ductwork Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, expansion joints, reheat coils, and any other item exposed to ductwork air temperature.

C. Insulated Ductwork Conveying Air Above Ambient Temperature:
1. Provide with standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. Duct Liner Application:
1. Adhere insulation with adhesive for 100% coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing. Pin length as required to limit compression of liner.
3. Seal and smooth joints. Seal and coat all exposed edges.
4. Seal liner surface penetrations with adhesive.

3.03 SCHEDULES

FIBERGLASS FLEXIBLE DUCT WRAP

DUCTWORK	THICKNESS
Supply Ducts	1-1/2"
Fire, Smoke, and Fire/Smoke Damper Sleeves	1-1/2"

FIBERGLASS DUCT LINER

DUCTWORK	THICKNESS
Return Air Ducts	1/2"
Transfer Air Duct	1/2"

END OF SECTION 23 0713

SECTION 23 0913
DDC INSTRUMENTS AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Input/output sensors for DDC controls

1.02 RELATED SECTIONS

A. Specification Section 23 0923 - DDC System

B. Specification Section 23 0933 - Direct Digital Control System for Laboratory Air Flow Control

C. Specification Section 23 0993 - Sequence of Operation for HVAC Controls

1.03 REFERENCES

A. AMCA 500D - Laboratory Methods of Testing Dampers for Ratings

B. NFPA 70 - National Electrical Code

C. NFPA 90A - Installation of Air Conditioning and Ventilation Systems

1.04 SUBMITTALS

A. Shop Drawings:
   1. Trunk cable schematic showing Tier #1, Tier #2 and Tier #3 conductors. These schematics must show all Tier #1, Tier #2 and Tier #3 equipment and controllers added by or affected by this project, the location of each device and the location of power circuits for each device.
   2. Drawings of connected input and output points. These drawings must show the input or output device, terminal points on the input or output device, the controller that the device connects to, terminal points on the controller and intermediate connections such as terminal blocks.
   3. Drawings of location of control components, including sensors not close to their mechanical system (i.e., room temperature sensors, duct mounted sensors) and control enclosures. The locations may be shown on copies of the project's mechanical system drawings.

B. Descriptive data of operating, user and application software located at Tier #1, Tier #2 and Tier #3. If existing software affects the controls installed for this project, include descriptive data of that software.

C. Control System Components:
   1. Front and side views of enclosures with overall dimensions and conduit entrance locations.
   2. Voltage, amp draw, MOCP and MCA of the controllers and attached devices.
   3. Ambient conditions to include temperature and relative humidity allowed for storage and operation of the controllers and attached devices.
   4. Listed Marks from an OSHA nationally recognized testing laboratory that comply with the listing requirements in Specification Section 23 0923 and Specification Section 23 0993.

D. Sequence of operation that outlines the programming running in the Tier #2 Tier #3 controllers, both programmable and application specific, and shows compliance with the sequence of control published in Specification Section 23 0993 and on the construction drawings. The sequence may be presented in a narrative or flow chart format.

E. Schedule of valves indicating size, flow and pressure drop for each valve. Demonstrate the valves' materials of construction, static pressure rating, pressure drop rating and close off pressure rating using the submitted actuator.

F. Schedule of dampers indicating size, blade arrangement and pressure drop at the design CFM. Demonstrate the dampers' materials of construction, FPM at design CFM and shaft torque at design CFM.

G. Closeout:
   1. Record actual location of control components, including sensors not close to their mechanical system (i.e., room temperature sensors, duct mounted sensors) and control enclosures. Show these locations on marked up project mechanical system drawings and / or the shop drawings.
   2. Revise shop drawings to reflect the as installed system and the final sequences of operation.
   3. Routine preventative maintenance schedule that follows NEMA ICS 1.3 - Preventative Maintenance of Industrial Control and Systems Equipment. Include instructions for operating controllers and describe the operating limits that must be maintained to prevent hazardous or unsafe conditions.
   4. Provide manufacturers' warranties in writing. All equipment provided or furnished by the FMS contractor must be warranted as required in the project specification. Make out the warranties in owner's name and register with the equipment's manufacturer.

1.05 QUALITY ASSURANCE

A. The installer must be a company specializing in applying the work of this section with a minimum of five years experience. The installer may be a subcontractor with the minimum five years experience with their work overseen and directed by the Facility Management System (FMS) contractor.

B. Any electrician installing electrical circuits must be licensed in Iowa as a Class A or Class B Master Electrician or must be licensed in Iowa as a Class A or B Journeyman Electrician and be employed either by an Iowa recognized electrical contractor or an Iowa licensed Class A or Class B Master Electrician. This licensing requirement does not apply to the installation of class two or class three remote control circuits, signaling circuits, power limited circuits, optical fiber cables, other cabling or communications circuits, including raceways, as defined by NFPA 70 for voice, video, audio and data circuits. Refer to Iowa Code Section 103.

1.06 REGULATORY REQUIREMENTS

A. Electrical installation to conform to requirements of NFPA 70.

B. Products must be listed and classified by Underwriters Laboratories, Inc. (UL) or ETL as suitable for the purpose specified and indicated.

C. All electrical work must be inspected in accordance with Iowa law. The inspection must be conducted by a state licensed inspector or the inspector of a political subdivision that Iowa State law recognizes as allowed to conduct inspections inside that subdivision. This inspection requirement does not apply to the installation of class two or class three remote control circuits, signaling circuits, power limited circuits, optical fiber cables, other cabling or communications circuits, including raceways, as defined by NFPA 70 for voice, video, audio and data circuits. Refer to Iowa Code Section 103.

1.07 WARRANTY

A. Warranty must be one-year parts and labor unless noted otherwise for specific components. Warranty starts when the FMS Tier #1 software is operating; all required graphics are installed, fully active and displaying the input and output points, access to the internet is established, the Tier #2 hardware is operating, the Tier #3 hardware is operating, the Tier #2 and Tier #3 databases are stored on the Tier #1 mass storage device and the owner has taken beneficial occupancy of the building.

B. All warranty service must be conducted by a technician employed by the FMS contractor except that problems specific to installation by a subcontractor may be resolved by that subcontractor.

1.08 MAINTENANCE SERVICE

A. No regular maintenance of the control system is required after the warranty starts.

B. Submit a written report to the owner after any warranty call. The report must state the reason for the warranty call, the FMS contractor's technicians diagnosis and any hardware or software repair or replacement required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Instruments and control devices specified below may be made by the FMS manufacturer or may be third party OEM equipment cataloged by the FMS manufacturer that meets the specification requirements. All third party OEM devices must be warranted the same as devices manufactured by the approved FMS manufacturers and those warranties; both labor and material, must be executed by the FMS contractor.
   1. Reliable Controls
   2. Minco
   3. BAPI
   4. Dwyer
   5. Veris
   6. ACI
   7. Belimo Air Control
   8. Apollo
   9. Bray
   10. Fisher
   11. Tyco/Keystone
   12. Griswold
   13. Danfoss
   14. Flow Control Industries
   15. Ruskin
   16. Tamco
   17. Honeywell Analytics
   18. MSA
   19. Setra
   20. Rosemont
   21. Endress + Hauser
   22. Gerand Engineering
   23. Onicon
   24. Badger
   25. Ebtron
   26. Air Monitor
   27. Engineer approved equal.

B. This is a list of allowed manufacturers of end devices, both input (i.e. sensors) and output (i.e. actuators, valves, dampers). Inclusion of this list does not allow that manufacturer to bid the FMS System as the FMS contractor. The qualifications of the FMS contractor are established in Specification Section 23 0923 - Direct Digital Control Systems for HVAC.

2.02 INPUT/OUTPUT SENSORS FOR DDC CONTROL

A. Temperature Sensors and Transmitters:
   1. Temperature sensors used for measuring room temperature and mounted on a wall or ceiling or installed in a return duct must have a +/- 0.5 F accuracy over a range of 55F to 95F. The sensor accuracy requirement applies to sensors that are connected to a Tier 2 or Tier 3 controller or sensors that are part of a thermostat. Room temperature sensors may be thermistor or RTD.
   2. Temperature sensors used to measure the discharge air temperature from an air valve, unit heater, fan coil unit, unit ventilator or duct mounted reheat coil must have a +/- 0.75F accuracy over a range of 20F to 120F. These temperature sensors may be thermistor or RTD. A duct mounted temperature sensor assembly must include a gasket to prevent air

leakage. The temperature sensor may connect directly to a Tier 2 or Tier 3 controller or may connect to a temperature transmitter that in turn connects to a Tier 2 or Tier 3 controller.

3. FMS contractor furnished or provided temperature sensors used for duct, air processing machine, immersion or outside air measurement other than to measure an air valve, unit heater, fan coil unit, unit ventilator or duct mounted reheat coil discharge temperature, may use a thermistor or RTD. Single point sensors must have an accuracy of +/- 0.36F or better in the range of 20F to 120F. Averaging sensors must have an accuracy of +/- 0.5F or better in the range of 20F to 120F.
    a. An air processing machine is a packaged air handler, modular air handler, field built air handler, energy recovery ventilator, standalone preheat coil assembly or stand alone fan.
    b. Duct or air processing machine temperature sensors include single point or averaging element sensors listed on the point list in the sequence of operation or on the control system drawings that are used to sense discharge air temperature from an air processing machine, discharge temperature from any coil inside an air processing machine, entering air temperature into any coil inside an air processing machine, mixed air temperature associated with an air processing machine or air temperature entering an air processing machine.
    c. Use single point temperature sensors in ducts or air processing machine locations that are 10 square feet or smaller and not used to measure mixed air temperature.
    d. Use averaging elements for locations required in a point list or that are larger than 10 square feet or used to measure mixed air temperature, regardless of duct area. Use averaging elements that are at least 24 inches long at locations with up to 5 square feet of cross sectional area. Use averaging elements that are at least 48 inches long at locations with between 5 and 10 square feet of cross sectional area. Use averaging elements with a length of at least 96 inches long at locations with between 10 and 15 square feet of cross sectional area. Use averaging elements with a length of at least 96 inches long plus additional 12 inch increments for each square foot increment of cross sectional area above 15 square feet (i.e., a cross sectional area of 16 square feet requires a 108 inch long element. A cross sectional area of 20 square feet requires a 154 inch long element.). Multiple averaging bulb sensors may be used at a particular location to meet the bulb length requirement. Averaging sensors that are up to 48-inches long may be rigid or bendable. Averaging sensors longer than 48-inches long must be bendable.
    e. Single point and averaging temperature sensor assemblies must include a junction box with a gasket to prevent leakage and reduce vibration noise.
    f. Temperature sensors used for outside air temperature measurement be in a NEMA 4 watertight fitting or enclosure and shielded from the direct rays of the sun at all times.

B. Equipment Operation Sensors:
    1. Sense fan on/off status with adjustable threshold current sensors sized for the fan motors full load current draw on one horse power and larger motors. Use on/off current sensors for smaller motors.
    2. Sense the run status of any other electric motor with adjustable threshold current sensors sized for the motors full load current draw on one horse power and larger motors. Use on / off current sensors for smaller motors.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that systems are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

E. Ensure installation components are complementary to installation of similar components.

F. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

G. Do not install control instruments, including controllers, until building environment can be maintained within the operating conditions required by the manufacturer.

H. Verify that field measurements are as indicated on shop drawings and instructed by manufacturer.

3.02 INSTALLATION

A. Install all devices in accordance with manufacturer's instructions.

B. Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Align with lighting switches.

C. Mount long bulb duct thermostats and temperature sensors using flanges and element holders.

D. Mount all outside sensor's transmitters indoors and place the outside located elements under a sun shield.

E. Automatic dampers must have parallel blades. When two dampers mix air, such as an outside and a return damper combination, install dampers so the air streams butt each other as the dampers open.

F. Install damper motors on the outside of the duct in a warm location for outside air dampers. Extend damper shaft, including jack shafts, to the outside of the duct. The actuators for return dampers may be installed inside the duct. The actuators for exhaust and relief dampers may be mounted inside the duct if placed on the air entering side of the damper. Any actuator placed inside the duct must be accessible for replacement through a hinged access door. If any damper actuator must be installed outside in the weather, it must be in a NEMA 2, 3R or 4 (or IEC equivalent) enclosure and must have a heating element in the enclosure. The actuator must be able to provide full torque as the outside air temperature varies from -20F to 110F. If any damper actuator must be installed inside roof mounted HVAC equipment, that actuator must be cooled and / or heated as needed so that the motor provides full torque as the outside air temperature varies from -20F to 110F. Damper actuators may be stacked as long as done so in accordance with the manufacturer's instructions for stacking actuators.

G. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room.

H. Provide engraved plastic nameplates, attached with rivets or screws, for instruments and controls inside cabinet and on the cabinet face. Each controller must have a label that matches the designation used on the shop drawings. Each cabinet must have a label that matches the designation on the shop drawings. Each controller must have a label that describes the distribution panel board and circuit breaker that supplies its power. Each group of transformers must have a label that describes the distribution panel board and circuit breaker that supplies the group's power. If all components inside a cabinet are powered from the same circuit breaker, place the power source label on the front of the cabinet.

I. Provide raceway, electrical wiring and wiring devices.

J. Provide a dedicated 120 Vac, 20 amp circuit for the Tier #1 PC workstation and server (if required) and each Tier #2 controller. Tier #3 controllers that require 120 vac must be powered from the same circuit as the associated Tier #2 controller or a dedicated 20 amp circuit for Tier #3 controllers. The transformers for Tier #3 controllers that require 24 vac must be powered from the same circuit as the associated Tier #2 controller or a dedicated 20 amp circuit for Tier #3 controllers. The associated sensors and actuators of each Tier #2 and Tier #3 controller must be powered from the same circuit as the controller. If sensors and actuators must be

electrically isolated from each other or their controllers, use 1:1 isolation transformers so that the same power circuit requirement is met. The FMS components, including sensors and actuators, must not share power circuits with anything else.

K. Low voltage wiring must be run in raceway in exposed locations and non-accessible ceiling and wall areas. In concealed but accessible locations, control wiring must be in cable tray where available. Where cable tray is not available, low voltage control wiring must be neatly routed parallel and perpendicular to the building lines above accessible ceilings and grouped using D-rings. Use type CL2P (plenum) cable for all wiring and cables not in enclosed raceway. No raceway may be installed in view of occupants except in mechanical and electrical utility rooms.

L. When installing a current sensor on any motor that is controlled by a VFD, place the current sensor on the power entering side of the VFD. Provide a separate junction box up-stream of the VFD to house the CT.

M. Provide conduit and electrical wiring. Refer to electrical specification for conduit requirements. All conduits for control system wiring and cabling must match the color required in the electrical Specification Section 26 0553 Identification for Electrical Systems.

END OF SECTION 23 0913

SECTION 23 0923
DDC CONTROL SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work will extend the existing building direct digital control system to the renovation construction. The control vendor allowed to bid is:
   1. FM Controls (Reliable) at 102 1st Ave S, Fort Dodge, IA 50501

1.02 FMS CONTRACTOR RESPONSIBILITIES

A. The FMS (facility management system) contractor will provide and connect together all building automation equipment for HVAC equipment control.

B. The building automation equipment includes, but is not limited to, DDC panels, controllers, auxiliary panels, sensors, thermostats, operator interface hardware, relays, switches, transformers valves, actuators and variable frequency drives.

C. The FMS contractor must see equipment in compliance with UL 946 PAZX and UL 864 UDTZ and other subsystem listings as applicable.

D. All electronic equipment must conform to the requirements of FCC Regulations, Part 15, Subpart B governing radio frequency electromagnetic interference by an unintentional radiator and must be so labeled.

E. The FMS contractor must submit the necessary shop drawings required for the installation of the control system.

F. The FMS contractor must provide all low voltage control wiring and its enclosing raceways, except for the specific mounting box and conduit installation assigned to the electrical contractor. The FMS contractor must terminate this wiring in the DDC panels and all field devices.

G. The FMS contractor must document the installed system.

1.03 MECHANICAL CONTRACTOR RESPONSIBILITIES

A. The mechanical contractor must include the following:
   1. Install the temperature sensor wells furnished by the FMS contractor.
   2. Install the automatic control valves furnished by the FMS contractor.

1.04 ELECTRICAL CONTRACTOR RESPONSIBILITIES

A. The electrical contractor must include the following:
   1. Provide power wiring to and through the disconnect to electrical motors, starters and control transformers.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. See Specification Section 23 0913 DDC Instruments and Control Devices for HVAC Part 3.01 for required preparation work.

3.02 INSTALLATION

A. See Specification Section 23 0913 DDC Instruments and Control Devices for HVAC Part 3.02 for required installation work.

END OF SECTION 23 0923

SECTION 23 0993

SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SCOPE

A. Rooftop Unit

1.02 RELATED SECTIONS

A. Specification Section 23 0913 - DDC Instruments and Control Devices for HVAC.

B. Specification Section 23 0923 - Direct Digital Control System

C. Specification Section 23 2923 - Variable Frequency Motor Controller

1.03 GENERAL PROVISIONS

A. The Facility Management System (FMS) contractor, general contractor, mechanical contractor, electrical contractor, low voltage systems contractor and all equipment suppliers must examine this sequence of operation and provide hardware, software, design services, technician services, programming services, computers, controllers, sensors, transmitters, switches, actuated devices, relays, contactors, automation dampers, electrical power, cabling, wiring, enclosures, raceways, installations and anything else required to implement the intent of the individual sequences of control embodied in this sequence of operation and result in fully functioning FMS systems. The FMS system includes all required interfaces and connections to equipment not furnished by the FMS contractor. Anything required to meet the intent of this sequence of operation, even if not specifically listed, must be furnished, installed, or provided as required.

B. FMS Tiers
   1. The facility management system (FMS) is established in three tiers.
   2. These tiers are functional. The physical layout may place all devices on one, two or three levels of communication. For example, an Ethernet network to which thermostats, sensors, actuators, controllers, and web servers connected would be physically a single tier but function as the three tiers described here.
   3. Tier 1 refers to the enterprise level tier. This is the level that servers, integration bridges to other systems and bridges to the Internet are located.
   4. Tier 2 refers to the programmable controller level tier. This is where controllers with real time clocks communicate with each other peer to peer. The Tier 2 controllers run complex, custom programmed functions such as energy plants and complex air handlers. The Tier 2 controllers may also provide integration bridges to other systems.
   5. Tier 3 refers to the application specific controller level tier. This is where preprogrammed or custom programmed controllers focus on single purpose functions such as controlling a single air valve. The Tier 3 controllers usually require coordination and clock functions from a Tier 2 controller.

C. The requirements stated in this sequence of operation take precedence over any control features or requirements stated in the specification document or in the drawing notes for any equipment that is touched by this sequence of operation.

D. The equipment suppliers must examine all this sequence of operation. They are commended to pay attention to the following parts of the sequence of operation because of the need to integrate the FMS with the factory provided controls on the equipment, either through a communications bridge or hard-wired points.

E. All points in the point lists must be provided. Additionally, any additional physical or virtual points that are required to execute the sequence of operation must also be provided as part of the base bid contract.

F. All set points, alarm thresholds, timers, dead bands, time constants, sampling intervals, etc. stated in the sequence of operation are preliminary and must be modified by the FMS contractor during start up, formal commissioning and as required during the warranty period to

insure a stable and comfortable building environment commensurate with proper operation of the equipment that preserves their manufacturers' warranties.

G. All P, PI and PID control loops must be tuned during startup to provide a combination of timely response and stability. The loops must not be tuned only for stability. The loops must be as fast responding as possible, consistent with stability. Continuous loop tuning may be implemented.

H. All FMS contractor furnished VFDs must have an integration to the FMS. If required in the sequence, the VFD speed analog output must be hard wired between the FMS and the VFD and completely independent of the functioning of the integration. All other VFD points, such as start / stop, alarms, etc. may be transferred across the integration.

I. All VFD speeds must be represented in terms of 0 – 100% on the graphics. The 0% must represent the minimum speed of the connected motor (i.e., a pump motor with a minimum allowed speed of 12 Hz has 12 Hz represented by 0%). The 100% must represent the maximum speed of the connected motor (i.e., a fan motor with a design CFM delivery speed of 75 Hz has 75 Hz represented by 100%).

J. When the control system is fully operational, label each control input sensor or transmitter, thermostat, safety control, actuator, valve controller, control enclosure, VFD enclosure, motor starter, switch, and switch position. Label with a secure, permanent tag that is marked with the device designation used in the as-built control shop drawings. The tag must be outdoor rated and waterproof self- adhesive printed vinyl, engraved phenolic, engraved, or stamped aluminum or engraved or stamped brass. The tag must be secured by backing adhesive (vinyl), epoxy glue, rivets, screws, or a substantial wire.

K. When the control system is fully operational, the FMS contractor must backup the control system database, graphics, and individual controller programs on the server. The FMS contractor must provide as built shop drawings and as built catalog cut files to the owner. These must all be placed on two CDs or flash drives as Adobe .PDF (latest revision) files as well as the hard copies required by the specification document's general provisions. The owner must be able to use their existing FMS server to restore the complete control system's as-built operation after all Tier 2 and Tier 3 controllers installed on this project have lost their memories.

L. The FMS contractor must include the following:
   1. Provide and connect all building automation equipment for HVAC equipment control. The building automation equipment includes but is not limited to:
      a. Sensors and transmitters
      b. Thermostats
      c. Controllers
      d. Relays and bases
      e. Switches
      f. Transformers and power supplies
      g. Automatic valves
      h. Actuators
      i. Variable frequency controllers
      j. Panels and other enclosures for other building automation equipment.
      k. Panels' and other enclosures' interior components and materials such as back planes, mounting rails, terminal blocks, wire duct, wire, and cables.
   2. Provide the communications infrastructures to include:
      a. Tier 1 communications infrastructure.
      b. Tier 2 communications infrastructure.
      c. Tier 3 communications infrastructure.
      d. The three tiers are functional. The physical communications infrastructure may be one, two or three layers.
   3. Provide all connections to any packaged equipment's control system required to affect the sequences described in this specification section. These connections include but are not limited to RS-232, RS-485, USB, fiber optics and individually wired hard wire connections.

4. Provide all 120 VAC branch circuits and low voltage AC and DC power required for all components provided by the FMS contractor.
5. Provide the wires, cables, and raceway for the 120 VAC and low voltage FMS infrastructure.

M. The FMS contractor must furnish, and the mechanical contractor must install the following:
1. Automated control valves.

N. The FMS contractor must furnish, and the sheet metal contractor must install the following:
1. Field installed air flow measuring instruments.

O. The FMS contractor must furnish, and the electrical contractor must install the following:
1. Variable frequency drives for fans scheduled or noted to have field installed drives.

P. Point Notes.
1. The point notes apply to the equipment sequences in PART 3.
2. Determine means to make a calculation at a time interval. For example, determine the set point every 15 minutes means to calculate a set point and maintain the value of the calculation for 15 minutes then calculate the set point again. This allows the control system to adjust to a set point before needing to adjust to a new set point.
3. Evaluate means to look at a point status or point value and store the value. For example, evaluate the outdoor air temperature every 30 minutes means to look at the outdoor temperature and store the value for 30 minutes then look again and update the stored outdoor air temperature. This stabilizes the program response to rapid changes in the evaluated point.
4. If a point is labeled (GRAPHIC), that point must be placed on the equipment's master graphic so authorized users may adjust (AO) or toggle (DO) or index (MSV). The analog values stated in this sequence are good starting points. The FMS contractor must adjust these values during startup to optimize control operation. If the point resides in the equipment's factory provided controls (i.e., set back temperature set point), the FMS must reach to the resident point through the integration.
5. If a point is labeled (adj.), the point must be a virtual point that is changed by commanding the point to a new value by a command line prompt or clicking on the point on a point data base display. The point is not displayed on the graphic. The initial value given in this sequence is a good starting point. These points must be adjusted as needed during system startup to provide stable and comfortable system operation.
6. If a point is labeled (locally adj.), that control must be readily adjustable by hand or with a screwdriver. The initial value given in this sequence is a good starting point. These points must be adjusted as needed during system startup to provide stable and comfortable system operation.
7. Point notes for integrated equipment.
    a. If a point related to integrated equipment is labeled (GRAPHIC), that point must be placed on the equipment's master graphic so authorized users may adjust (AO) or toggle (DO). The analog values stated in this sequence are good starting points. The FMS contractor must adjust these values during startup to optimize control operation. If the point resides in the integrated equipment's factory provided controls (i.e., set back temperature set point), the FMS must reach to the equipment's resident point through the integration.
    b. If a point is labeled (FMS), that point resides in the FMS.
    c. If a point is labeled (EQUIP), that point resides in the integrated equipment's factory provided controls.
    d. If a point is labeled (FMS adj.), that point must be adjustable from a user logged into the FMS system or by the program running in the FMS. The values stated in this sequence are good starting points. The FMS contractor must adjust these values during startup to optimize control operation.
    e. If a point is labeled (EQUIP adj.), that point may be adjustable from a user using a service tool or man to machine interface that is connected to the integrated

equipment's factory provided controls. The values stated in this sequence are good starting points. The FMS contractor must adjust these values during startup to optimize control operation. This kind of point may also be accessible through the FMS at the FMS contractor's discretion.

PART 2 SEQUENCE OF OPERATION

NOT USED

PART 3 EXECUTION

3.01 ROOFTOP UNIT

A. The CAV rooftop air handler (RTU) functions as a single zone CAV unit.
   1. The RTU has:
      a. Constant speed supply fan
      b. DX cooling and dehumidification coil
      c. Modulating hot gas reheat
      d. Natural gas heating section
      e. Air side economizer with outdoor dry bulb control
      f. Variable speed relief fan
   2. The RTU must have a complete factory installed control system that executes this section of the sequence of control.

B. The RTU's factory provided controls must perform the important control functions that include the following.
   1. Room temperature control using the heating section, economizer, and cooling section.
   2. Room relative humidity control using the cooling / dehumidification section and hot gas reheat.
   3. Building pressure control using the powered relief fan(s).
   4. The facility management system (FMS) is an interface between the user and the RTU and does not perform any control function. It is used to command the RTU on / off, input set points to the RTU controls and monitor selected physical and virtual points that are in the RTU controls. The RTU must be capable of performing the important control functions as if the FMS were not present.

C. The RTU manufacturer must include the following:
   1. Provide a complete factory provided control system that executes this section of the sequence of control.
   2. The factory provided control system's points must be accessible for view and adjustment by a service tool or man to machine interface connected to the control system. The tool or interface does not need to be furnished as part of this contract.
   3. Provide all hardware, software and permanent licenses required to implement an interface to the FMS using BACnet TCP/IP or BACnet MS/TP.
      a. The FMS contractor must not be required to do more than connect a cable to the RTU's factory controls and be able to communicate in the required protocol to implement the interface.
      b. The FMS contractor may be required to map points across the integration.
   4. Provide a complete integration points list with registry information that is specific to the equipment furnished for this job.
      a. A general integration points list that is not edited for the specific serial number(s) shipped for this job is not acceptable.
      b. This list must be part of the RTU submittal.
   5. Allow all RTU resident points in the sequence listed as (FMS adj.) to be adjustable across the integration by an operator using the FMS or the program in the FMS.
   6. Allow all RTU resident points in the sequence listed as (FMS command) to be commanded across the integration by an operator using the FMS or the program in the FMS.
   7. Furnish a wall mounted thermostat that includes the following:

a. Local set point adjustment.
b. Unoccupied override button.
c. Adjustable local set point limit range at least between 65F and 80F.
d. Adjustable dead band between heating and cooling set points of at least 5F.
e. Override button initiates occupied operation for a time duration adjustable up to at least four hours.

8. Furnish a wall mounted relative humidity sensor. This sensor may be incorporated into the thermostat.
9. Furnish an inside to outside differential pressure sensor for building pressure control.

D. The FMS contractor must include the following:
1. Integrate to the RTU control system using the communication protocol required by the RTU's manufacturer. The integration protocol must be BACnet TCP/IP or BACnet MS/TP.
2. Install the RTU's thermostat. The FMS contractor must provide the wiring from the instruments to the RTU.
a. Limit the set point adjustment to a range of 70F (EQUIP adj.) to 75F (EQUIP adj.).
b. Program a 5F (RTU adj.) dead band between the heating set point and the cooling set point that is centered on the local set point.
c. Program the override duration at 2 hours (EQUIP adj.).
3. Install the RTU's relative humidity sensor. Place next to the thermostat. The FMS contractor must provide the wiring from the sensor to the RTU.
4. Install the building inside to outside differential pressure sensor and its required air tubing. The FMS contractor must provide the wiring from the instrument to the RTU.
a. Place the inside pressure sensing point in the conditioned space.
b. Use a Dwyer A-420A wind gust pressure attenuator for the outside air pressure pickup.
c. Place the wind gust pressure attenuator at the top of a 10-foot-long ¾" EMT that is attached to the side of the RTU. Bend the top of the EMT so the attenuator's baffle plate is parallel to the roof.
5. Provide a supply temperature sensor (TE-1).
6. Provide a current activated status switch (CS) for each supply fan.
7. Provide a current activated status switch (CS) for each pressure relief fan.

E. Integrated Points
1. The integration is BACnet MS/TP or BACnet TCP/IP.
2. The point names in this list express the function of write and read integrated points. The manufacturer may use different names to describe the points. The manufacturer may use several points working together to obtain the function.
3. RTU Occupied / Unoccupied (write). If RTU indexed to Occupied, it runs. If RTU indexed to Unoccupied, it stops but responds to a user pushing the override button and to low and high room temperatures.
4. Economizer On / Off (write)
5. SETBACK TEMPERATURE SET POINT (deg F) (write)
6. SETUP TEMPERATURE SET POINT (deg F) (write)
7. ROOM RELATIVE HUMIDITY SET POINT (%RH) (write)
8. BUILDING INSIDE TO OUTSIDE DIFFERENTIAL PRESSURE SET POINT (in W.C.) (write)
9. OUTSIDE AIR DAMPER MINIMUM POSITION SET POINT (%) (write)
10. Timed Override Active (read)
11. Room Temperature (deg F) (read)
12. Room Temperature Set Point (deg F) (read)
13. Supply Air Temperature (deg F) (read) (Label on graphic as "RTU Sensor")
14. Mixed Air Temperature (deg F) (read)
15. Return Air Temperature (deg F) (read)
16. Room Relative Humidity (%RH) (read)

17. Inside to Outside Differential Pressure (in W.C.) (read)
18. Supply Fan Run Status (On or Off) (read)
19. Pressure Relief Fan Run Status (On or Off) (read)

F. RTU Protection Functions.
   1. Safeties
      a. Safeties must be hard wired and not depend on the operation of the FMS to work.
      b. If the building fire alarm activates, shut down the fans.
   2. Alarms. Alarms must appear and buffer at the alarm reporting locations until acknowledged.
      a. If the supply air temperature (TE-1) is below 40F (adj.) for more than 5 minutes (adj.), annunciate an alarm.
      b. If the supply air temperature (TE-1) is below 30F (adj.) for more than 5 minutes (adj.), annunciate a critical alarm.
      c. If the room temperature is above 90F or below 55F, annunciate an alarm.
      d. If the room temperature is below 50F, annunciate a critical alarm.
      e. If the supply fan does not indicate operation (CS) if RTU Occupied / Unoccupied is Occupied, annunciate an alarm.

G. Set Points
   1. The SETBACK TEMPERATURE SET POINT is 62F (GRAPHIC). Limit adjustment range to between 60F (adj.) and 66F (adj.).
   2. The SETUP TEMPERATURE SET POINT is 84F (GRAPHIC). Limit adjustment range to between 80F (adj.) and 86F (adj.).
   3. The ECONOMIZER ON SET POINT is 67F (adj.).
   4. The ROOM RELATIVE HUMIDITY SET POINT is 55% (GRAPHIC). Limit adjustment range to between 40% RH (adj.) and 60% RH (adj.).
   5. The BUILDING INSIDE TO OUTSIDE DIFFERENTIAL PRESSURE SET POINT is +0.05 in W.C. (GRAPHIC). Limit adjustment range to between +0.02 in W.C. (adj.) and +0.1 in W.C. (adj.).

H. Logic Functions.
   1. Economizer
      a. Evaluate the outside air temperature every 15 minutes (FMS adj.).
      b. If the outside air temperature is below the ECONOMIZER ON SET POINT, index Economizer to On.
      c. If the outside air temperature is above the ECONOMIZER ON SET POINT, index Economizer to Off.

I. RTU Occupied / Unoccupied
   1. Index the RTU between Occupied and Unoccupied in response to a FMS time of day schedule.
      a. Use a time clock based optimized start routine to transition the RTU from off to on.
      b. The optimizer goal is to have the room temperature no less than 69F during cool or cold weather and no more than 76F during warm or hot weather.
      c. At no less than 15 minutes and no more than two hours before scheduled occupancy.
         1) Index RTU Occupied / Unoccupied to Occupied.
      d. At the end of scheduled occupancy.
         1) Index RTU Occupied / Unoccupied to Unoccupied.
   2. If a user presses the thermostat's override button (Timed Override Active is ON to indicate override operation) and the RTU is indexed to Unoccupied:
      a. The RTU controls turn the unit on.
   3. If the override time is expired (Timed Override Active is Off) and the RTU is indexed to Unoccupied:
      a. The RTU controls turn the unit off.
   4. If the room temperature is below the SETBACK TEMPERATURE SET POINT or above the SETUP TEMPERATURE SET POINT and the RTU is indexed to Unoccupied:

a. The RTU controls turn the unit on.

5. If the room temperature is between the SETBACK TEMPERATURE SET POINT and the SETUP TEMPERATURE SET POINT and the RTU is indexed to Unoccupied:
   a. The RTU controls turn the unit off.
6. If the FMS indexes RTU Occupied / Unoccupied to Unoccupied.
   a. The supply fan shuts down.
   b. The relief fan(s) stop.
   c. The DX compressors stop.
   d. The heating section shuts down.
   e. The outside air damper closes.
   f. The return damper opens.
   g. The relief damper closes.
7. If the FMS indexes RTU Occupied / Unoccupied to Occupied or if the RTU controls turn the unit on in response to a user pressing the thermostat's override or the RTU controls turn the unit on in response to low or high room temperature:
   a. The supply fan runs.
   b. The relief fan(s) may run.
   c. The relief fan(s) may modulate.
   d. The DX compressors may stage and modulate.
   e. The hot gas reheat may modulate.
   f. The heating section may run and modulate.
   g. The outside and return air dampers may modulate.
   h. The relief or exhaust damper may modulate.

J. Room Temperature Control.
   1. The RTU controls operate the heating section, economizer, and DX compressors to maintain the Room Temperature Set Point.

K. Room Relative Humidity Control.
   1. The RTU controls operate the cooling and dehumidifying section and hot gas reheat to maintain the ROOM RELATIVE HUMIDITY SET POINT.

L. Building Pressure Control.
   1. The RTU controls operate the pressure relief fans to maintain the BUILDING INSIDE TO OUTSIDE DIFFERENTIAL PRESSURE SET POINT.

M. Points List.
   1. All points listed below must appear on the RTU graphic.
   2. All points in the sequence labeled as (GRAPHIC) must appear on the RTU graphic.
   3. All integrated points must appear on the graphic.
   4. Analog Input (AI)
      a. Supply air temperature (TE-1) (averaging sensor) (Label on graphic as "FMS Sensor")
      b. Outside air temperature (global)
   5. Digital Input (DI)
      a. Supply fan status (CS) (current switch)
      b. Pressure relief fan status (one for each fan) (CS) (current switch)
   6. Linkage
      a. Direct link from the graphic to the sequence of operation section RTU-1.
      b. Direct link from the graphic to the time-of-day schedule.

END OF SECTION 23 0993

SECTION 23 1123
NATURAL GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Natural gas piping
B. Gas control vents
C. Flanges, unions, and couplings
D. Gas pressure regulators
E. Plug valves
F. Gas ball valves

1.02 REFERENCES

A. ANSI LC-4/CSA 6.32 Press-connect Metallic Fittings for Use in Fuel Gas Distribution Systems
B. ASHRAE 90A - Energy Conservation in New Building Design
C. ASME Section 8D - Pressure Vessels
D. ASME B16.3 Standard for Malleable Iron Threaded Fittings: Classes 150 and 300
E. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
F. ASTM A420 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service
G. NFPA 30 - Flammable and Combustible Liquids Code
H. NFPA 54 - National Fuel Gas Code
I. NFPA 70 - National Electrical Code

1.03 QUALITY ASSURANCE

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

1.04 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Deliver, store, protect and handle products to the site.
B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING (ABOVE GRADE)

A. Steel Pipe:
   1. ASTM A53 Schedule 40 black.
   2. Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type.
   3. Joints: NFPA 54, threaded or welded to ANSI B31.1.

2.02 GAS CONTROL VENTS

A. All gas control vents shall be vented separately to the exterior of the building. Terminate with screwed vent cap.

2.03 FLANGES, UNION, AND COUPLINGS

A. Pipe Size Under 2 Inches:
   1. Ferrous Pipe: Class 150 psig malleable iron threaded unions.
   2. Copper Tube and Pipe: Class 150 psig bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

2.04 GAS PRESSURE REGULATORS

A. Manufacturers:
   1. Fisher
   2. Engineer approved equal.

B. Direct-operated, spring-loaded regulator with internal relief. Regulator shall have internal relief across diaphragm to minimize overpressure. Any outlet pressure above the start-to-discharge point of the nonadjustable relief valve spring shall be allowed to bleed out through a relief vent.

2.05 PLUG VALVES

A. Up To and Including 2 Inches:
   1. Manufacturers:
      a. Homestead Valve #612
      b. Engineer approved equal.
   2. Full port body, lubricated plug type, without taper, close tolerance between plug and body sealing surfaces, Teflon reinforced stem seal, leak-proof spring loaded check valve, combination lubricant screw and button head. Valve plugs shall be floated on low-friction Teflon surfaces. Lubricant system shall have sufficient pressure to force lubricant over all seating surfaces.
   3. Valves shall handle natural gas at temperature and pressure indicated.

2.06 GAS BALL VALVES

A. Up To and Including 2 Inches:
   1. Manufacturers:
      a. Apollo #80-100
      b. Watts #B-6000-UL
      c. Nibco #T-580-70-UL
      d. Engineer approved equal.
   2. Bronze two piece body, standard or full port, chrome plated ball, Teflon seats and stuffing box ring, lever handle, threaded ends. UL listed for natural gas service.

PART 3 EXECUTION

3.01 INSTALLATION

A. This contractor shall furnish all labor and material necessary to install gas piping to all items of equipment shown on the drawings as requiring gas.

B. Accessible piping smaller than two inch (2") may be screwed.

C. All concealed gas pipe and all gas piping two inch (2") and larger shall be fabricated using weld type fittings.

D. All steel gas piping buried in earth shall be Schedule 40 black steel mill wrapped and all joints shall be welded.

E. Underground joints shall be wrapped with Minnesota Mining and manufacturing Scotchwrap.

F. All gas piping shall be tested at 50-psi air pressure for a 24-hour period.

G. This contractor shall furnish and install a gas cock shut off in the branch line to each gas-consuming piece of equipment. Provide plug valves where noted on the plans.

H. This contractor shall begin at the meter and shall run gas piping to all gas using equipment as shown on the drawings.

I. Verify all piping regulations and regulators required with local gas company before running gas lines.

J. All gas piping that is run exposed to weather shall be given two coats of rust resisting paint.

K. All gas piping carrying 1 psig or more shall be welded.

3.02 GAS REVISIONS

A. The present natural gas service shall remain in its' present location.

B. Any charges by the gas utility company to provide service to the building shall be included in this contractor's bid.

C. Gas mains run over roof shall be supported on 4' x 4' sleepers, roof products, corps supports, or plastic molded roof support devices.

D. Coordinate construction heating gas requirements with utility company prior to start of construction.

END OF SECTION 23 1123

SECTION 23 2923
VARIABLE FREQUENCY MOTOR CONTROLLER

PART 1 GENERAL

1.01 SCOPE

A. All variable frequency motor controllers that are not integral to factory furnished equipment such as air handlers, chillers, pump skids, etc., must be furnished by the facilities management system (FMS) contractor and installed by the electrical contractor.

B. The FMS contractor is responsible to provide all low voltage control wiring and cabling required to interface the FMS with the variable frequency motor controllers.

1.02 SECTION INCLUDES

A. Variable frequency motor controller to include a variable frequency drive (VFD) and a VFD bypass.

1.03 RELATED SECTIONS

A. Specification Section 23 0993 - Sequence of Operation

1.04 REFERENCES

A. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives

B. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association)

E. NFPA 70 - National Electrical Code

F. UL 508C - Standard for Power Conversion Equipment

G. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements - Electrical, Thermal and Energy

1.05 SUBMITTALS

A. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and over current protective devices, short circuit ratings, dimensions, and enclosure details.

B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

C. Test Reports: Indicate field test and inspection procedures and test results.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Manufacturer's Field Reports: Indicate start-up inspection findings.

F. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

G. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: UL or ETL Listed Mark to demonstrate product as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept controllers on site in original packing. Inspect for damage.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.08 WARRANTY

A. Provide parts and labor warranty of variable frequency motor controller for one year from date of substantial completion of project or 18 months after date of shipment from manufacturer, whichever is sooner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB

B. Danfoss

C. Siemens

D. Square D

E. Toshiba

F. Yaskawa

G. Trane

H. Johnson Controls

I. No engineer approved equal.

2.02 DESCRIPTION

A. Enclosed variable frequency controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7.

B. Select unspecified features and options in accordance with NEMA ICS 7.1.

2.03 RATINGS

A. Rated Input Voltage: See schedule.

B. Motor Nameplate Voltage: See schedule.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 deg C to 40 deg C.

E. Provide equipment which complies with UL508C or UL 61800-5-1.

2.04 DESIGN FEATURES

A. VFD must use microprocessor-based inverter logic isolated from power circuits.

B. VFD must use variable torque pulse-width-modulated inverter system.

C. VFD must have ability to operate at full load and have motor disconnected from output without damage to the system.

D. VFD must attempt five automatic restarts following fault condition before locking out and requiring manual restart.

E. VFD must catch and run forward a reverse rotating load.

F. VFD and VFD bypass (variable frequency motor controller) to have short circuit withstand rating of at least 65K RMS symmetrical Amps.

G. VFD must be field programmable to skip two adjustable width frequency bands.

H. VFD must have a field programmable carrier frequency adjustable up to at least 15 KHz.

I. VFD must have a P+I controller that can modulate the VFD speed to maintain a set point and use a field provided 4-20 mA or 0-10 Vdc transmitter.

2.05 PRODUCT OPTIONS AND FEATURES

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for over current, over voltage, ground fault, over temperature, and input power ON.

C. Volts Per Hertz Adjustment: +/- 10%

D. Current Limit Adjustment: 60% - 110% of rated.

E. Acceleration Rate Adjustment: 0.5 - 30 seconds.

F. Deceleration Rate Adjustment: 1 - 30 seconds.

G. Input Speed Signal: 4 - 20 mA and 0-10 Vdc.

H. Under voltage release.

I. Control Power Source: Integral control transformer.

J. Door Interlocks: Provide mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

K. Safety Interlocks: Provide terminals for remote contact to inhibit starting under both manual and automatic mode.

L. Control Interlocks: Provide terminals for remote contact to allow starting in automatic mode.

M. VFD Bypass: Provide HOA switch, contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. Provide isolation switch to allow maintenance of VFD during bypass operation. Provide terminals for field provided safety interlock that can shut down the VFD and VFD bypass.

N. Disconnecting Means: Include integral disconnect switch on the line side of each controller.

O. Output Filter: Provide 5% load reactor when output lead length is over 150 feet.

P. Input Filter: Provide 3% input AC line reactor.

Q. Condensation Control: If the enclosure is NEMA 3R or NEMA 4, provide an enclosure heater and thermostat.

2.06 FMS INTERFACE

A. Provide the VFD with a communication interface to the FMS.

B. The VFD must have enough internal logic and memory to respond to control and monitoring by the FMS.

C. The interface must use BACnet MS/TP or MODBUS RTU communication protocol.

D. The interface may alternately use Johnson N2 or Siemens Apogee FLN communication protocol at the request of the FMS contractor.

2.07 FABRICATION

A. Wiring Terminations: Match conductor materials and sizes indicated.

B. Enclosure: NEMA 250, suitable for equipment application in places restricted to persons employed on the premises.
   1. Indoor dry locations: Type 1.
   2. Indoor wet or outdoor locations: Type 3R.

C. Finish: Manufacturer's standard enamel.

2.08 SOURCE QUALITY CONTROL

A. Shop inspect and perform standard productions tests for each controller.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

C. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION

A. The electrical contractor is responsible for the installation items.

B. Install in accordance with NEMA ICS 7.1.

C. Make sure that the motor(s) rotate in correct direction when VFD and VFD bypass are used.

D. Tighten accessible connections and mechanical fasteners after placing controller.

E. Select and install overload heater elements in motor controllers to match installed motor characteristics.

F. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.03 FIELD QUALITY CONTROL

A. Inspect in accordance with NETA ATS.

B. Perform inspections listed in NETA ATS.

3.04 MANUFACTURER'S FIELD SERVICES

A. Provide as many start up sessions as are required for phasing.

3.05 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of loads. Obtain performance requirements from installer of loads.

3.06 DEMONSTRATION

A. Demonstrate operation of VFD in automatic and manual modes.

B. Demonstrate operation of VFD bypass.

END OF SECTION 23 2923

SECTION 23 3100
HVAC DUCTS AND CASING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials

B. Ductwork fabrication

C. Manufactured ductwork and fittings

1.02 RELATED SECTIONS

A. Specification Section 23 0593 - Testing, Adjusting, and Balancing for HVAC

B. Specification Section 23 0713 - Duct Insulation.

C. Specification Section 23 3300 - Air Duct Accessories.

D. Specification Section 23 3600 - Air Terminal Units.

E. Specification Section 23 3700 - Air Outlets and Inlets.

1.03 REFERENCES

A. ASTM A 36 - Structural Steel

B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles

C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality

E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

F. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality

H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled

I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality

J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate

K. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe

L. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets

M. AWS D9.1 - Welding of Sheet Metal

N. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyester Chemical Resistant Process Equipment

O. NFPA 90A - Installation of Air Conditioning and Ventilating Systems

P. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems

Q. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying

R. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment

S. SMACNA - HVAC Air Duct Leakage Test Manual

T. SMACNA - HVAC Duct Construction Standards - Metal and Flexible

U. UL 181 - Factory-Made Air Ducts and Connectors

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for four inch (4") pressure class and higher and kitchen hood exhaust systems.

B. Product Data: Provide data for duct materials, duct liner, and duct connectors.

1.06 PROJECT RECORD DOCUMENTS

A. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

B. Maintain one copy of document on site.

1.08 QUALIFICATIONS

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

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

1.09 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A Standards.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Galvanized Steel Ducts: ASTM A924 and ASTM A653 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90.

B. Insulated Flexible Duct
   1. Manufacturers:
      a. Thermaflex G-KM
      b. Flexmaster
      c. Atco
      d. Engineer approved equal.
   2. UL 181, Class 1, NFPA 90A and 90B compliant, interlocking spiral of steal wire, fiberglass insulation with R value of 4.2 or greater; core shall be chlorinated polyethylene vapor barrier film. (Polyester is not acceptable). Outer shell/vapor barrier shall be metalized polyester or polyethylene film.
   3. Pressure Rating: Six inch (6") positive and one inch (1") negative.
   4. Maximum Velocity: 5000 fpm.
   5. Temperature Range: -20 to 180 deg F.
   6. Vapor Transmission: 0.1 perms or less (ASTM E96)
   7. Flex Elbows: Flex duct 90 degree elbow splines for connections to diffusers. Flex elbows shall prevent kinks in flex duct. Elbow spline shall be UL-2043 listed for use in plenums.

C. Fasteners: Rivets, bolts or sheet metal screws.

D. Duct Sealant
   1. Manufacturers:
      a. Design Polymerics (DP1010)
      b. Ductmate
      c. Durodyne
      d. Engineer approved equal.
   2. Description: Water based, non hardening, high velocity/high pressure duct sealant intended for indoor and outdoor HVAC ducts.
   3. Pressure Rating: 10" water column minimum.
   4. Service Temperature: -20 to 200F
   5. Listings
      a. ASTM E-84/UL723 Flame/Smoke Spread: 25/50 or less.
      b. UL-181B listed for use on Flex Duct connections.
      c. Conforms to NFPA 90A & 90B requirements.
      d. Approved for use on interior of ducts.
   6. VOC Content
      a. 0 g/L
      b. CDPH Standard Method v1.1 (14 days): Less than 5.0 mg/m3.

E. Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing and sealing for operating pressures indicated.

B. Increase duct sizes gradually, not exceeding 15 degree divergence wherever possible; maximum 30 degree divergence upstream of equipment and 45 degree convergence downstream.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with fiberglass insulation.

D. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum four inch (4") cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs or 90 degree conical tee takeoffs.

F. Fabricate all exposed ductwork using paint grip galvanized sheet metal.

G. All outside air intake or relief ductwork above finished areas shall be caulked to be watertight. An auxiliary continuous drain pan shall be provided beneath these ducts to prevent damage in case of a waterproofing failure. Line this drain pan with 1/2 inch duct liner and turn up all edges.

H. All joints in rectangular, round or oval ductwork that exceed 100 inches in perimeter length shall be made with Ductmate, TDC, or TDF connections.

2.03 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Round Ducts: Machine made from round spiral lock seam duct with light reinforcing corrugations, fittings manufactured at least two gauges heavier metal than duct.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. All ductwork shall be sealed to provide a SMACNA Seal Class A installation for all longitudinal seams, all transverse seams and all duct penetrations. Flame spread rating shall not exceed 25 and smoke developed shall not exceed 50 when tested in compliance with ASTM-E-84-87.

D. Sealant shall be non-hardening and water resistant. Sealant shall be capable of being applied with a brush and shall be applied in accordance with manufacturer's instructions. Each seam or penetration shall be dressed after application of sealant for neat appearance.

E. Ductwork shall be installed following essentially lines indicated on the drawings. Install offsets, and angles. Transitions may be required to avoid interference with other work and existing conditions. Maintain full capacity of ductwork.

F. Flex Duct Installation:
   1. Maximum length of flex duct: 5ft
   2. Provide 90 deg elbow splines to prevent flex duct kinking, especially when connecting to ceiling diffusers
   3. Connections to rigid ducts and fittings: Peal back insulation and place flexible inner core over fitting and seal with two layers of duct tape (minimum 2" overlap on fitting and flex duct core). Install clamps over the top of the duct tape. Stretch insulation back over fitting and wrap with two layers of duct tape. Duct Sealant/Mastic may be substituted for the tape that seals the inner core to the fitting. Refer to manufacturer's instructions. Duct tape, mastic/sealant and clamps shall be UL181 listed.

G. Duct sizes are net outside dimensions. Maintain outside sizes for lined ducts. Do not increase duct dimensions.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

J. Use crimp joints with or without bead for joining round duct sizes eight inch (8") and smaller with crimp in direction of airflow.

K. Use double nuts and lock washers on threaded rod supports.

L. Connect diffusers to low pressure ducts directly or with five foot (5') maximum length of flexible duct held in place with strap or clamp.

M. Connect flexible ducts to metal ducts with draw bands.

N. Set plenum doors six inch (6") to 12 inches above floor. Arrange door swing so that fan static pressure holds door in closed position.

O. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.02 SCHEDULES

DUCTWORK MATERIAL

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel

DUCTWORK PRESSURE CLASS

AIR SYSTEM	PRESSURE CLASS
Supply	2"
Return and Relief	1"
General Exhaust	1"

END OF SECTION 23 3100

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors

B. Backdraft dampers

C. Duct access doors

D. Duct test holes

E. Flexible duct connections

F. Volume control dampers

1.02 RELATED SECTIONS

A. Specification Section 23 3100 - HVAC Ducts and Casings.

B. Specification Section 23 3600 - Air Terminal Units.

1.03 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems

B. NFPA 92A - Smoke Control Systems

C. NFPA 70 - National Electrical Code

D. SMACNA - HVAC Duct Construction Standards - Metal and Flexible

E. UL 33 - Heat Responsive Links for Fire-Protection Service

F. UL 555 - Fire Dampers and Ceiling Dampers

G. UL 555S - Leakage Rated Dampers for use in Smoke Control Systems

1.04 SUBMITTALS

A. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and all accessories.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, and fire and smoke dampers. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate for combination fire and smoke dampers.

1.05 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors or test holes.

1.06 QUALIFICATIONS

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

1.07 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Architectural Specification Sections.

B. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction with push-pull operator strap.

2.02 BACKDRAFT DAMPERS

A. Manufacturers:
   1. Ruskin
   2. United Air
   3. Greenheck
   4. NCA
   5. United Enertech
   6. Air Balance
   7. Engineer approved equal.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Extruded aluminum with blades of maximum six inch (6") width with flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, bearings and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ruskin
   2. Nailor
   3. Engineer approved equal.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. Install minimum one inch (1") thick insulation with sheet metal cover for insulated ductwork.
   1. Less Than 12 Inch Square: Secure with sash locks.
   2. Up to 18 inch Square: Provide two hinges and two sash locks.
   3. Up to 24 inch x 48 Inches: Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Provide an additional hinge.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches or neoprene plugs.

B. Permanent Test Holes: Factory fabricated, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Connector: Fabric crimped into metal edging strip.

C. Fabric: UL listed fire-retardant neoprene coated woven fiberglass fabric to NFPA 90A, minimum density 30 oz. per sq. yd.

D. Net Fabric Width: Approximately two inches (2") wide.

E. Metal: Galvanized 24 gauge steel, three inches (3") wide.

F. Leaded Vinyl Sheet: Minimum 0.55 inches thick, 0.87 lbs. per sq. ft., 10 dB attenuation in 10 to 10,000 Hz range.

2.06 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Single Blade Dampers: Fabricate for duct sizes up to 6" x 30 inches.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 inches x 72 inches. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. End Bearings: Except in round ductwork 12 inch and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases or adapters.
   3. Where rod lengths exceed 30 inches, provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install duct pressure relief doors in ductwork serving the scheduled equipment.

B. Install duct pressure relief doors in easily observable location.

C. Adjust duct pressure relief doors to the specified pressure relief setting.

D. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.

E. Provide backdraft dampers on exhaust ducts nearest to outside and where indicated.

F. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers at fire dampers, combination fire and smoke dampers and elsewhere as indicated. Review locations prior to fabrication.

G. Provide duct test holes where indicated and required for testing and balancing purposes.

H. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment and supported by vibration isolators. Use braided stainless steel flexible connections to equipment located within a one hour rated area.

I. Provide volume balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off. Drawings may not indicate all volume damper locations.

J. Provide volume balancing dampers on duct take-off to diffusers, grilles and registers, regardless of whether dampers are specified as part of the diffuser, grille or register assembly. Locate as close as possible yet accessible to the main trunk duct. Drawings may not indicate all volume damper locations.

K. Provide turning vanes in all supply, return and exhaust ductwork unless noted otherwise. Turning vanes shall not be installed in kitchen hood exhaust, dishwasher hood exhaust and kiln hood exhaust.

END OF SECTION 23 3300

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters

1.02 RELATED SECTIONS

A. Specification Section 23 3100 - HVAC Ducts and Casings

B. Specification Section 23 3300 - Air Duct Accessories

C. Specification Section 23 3416 - Centrifugal HVAC Fans

D. Specification Section 23 2923 - Variable Frequency Drives

E. Specification Section 23 0993 - Sequence of Operation for HVAC Controls

1.03 REFERENCES

A. AMCA 99 - Standards Handbook

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes

C. AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal

D. AMCA 300 - Test Code for Sound Rating Air Moving Devices

E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices

F. NEMA MG1 - Motors and Generators

G. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Vapors from Commercial Cooking Equipment

H. UL 705 - Power Ventilators

1.04 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate installation instructions.

1.05 QUALITY ASSURANCE

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

1.06 REGULATORY REQUIREMENTS

A. Kitchen Range Hood Exhaust Fans: Comply with requirements of NFPA 96.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 ROOF EXHAUSTERS

A. Manufacturers:
   1. Greenheck
   2. Carnes
   3. Penn Ventilators
   4. Cook
   5. Twin City Fan
   6. Acme
   7. Engineer approved equal.

B. Product Requirements:

1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.
4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

C. Performance: See drawings.

D. Fan Unit: V-belt or direct driven as indicated with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 16 gauge aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

E. Roof Curb: Self-flashing (14 inch high) aluminum or galvanized steel in here noted with continuously welded seams, built-in cant strips, one inch (1") insulation and curb bottom, curb bottom and factory installed nailer strip. The roof curb is to be approved by the building supplier when used on a metal roof.

F. Disconnect Switch: Factory wired, non-fusible in housing for thermal overload protected motor and wall mounted.

G. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked. Where indicated on the drawings and schedules provide a powered back draft damper with line voltage motor drive, power open, and spring return. Verify voltage.

H. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof or wall exhausters with cadmium plated steel lag screws to roof curb or structure.

C. Extend ducts to roof or wall exhausters into roof curb or structure. Counterflash duct to roof or wall or opening.

D. Provide sheaves required for final air balance.

E. Install backdraft dampers on inlet to roof and wall exhausters.

F. Do not operate fans until ductwork is clean, filters are in place, and bearings are lubricated.

G. If equipment is to be operated prior to building turn over to the owner, the mechanical contractor must install filter media on all return and exhaust grilles. The contractor shall provide documentation that filters have been check on a daily basis.

3.02 EXAMINATION

A. Examine areas to receive fans. Notify the Design Team Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans.

3.03 SCHEDULES

A. See drawings.

END OF SECTION 23 3423

SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers/registers/grilles

1.02 REFERENCES

A. ADC 1062 - Certification, Rating and Test Manual

B. AMCA 500 - Test Method for Louvers, Dampers and Shutters

C. ARI 650 - Air Outlets and Inlets

D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets

E. SMACNA - HVAC Duct Construction Standard - Metal and Flexible

F. NFPA 70 - National Electrical Code

G. NFPA 90A - Installation of Air Conditioning and Ventilating Systems

1.03 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Review ceiling type and style before submitting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 PROJECT RECORD DOCUMENTS

A. Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.06 QUALIFICATIONS

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

PART 2 PRODUCTS

2.01 DIFFUSERS/REGISTERS/GRILLES

A. Manufacturers:
   1. Titus
   2. Carnes
   3. Tuttle & Bailey
   4. Price Ind.
   5. Krueger
   6. Nailor
   7. Engineer approved equal.

B. Refer to schedule on drawings for style, size, and finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position and type to conform to architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with airtight connection.

D. Provide balancing dampers on duct take-off to diffusers, grilles and registers, despite whether dampers are specified as part of the diffuser or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

3.02 SCHEDULES

A. See drawings.

END OF SECTION 23 3700

SECTION 23 7400

SMALL PACKAGED ROOFTOP UNITS (ECONOMY 3-12 TONS)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rooftop Units (6-12 ton)

1.02 RELATED SECTIONS

A. Specification Section 23 0553 - Identification for HVAC Piping and Equipment

B. Specification Section 23 0593 - Testing, Adjusting, and Balancing for HVAC

C. Specification Section 23 0923 - DDC Control System

D. Specification Section 23 0993 - Sequence of Operation for HVAC Controls

E. Specification Section 23 1123 - Natural Gas Piping

1.03 REFERENCES

A. AHRI 340/360 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment (Ratings for 6 ton and larger, EER/IEER)

B. AHRI 210/240 Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment (Ratings for 3-5 ton, EER/SEER)

C. AHRI 370 Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment

D. AMCA 511 Laboratory Methods of Testing Dampers

E. ANSI Z21.47 Gas-Fired Furnaces

F. ASTM B117 Standard Practice for Operating Salt Spray Apparatus

G. UL 1995 Heating and Cooling Equipment

H. NEC National Electric Code, current version

I. NFPA 90A/B Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems

J. ASHRAE 90.1 Energy Standard for New Buildings except Low-Rise Residential Buildings

K. ASHRAE 15 Safety Code for Mechanical Refrigeration

L. ASHRAE 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (MERV ratings)

1.04 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities of selected model clearly indicated; dimensions; required clearances; shipping, installed, and operating weights; furnished specialties; accessories; and installation and startup instructions.

B. Shop drawings detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.

C. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

D. Commissioning Reports: Indicate results of startup and testing commissioning requirements. Submit copies of checklists.

E. Maintenance Data: Provide all Installation and Maintenance data available from the manufacturer.

F. Warranties: Warranties specified in this section

1.05 QUALITY ASSURANCE

A. Units shall be tested and certified to ANSI Z21.47/UL 1995.

B. Efficiency Ratings: Units shall exceed or be within 5% of the scheduled ratings (EER/SEER/IEER) per AHRI 210/240 (3-5 ton) or AHRI 340/360 (6 ton and larger). All units shall be certified and rated by AHRI. A manufacturer calculated EER/SEER/IEER is not an acceptable substitution to AHRI certification.

C. Fabricate and label refrigeration system to comply with ASHRAE 15.

D. Unit performance shall meet or exceed the requirements shown on the schedule included within the construction documents.

E. Unit shall be test run at the factory. This test includes pressure testing of the fans, the heating and cooling operation, the hot gas re-heat operation, and control system. All coils and piping shall be leak tested.

1.06 DELIVERY AND HANDLING

A. The RTU must be delivered to the job site fully assembled and ready for installation.

B. The RTU must be fully charged with refrigerant and oil by the manufacturer or a manufacturer trained and authorized service organization.

C. Store, handle and lift the RTU per the manufacturer's instructions.

1.07 WARRANTY

A. Contractor shall provide a full parts and labor warranty for one year from start-up or 18 months from shipment, whichever occurs first.

B. Provide a five year extended warranty for compressors (parts only).

C. Provide a 10 year limited warranty for the gas heat exchanger (parts only). Warranty period shall be 15 years for Stainless Steel Heat Exchangers.

1.08 EXTRA MATERIALS

A. Provide two sets of filters. One set shall ship within the unit. The second set shall be sent within original packaging and used at substantial completion.

B. Belt driven fans: Provide an extra set of fan belts. Ship within unit cabinet.

PART 2 PRODUCTS

2.01 ROOFTOP UNITS (6-12 TON)

A. Manufacturers:
   1. Trane
   2. Carrier
   3. Daikin
   4. JCI
   5. Lennox
   6. AAON
   7. Engineer approved equal.

B. General
   1. Factory assembled and tested; designed for roof or slab installation; and consisting of compressors, condensers, evaporator coils, hot gas reheat coils, condenser and evaporator fans, refrigeration and temperature controls, heater, filters, and dampers.

C. Cabinet
   1. Material: Galvanized steel with factory finish certified to a minimum 500 hour salt spray test per ASTM-B117.
   2. Insulation: ½" fiberglass insulation with foil facing.
   3. Access Panels: Hinged panels with ¼ turn latches shall be present on the fan, evaporator, economizer and filter sections.

4. Base rail: Structural galvanized steel with rigging holes.
5. Convertible configuration: Unit shall be able to be field converted for horizontal duct connections. See plans for duct connection details.
6. Condensate Pan: Double sloped non-corrosive polymer or stainless steel.

D. Refrigerant System
1. Refrigerant: R-410A
2. System Components
   a. Thermal expansion valve
   b. Filter drier/strainer
   c. Service gage connections for suction and liquid lines
   d. Hot-gas Reheat: A hot-gas reheat valve shall divert hot gas off the compressor and direct it to the re-heat coil allowing for dehumidification without a call for space cooling.
3. Compressors
   a. Fully hermetic Direct-drive scroll compressors. System shall have a minimum of two stages. See schedule for required staging.
   b. Compressor shall be factory mounted on rubber grommets.
   c. Compressors shall be internally protected from high discharge temperature conditions.
   d. Provide crankcase heaters for cold weather operation and start-up.
   e. Evaporator Coil
      1) Multi-row coil with copper tubes with mechanically bonded aluminum fins.
      2) All joints shall be soldered or brazed.
      3) Coils shall be factory leak tested, evacuated and charged with refrigerant.
   f. Condenser Coil
      1) Copper tubes with mechanically bonded aluminum fins.
      2) All joints shall be soldered or brazed.
      3) Coils shall be factory leak tested, evacuated and charged with refrigerant.

E. Evaporator Fan Assembly
1. Fan Wheel: Double Inlet Forward Curved wheel or Backward Curved plenum fan, statically and dynamically balanced for entire RPM range.
2. Bearings: Permanently Lubricated.
3. Drive: Belt Drive with adjustable sheaves for balancing.
4. Variable Speed Operation: Motors may be multi-speed or controlled via a VFD. Fan speed must modulate with compressor staging.

F. Condenser Fan
1. Direct drive propeller type
2. Bearings: Permanently lubricated
3. Construction: Aluminum blades riveted to a steel shaft. Composite blades are acceptable.

G. Gas Fired Heating
1. Induced draft, power vented, indirect gas fired furnace.
2. Direct Spark Ignition with in shot burners.
3. Construction: 409 Stainless Steel
4. Heating Stages: 2 stages minimum.
5. Safeties: High temp limit, motor speed sensor, flame roll-out switch, flame proving controls.

H. Mixed Air/Economizer Section
1. Fully Modulating (0-100%) economizer with prewired actuators.
2. Minimum damper setting shall be field adjustable.
3. Dampers: Low leak dampers. Class 1 per AMCA 511 (maximum leakage of 4cfm/sq.ft @ 1” static).
4. Intake: Provide with weather hood and bird screen.

5. Relief:
    a. Power Exhaust Relief: Exhaust fan assembly provides building pressure relief during economizer operation. Power Exhaust assembly shall include a weather hood and barometric backdraft dampers
6. Economizer Control: Fixed Dry Bulb

I. Filter Section
1. Frame: 2” slide in filter frame accessed via a hinged access panel.
Media: MERV 13 pleated throwaway filters.

J. Electrical
1. Single Point Power Connection
2. Factory mounted disconnect

K. Accessories
1. Condenser Coil Hail Guards. Guards shall be factory installed.

L. Roof Curb
1. Galvanized steel curb with factory wood nailer
2. Insulation: Minimum 1” rigid insulation
3. Height: 24”

M. Controls
1. Provide all necessary microprocessor control components to properly perform the features required in this specification and on the schedule.
2. Multi Speed Operation: The evaporator fan motor shall vary its speed based on cooling demand in the space. At a minimum the fan motor speed shall correlate to the cooling stage. At cooling stage one, the evaporator fan shall operate at approximately 75% airflow. At cooling stage 2 the fan speed increases to 100% airflow.
3. Space Sensors:
    a. Programmable Digital Thermostat (compatible with specified cooling and heating stages) capable of night setback and 7-day programming.
    b. Humidity Sensor (Hot Gas re-heat control)
4. Building Automation Communication Interface: Provide a BacNet DDC integration package that allows the building automation system to communicate with the rooftop unit. The DDC integration shall allow the BAS user to adjust RTU setpoints. See 23 0993 for additional integration requirements. Coordinate exact communication protocol with the Building Automation contractor prior to issuing submittals

PART 3 EXECUTION

3.01 INSTALLATION

A. Install per manufacturer’s instruction.

B. Install in accordance with NFPA 90A and NFPA 54.

C. Mount units on roof curb to provide a watertight enclosure. Curb shall be installed level.

3.02 FACTORY STARTUP

A. Engage a factory-authorized service representative to perform startup service. The installing contractor shall not be considered a factory-authorized service representative.

B. The factory-authorized service representative shall complete startup checks according to manufacturer’s written instructions. This shall include, but is not limited to the following:
1. Evaporator Fan Balancing (maximum flow): On direct drive fans the maximum fan speed will need to be adjusted according to the actual external static pressure on the installed system. The max fan speed shall be adjusted to match the scheduled maximum flow on the schedule. This balancing will likely include measuring the amp draw and system ESP to determine the maximum fan speed. This work shall be coordinated with the Test and Balance Contractor.

2. Outdoor Air Damper Operation: On multi-speed and variable speed units, the outdoor air damper position will change based on the fan speed. The damper position needs to be balanced/commissioned for each possible fan speed. This work shall be coordinated with the Test and Balance Contractor.
3. Power Exhaust: On units equipped with power exhaust, the “on” setpoint shall be set and commissioned per the manufacturer’s instruction. The “on” setpoint will likely be associated with the OA damper position. The “on” setpoint shall be adjusted accordingly to ensure that the space does not become too positive during economizer operation. The “on” setpoint will likely fall within an OA damper position of 70-90%.

C. Start unit according to manufacturer’s written instructions.

3.03 OWNER DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain the unit. Provide a sign in sheet to document when demonstration occurred, who attended, and what maintenance items were reviewed.

END OF SECTION 23 7400

SECTION 26 0050
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Electrical Division Specification Sections.

B. Division 26 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

C. Division 26 Specification requirements also include, by reference, Specification Section 08 7100 - Door Hardware. Review and inclusion of the electrical requirements of this specification section are included as a part of this contract.

1.02 OWNER OCCUPANCY

A. The owner will occupy the premises during the construction period.

B. Limit use of site and premises to allow owner occupancy.

C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.

D. Schedule the work to accommodate this requirement.

1.03 REGULATORY REQUIREMENTS

A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.

B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.

C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.

E. All work shall comply with the applicable recommendations of:
   1. The National Board of Fire Underwriters
   2. The ANSI-NFPA 70 National Electrical Code
   3. The National Fire Protection Association (NFPA)
   4. The Occupations Safety and Health Act (OSHA)
   5. IBC Building Code (current) and any current applicable city building and or electrical codes.
   6. Fire Protection: Conform to International Fire Code (IFC) and NFPA.
   7. International Energy Conservation Code (IECC)

F. Obtain permits and request inspections from authority having jurisdiction.

G. Conform to latest approved versions of codes.

1.04 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.

C. This contractor, before submitting their bid, shall visit the site of the project to familiarize themselves with locations and conditions affecting their work.

D. It is the intent of this specification that the contractor furnish all labor and material required to complete the installation as outlined in the drawings and specifications. No additions to the contract price will be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.

E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing wiring conduits, electrical panels, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.

F. This contractor shall provide, as necessary, for the installation of their work and in accordance with materials other than the structure.

1.05 SEQUENCING AND SCHEDULING

A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.

B. This contractor shall be kept informed as to the work of other trades engaged in the project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.

C. Where space for mechanical and electrical lines and piping is limited, it is imperative that all such trades coordinate their work so as to insure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.06 GUARANTEE

A. This contractor shall guarantee all of the apparatus, materials, equipment furnished, and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.

B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.07 ENGINEER APPROVED EQUAL PRODUCTS

A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.

B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.

C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".

D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.08 OWNER'S RIGHT OF SALVAGE

A. Before beginning construction, the contractor shall check and verify with the owner each item of existing equipment that must be removed.

B. The owner will designate which items of material or equipment not reused that they may wish to keep. The contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.

C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from the site.

1.09 PROTECTION AND MAINTENANCE

A. The work covered by these drawings and specifications may involve work in both new and remodeled areas of the building.

B. Where necessary to connect to any existing utility service, this electrical contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.

C. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.

D. This contractor shall protect existing equipment in finished areas from dirt, dust and damage as a result of their work.

E. Coordinate protection requirements with department heads before beginning construction.

F. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.10 DEMOLITION

A. This contractor shall be responsible for the demolition and removal of all existing electrical elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be reused".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.
   4. All elements to be removed are subject to the Owner's Right of Salvage.

B. Preserve services to the existing facility. Extend/reroute/reconnect the existing systems as required providing for the continued function of these systems.

1.11 CUTTING AND PATCHING

A. This contractor shall do all cutting and patching necessary for the installation of his work in all existing and new buildings unless otherwise noted.

B. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, this contractor shall be responsible to patch and/or seal openings as necessary to maintain and/or return fire separation to rating as required by applicable codes.

C. This contractor shall do all cutting and patching required for his work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.12 CLEANING AND RUBBISH

A. This contractor, upon completion of their work, shall remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.

B. As far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.

C. This contractor shall maintain the work area each day to prevent hazardous accumulation of waste from their work.

1.13 SEALING AND PENETRATION

A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.

B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.

C. Manufacturer offering products to comply with the requirements include the following:
   1. Dow Corning "Silicone RTV Foam"
   2. 3-M Corporation "Fire Barrier Caulk and Putty"
   3. Thomas & Betts "Flame Safe Fire Stop System"

D. Installation of these products are to be in strict accordance with the manufacturer's recommendations.

E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.14 ELECTRICAL CONNECTIONS

A. This contractor shall mount and wire all magnetic starters, thermal protective switches, and speed changing switches furnished under the mechanical contract and install such starters and switches and wire them to their respective motors as a part of the electrical contract.

B. All other magnetic starter switches, safety switches and speed control devices indicated on the electrical drawings or specifications are the responsibility of the electrical contractor to furnish and install.

C. Unless specifically stated elsewhere, the wiring of the temperature control system shall be the responsibility of the mechanical contractor.

D. The contractor shall provide line voltage power and rough-in for Fire Alarm system. Coordinate required line voltage and installation locations prior to bid.

1.15 HAZARDOUS MATERIALS

A. If the contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them at the site. The contractor shall inform the owner and all employed of any potential exposure to this material.

B. At no time shall any product containing asbestos be incorporated into the work.
   1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.16 AS-BUILT DRAWINGS

A. This electrical contractor shall provide (at the conclusion of the project) one clean, non-torn, neat and legible "as-built" set of drawings to the owner. These drawings shall show the routing of conduit, wiring and equipment drawn in at scaled locations. All circuits shall be labeled and shall conform to labeled panel breakers. All dimensions indicated shall be referenced to a column line. A set of construction drawings will be furnished for this work.

B. All electrical panels and electrical installed equipment shall be shown on the "as-built" drawings.

C. Refer to General Specification Sections for additional requirements.

D. This contractor shall update these drawings during the project at least once a week.

1.17 ALTERNATES

A. Refer to description of alternate bids under General Specification Sections.

1.18 REVIEW OF MATERIALS

A. This contractor shall submit to the engineer for review one (1) electronic copy giving a complete list of materials, fixtures, devices and panels they propose to furnish. The brochure shall

contain complete information as to the make of equipment, type, size, capacities, dimensions, and illustration. One of the returned copies shall be kept on the job at all times.

B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless the contractor notifies engineer, in writing, of such deviation at time such drawings are furnished.

C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.

D. This contractor shall mark the date and sign each set. This indicates that each of them have been checked in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted or checked and will be marked "resubmit" and sent back to the contractor.

1.19 TEST OF SYSTEMS

A. This contractor shall, before concealed, test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.

B. This contractor shall be held responsible for all damage resulting from defects in the system.

C. Each individual feeder circuit shall be tested at the panel and in testing for insulation resistance to ground; the power equipment shall be connected for proper operation. In no case shall the insulation resistance to ground be less than that required by the National Electrical Code (NEC).

1.20 SCOPE OF WORK

A. This contractor shall furnish all the labor and material necessary to install a complete electrical system for the building. The system shall include all items of work as outlined in these specifications and on the drawings.

B. All work shall be performed by a well-qualified, licensed electrician with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their employees are familiar with all the various codes and tests applicable to this work.

C. All equipment shall be new and of the type specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.

D. The intent of the specifications and drawings is for complete installation of the systems outlined in the specifications and drawings so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation. The specifications and drawings cannot deal individually with the many minute items that may be eventually required by the nature of the systems.

E. This contractor is required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type.

F. This contractor, before proceeding with any work, shall review the architectural drawings. Any conflict between the electrical and architectural drawings shall be reported to the engineer for clarification.

G. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer’s attention and an addendum is issued for clarification.

H. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. All elevations shall be coordinated with all trades in the field prior to installation. When a conflict

between trades arises, the design team shall be notified immediately prior to further installation however priority shall be as follows:

1. Lighting Fixtures
2. Gravity flow piping, including steam and condensate.
3. Electrical bus duct.
4. Sheet metal.
5. Cable trays, including access space.
6. Other piping.
7. Conduits and wireway.

1.21 DAILY HOUSEKEEPING AND CLEANING

A. At the end of each workday, the contractor shall remove all of their debris, rubbish, tools, and surplus materials from the project work area. The work area shall be broom cleaned and left in a neat and orderly condition. The contractor shall not use the owner's waste disposal facility for the removal of debris from the project.

B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.22 OWNER'S RIGHT OF WORK CESSATION

A. The owner reserves the right to order an immediate cessation of work without giving advance notice.

1.23 ELECTRICAL UTILITY COMPANY

A. Any fees by the utility company are to be billed directly to the owner.

B. The contractor is required to assist the owner in the preparation of all utility company rebate forms that deal with equipment furnished and/or installed as a part of this contractor, including but not limited to LED Lighting.

1.24 TELECOMMUNICATIONS UTILITY COMPANY

A. Any fees by the telecommunications utility company are to be billed directly to the owner.

1.25 WALL CONTINUITY (1 HR.)

A. All items mounted in 1 hr. rated walls requiring an opening larger than a four inch (4") square (16 sq. inches) require the 1 hr. rating not be degraded.

B. Any branch panel in a 1 hr. wall will require the exterior of the recessed panel be covered with 5/8 inch fire rated gypsum board. This is true for any device requiring more than a 16 sq. inch opening.

1.26 LOW VOLTAGE CONDUIT INSTALLATION

A. This contractor shall install conduit serving low voltage cables located in all mechanical rooms and non-accessible areas and exposed structural areas. Use cable trays in other areas as indicated on the drawings. Where cable trays are not accessible, use J-hooks equal to Caddy Cable CAT. Provide hooks with closure holes and cable ties. Mount hooks three foot (3') on center.

B. This contractor shall install conduit sleeves serving low voltage cables through walls and floors.

C. Refer to other specification sections for additional information.

1.27 TEMPORARY POWER AND LIGHTING

A. Temporary electrical power and lighting necessary for the construction process is the responsibility of the electrical contractor and shall be included in the base bid amount.

1.28 EXTRA MATERIALS AND LABOR

A. The electrical contractor shall include in their bid additional resources for the removal and installation of 5 existing junction boxes in order to maintain access upon completion of construction. Provide new wiring as necessary where length is insufficient to maintain a complete system. The relocation requests may occur anytime during the construction process

as requested by the Owner or Design Team. Junction boxes may be associated with Divisions 26, 27 and 28.

1.29 DIGITAL MEDIA AGREEMENT

A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.

B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is $100.00 per CAD sheet.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 26 0050

SECTION 26 0051

PRE-BID SUBSTITUTION REQUEST FORM

This document shall be submitted for all MODUS projects where a manufacturer's sales rep requests that additional products be considered where they are not currently listed on the lighting fixture schedule and/or specifications. Where "Engineer Approved Equal" is listed on the fixture schedule, the designer for the project was unable to find a product that matched the performance and/ or aesthetic criteria required. Product submittals shall include notations on any variances so that they are brought to the attention of the designer for consideration.

All substitution requests shall be submitted to the electrical engineer (10) ten business days prior to the project bid date. The electrical engineer contact information can be found on the first page of the MEP cover sheet. If information is not available, please contact MODUS directly at (515) 251-7280 to identify the responsible party.

Refer to the paragraphs below for product submittal requirements. However, only page 2 is to be completed and submitted with the required information.

LIGHTING FIXTURE SUBSTITUTION REQUEST FOR CONSIDERATION:

1. Provide a summary, description, and any discrepancies of the lighting fixture(s) being submitted for consideration. - i.e. "submitting alternate fixtures for cove products", "submitting alternate LED troffer", etc.
2. Summarize any differences that you are aware of for each product: "has 3.5" aperture while 3" was specified", "fixture has slightly lower lumen package but better efficacy", "steel pole instead of aluminum", etc.
3. Provide a list of lighting fixtures being submitted on your company letterhead along with this form at the beginning of the submittal. The list shall include the TYPE, MANUFACTURER and MODEL NUMBER that is being submitted.
4. Submitter shall include a product page for each type(s) being submitted. The product page shall have all parts of the model number identified by highlighting or boxing in the specific components. If these items are not identified, we will not review the submittal request.
5. Submit IES files for all products submitted, re-named with the fixture type being submitted. Photopia or other software created files will not be accepted. ie: TYPE FA.ies

LIGHTING CONTROLS SUBSTITUTION REQUEST FOR CONSIDERATION:

1. Provide a summary, description, and any discrepancies of the lighting control devices being submitted for consideration. ie - "submitting alternate control devices".
2. Please provide and review the sequence of operation located on our lighting drawings that outline the required control methods for each space. It is our expectation that the submitter completely understands the manufacturer's responsibility to make sure all parts and pieces are included is your submittal.
3. Provide manufacturer warranty and commissioning information.
4. Submitter shall include a product page for each type(s) being submitted. The product page shall have all parts of the model number identified by highlighting or boxing in the specific components.

SUMMARY OF OTHER LIGHTING RELATED ITEMS BEING SUBMITTED:

1. This section is for battery packs, inverters or any other items that you would like us to consider where you believe that you have an equivalent product for us to consider. Again, please don't just include "generic" cutsheets – identify exactly what products you are submitting and if there are any differences that we should be aware of.

PROJECT NAME: _____

PROJECT LOCATION: _____

DATE SUBMITTED:

_____

BID DATE: _____

ELECTRICAL ENGINEER: _____

FIXTURE SCHEDULE SHEET: _____

LIGHTING FIXTURE SUBSTITUTION REQUEST FOR CONSIDERATION:

Note that if a fixture is approved in our addendum, light fixtures will be approved only with the TYPE and MANUFACTURER listed. It shall be the responsibility of the submitter to verify that all information contained within the submittals after bids are awarded matches the dimensions, lumen outputs, voltages, dimming types, warranties, etc.

LIGHTING CONTROLS SUBSTITUTION REQUEST FOR CONSIDERATION:

SUMMARY OF OTHER LIGHTING RELATED ITEMS BEING SUBMITTED:

END OF SECTION 26 0051

SECTION 26 0080

ELECTRICAL SCHEDULE OF VALUES

PART 1 GENERAL

1.01 FORM COMPLETION

A. The successful Electrical Contractor shall complete this form in its entirety within 30 days of receipt of signed contract from the General Contractor, and submit directly to MODUS.

B. This information is confidential and will not be disclosed to any individual outside of MODUS. Data collected will be used in evaluating pay applications.

1.02 OVERALL CONTRACT

Base Electrical Bid	$ _____
Add or deduct accepted alternates, negotiated changes, or other modifications to the contract	$ _____
Total Electrical Bid	$ _____

1.03 SCHEDULE OF VALUES

Electrical Distribution - Material and Labor	$ _____
Electrical Distribution Installation - Material and Labor	$ _____
Interior Lighting - Material and Labor	$ _____
Wiring Devices - Material and Labor	$ _____
Lighting Control Devices - Material and Labor	$ _____
Total Electrical Bid (Sum of Schedule of Values)	$ _____

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 26 0080

SECTION 26 0090

MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 26 0050 - Basic Electrical Requirements "General Provisions" apply to this section.

1.02 SCOPE

A. This contractor shall be responsible for the demolition and removal of all existing electrical elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be relocated".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.

B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.

C. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.

D. This electrical contractor shall remove all abandoned equipment, conduit, supports, equipment curbs and bases associated with the remodeled area unless noted otherwise.

E. This contractor is responsible to provide temporary electrical protection during this project.

1.03 MATERIALS

A. All elements to be removed are subject to the Owner's Right of Salvage.

B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.

C. The owner may designate and have salvage rights to any material herein demolished by this contractor. It will be the owner's responsibility to designate such salvageable items and remove them prior to the contractor working in that area.

1.04 WORK BY OTHERS

A. Unless specifically noted under other contracts, the electrical contractor shall assume they will perform all required work. In general, the following will be performed by others:
   1. The mechanical contractor shall be responsible for the cutting and capping of all existing gas, water, sewer, and any other utility service.

1.05 EXISTING CONDITIONS

A. If any existing fixtures or devices that are to remain are disturbed by operations under this contract, the contractor is required to re-establish continuity of such systems.

B. The electrical contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to removal of equipment and conduit.

C. The electrical contractor shall furnish all required labor and material, where required, to extend new work to connect to similar work for extension of existing systems.

D. Demolition plans are based on casual field observations and existing record documents. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.

E. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes x-ray or similar non-destructive means. Where conduit is in concrete slab, cut conduit flush with floor, pull out conductors, and plug conduit ends.

F. 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.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field-circuiting arrangements and reconnect as necessary.

B. Verify that abandoned wiring and equipment serve only abandoned facilities. Reconnect circuits, as required, to prevent de-energizing of remaining receptacles and lights.

C. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

E. Review existing panels to remain in the area of construction. Notify the design team of any damaged circuit breakers or missing closure plates.

F. Review existing lighting to remain in the area of construction. Notify the design team of any non-functional lamps, ballasts, or electrical parts.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal. Disconnect circuits at the source.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations. This shall include 600 volt or less systems and low voltage signal circuits.

C. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchover connections. Obtain permission from the owner, at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections as required.

D. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switch over and connections. Notify owner and local fire service at least 24 hours before partially or completely disabling the system. Minimize outage duration. Make temporary connections to maintain service within construction areas and in areas adjacent to work area. EXISTING FIREALARM SYSTEM IS TO BE REMOVED ONCE THE NEW ONE IS OPERATIONAL.

E. Existing Telephone System: Maintain existing system in service.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of this section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide a blank cover for abandoned outlets that have not been removed.

F. Disconnect and remove electrical devices and equipment serving utilization removed equipment.

G. Disconnect and remove abandoned luminaires, brackets, stems, hangers, and other accessories. This contractor shall include in their bid, associated fees for disposal of ballasts and lamps.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installation using materials and methods compatible with existing electrical installations or as specified.

K. The electrical contractor is responsible for removal of lamps and ballast from existing fixtures to be demolished. The electrical contractor is to properly dispose of these items in accordance with codes for hazardous materials.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials that remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry.

3.05 INSTALLATION

A. Install relocated materials and equipment.

END OF SECTION 26 0090

SECTION 26 0519
ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building wire

B. Wiring connectors.

1.02 RELATED SECTIONS

A. Specification Section 26 0553 - Identification for Electrical Systems

B. Specification Section 26 2416 - Panelboards

1.03 REFERENCES

A. NECA Standard of Installation (National Electrical Contractors Association)

B. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association)

C. NFPA 70 - National Electrical Code

D. Product Data: Provide for each cable assembly type.

E. Test Reports: Indicate procedures and values obtained.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.04 SUBMITTALS

A. Project Record Documents: Record actual locations of components and circuits.

B. Project Record Documents: Provide documentation of the manufacturer’s recommended lug torque value for aluminum conductors, the date the lugs were torqued, and installed torque readings.

1.05 QUALIFICATIONS

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

1.06 REGULATORY REQUIREMENTS

A. Conform to NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 PROJECT CONDITIONS

A. Verify that field measurements are as indicated.

B. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 foot of length shown.

1.08 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

PART 2 PRODUCTS

2.01 BUILDING WIRE

A. Manufacturers:
   1. Okanite
   2. Bell/Hubbell #BICC
   3. American Insulated Wire
   4. General Cable

5. Southwire
6. United Copper Industries
7. Encore Wire Corporation
8. Engineer approved equal.

B. Description: Insulated conductor wire.
1. All wire shall be stranded. Refer to Section 26 0553 Identification for Electrical Systems for conductor color requirements.
2. Provide solid wire pigtails at all wiring devices and lighting control devices.

C. Conductor:
1. Copper

D. Insulation Voltage Rating: 600 volts.

E. Insulation: NFPA 70, type #THHN/THWN-2. All cable installation procedures or sizing shall be based on 75 deg C temperature rating.

2.02 WIRING CONNECTORS

A. Split Bolt Connectors:
1. Burndy
2. Engineer approved equal.

B. Spring Wire Connectors:
1. Thomas & Betts
2. Engineer approved equal.

C. Compression Connectors:
1. Burndy
2. Thomas & Betts
3. Engineer approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

C. Verify that raceway installation is complete and supported.

3.02 PREPARATION

A. Completely and thoroughly swab raceway over two inch (2") in size or buried below grade before installing wire.

3.03 WIRING METHODS

A. Concealed Dry Interior Locations: Use only building wire, type #THHN/THWN-2 insulation in raceway.

B. Exposed Dry Interior Locations: Use only building wire, type #THHN/THWN-2 insulation in raceway.

C. Above Accessible Ceilings: Use only building wire, type #THHN/THWN-2 insulation in raceway.

D. Wet or Damp Interior Locations: Use only building wire, type #THHN/THWN-2 insulation in raceway.

E. Exterior Locations: Use only building wire, type #THHN/THWN-2 insulation, in raceway. Use liquid-tight wiring methods. Use liquid-tight connections.

F. Underground Installations: Use only building wire, type #THHN/THWN-2 insulation, in raceway. Use liquid-tight wiring methods.

G. Interior Installations: Use only building wire, type #THHN/THWN-2 insulation, in raceway.

H. Use wiring methods indicated.

3.04 INSTALLATION

A. Route wire and cable as required meeting project conditions.

B. Install cable in accordance with the NECA "Standard of Installation."

C. Use conductors not smaller than 12 AWG for power and lighting circuits. Only pre-manufactured fixture whips are allowed to be 14 AWG.

D. Use #10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

E. Use #10 AWG conductors for 20 ampere, 208/240 volt branch circuits longer than 200 feet.

F. Provide minimum #8 AWG wiring for exterior lighting and power circuits leaving building.

G. It shall be the responsibility of the electrical contractor to verify all voltage drop and size all wire accordingly.

H. Pull all conductors into raceway at same time.

I. Use suitable wire pulling lubricant for building wire #4 AWG and larger.

J. Protect exposed cable from damage.

K. Use suitable cable fittings and connectors.

L. Neatly train and lace wiring inside boxes, equipment and panel boards.

M. Clean conductor surfaces before installing lugs and connectors.

N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

O. Use split bolt connectors for copper conductor splices and taps, #6 AWG and larger. Tape non-insulated conductors and connector with electrical tape to 150% of insulation rating of conductor.

P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller.

Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, #10 AWG and smaller. All connections in exterior hand holes shall have liquidtight connections.

R. Identify and color code wire and cable under provisions of Specification Section 26 0553 - Identification for Electrical Systems. Identify each conductor with its circuit number or other designation indicated.

S. Do not install multi-wire branch circuits. No sharing of neutral shall be permitted.

T. Install all conductors and make final connections in accordance with all manufacturer’s recommendations.

U. Circuits indicated as 3-pole and having ECM motor loads shall include a neutral conductor.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

B. Inspect wire and cable for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

END OF SECTION 26 0519

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rod electrode and conductors

B. Mechanical connectors

C. Wire

1.02 RELATED SECTIONS

A. Specification Section 27 0526 - Grounding and Bonding for Communication Systems

1.03 SUBMITTALS

A. Product data and manufacturer's installation instructions for non-approved manufacturers shall be submitted for review prior to the bid date.

B. Submittals shall include:
   1. Dimensional drawing for each planned device.
   2. Exothermic Connection Certification for installers.

1.04 SUMMARY

A. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable codes as accepted by the authorities having jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.

B. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of Article 250 of the NEC and local codes. The bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.

C. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC. The grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. All grounding conductors that run with feeders in PVC conduit outside of building shall be bare only.

D. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to Article 800 of the NEC.

1.05 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code

B. NFPA 99 - Health Care Facilities

C. IEEE 837-2014: Standard for Qualifying Permanent Connections Used in Substation Grounding

D. IEEE Emerald Book

E. IEEE Green Book

1.06 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual locations of grounding electrodes.

B. Submit test results of each ground rod.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 ROD ELECTRODE AND CONDUCTORS

A. Material: Copper-clad steel.

B. Diameter: 5/8 inch.

C. Length: 10 feet (min). Increase number and/or lengths of ground rod electrodes as required to meet and achieve specified resistance.

D. Maintain separation of not less than eight foot (8') and not more than 20 feet between ground rod electrodes.

2.02 MECHANICAL CONNECTORS

A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.

B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals.

C. Lugs: Substantial construction, of cast copper or bronze with "ground" (micro-flat) surfaces, twin clamp, and two-hole tongue equal to Burndy QQA Series.

D. Grounding and Bonding Bushings: Malleable iron.
   1. Manufacturers:
      a. Thomas & Betts
      b. Engineer approved equal.

E. Piping Clamps: Burndy GAR-TC Series with a two-hole compression terminal.

F. Grounding Screw and Pigtail: Raco #983.

G. Building Structural Steel: Thompson #701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp or equal.

H. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets.

2.03 WIRE

A. Material: Stranded copper.

B. Size to meet NFPA 70 requirements as a minimum. Increase size if called for on drawings or in these specifications.

C. Insulated THWN (or bare as noted elsewhere).

PART 3 EXECUTION

3.01 GENERAL

A. Install products in accordance with manufacturer's instructions.

B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.

C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the N.E.C., the NFPA, and applicable standards of IEEE.

D. Where there is a conflict between these specifications and the above applicable codes/standards or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the current code/standard requirements shall comply.

E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

3.02 GROUNDING ELECTRODES

A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic clamping with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on drawings.

B. Each rod shall be die stamped with identification of manufacturer and rod length.

C. Install rod electrodes at locations indicated and/or as called for in these specifications.

D. Ground Resistance:
   1. Main Electrical Service (to each building):
      a. Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 5 ohms.
      b. Other Locations:
         1) Resistance to ground of all non-current carrying metal parts shall not exceed 5 ohms measured at motors, panels, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
         2) Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two or more rods connected together but not connected to the grounding electrode conductor.

E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor).
   1. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.
   2. Verify that final backfill and compaction has been completed before driving rod electrodes.
   3. Install ground rods not less than one foot (1') below grade level and not less than two feet (2') from structure foundation.

3.03 GROUNDING ELECTRODE CONDUCTOR

A. Conductor shall be sized to meet or exceed the requirements of NEC 250 to meet these specifications and/or drawings.

3.04 GROUNDING CONDUCTORS

A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.

B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.

C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug.

D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required) these specifications and/or drawings the requirements of NEC 250. The conductor shall be connected to the equipment grounding bus in switchboards and panelboards and as specified to lighting fixtures, motors, and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly

connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.

E. Provide green insulated ground wire for all receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.

F. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include food service equipment, laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.05 MAIN ELECTRICAL SERVICE

A. Existing Building:
   1. The electrical contractor shall verify that the building's electrical service is properly grounded as required by the NEC.
   2. Provide and install electrical service grounding at the building as called for herein for all existing services that do not comply with the grounding specified above.
   3. Supplement existing electrical service grounding at each building as required to comply with all requirements in these specifications.
   4. If exterior ground rod electrode does not exist at the buildings main electrical service, provide and install these ground rods as called for main electrical service, exterior of building.

B. Complete installation shall meet and exceed the requirements of the NEC 250.

C. Artificial electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.

D. Bond To All Of The Following When Available On Site:
   1. Ground Rods.
   2. Metal Water Pipe (Interior and Exterior to Building)
   3. Building Metal Frame, Structural Steel and/or Reinforced Structural Concrete
   4. All Piping Entering or Leaving All Buildings.
   5. Provide a main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to the building steel in each respective building. Reference NEC 250.104 (c). This ground conductor shall also be run individually from the main switchgear and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe.

E. Ground/bond neutral per NEC 250.

F. Provide and install ground bus bar on wall near main service disconnect/switchboard. Connect to ground bar in disconnect/switchboard bonded to switchboard/disconnect enclosure/neutral with copper grounding conductor sized per applicable table in NEC 250.

3.06 LIGHT FIXTURES

A. All new and removed/reinstalled fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.

B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.

C. Installation shall exceed minimum requirements of NFPA 780.

3.07 MISCELLANEOUS GROUNDING CONNECTIONS

A. Provide bonding to meet regulatory requirements.

B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded or bolted to steel in locations where weld will affect the structural properties of the steel. Required connections to existing building structural steel purlins/i beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.

C. Grounding conductors shall be so installed as to permit shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed or bolted to the equipment or to be grounded; in NO case be a current carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.

D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rust proofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.

E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.

F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.

I. Grounding provisions shall include double locknuts on all heavy wall conduits.

J. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an accepted ground point.

K. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten full length rebars that contact the connected rebar.

3.08 GROUNDING BAR INSTALLATION

A. Where indicated on the drawings, provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "Earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.

B. Mount bolt tapping lugs with hex head bolts to bus bar at two inch (2") on center spacing, one for each ground conductor.

C. Mount bus bar to wall using two inch (2") polyester molded insulator stand-off.

D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by N.E.C. for service ground, etc.) in PVC conduit to accepted service ground installation or ground bus/bar in main service equipment enclosure.

E. 'Systems' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC "Article 800-40(b).

F. A separate grounding bar shall be installed in telecommunication rooms. Connect to the main electrical grounding bar with a #4/0 AWG grounding conductor in conduit.

3.09 TESTING AND REPORTS

A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.

B. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.

C. Upon completion of testing, the testing conditions and results shall be certified by the electrical contractor and submitted to the engineer.

3.10 INTERFACE WITH OTHER PRODUCTS

A. Interface with communications system installed under other specification sections.

3.11 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument with current certificate of calibration to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method or signal injection method.

END OF SECTION 26 0526

SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Product requirements

B. Formed steel channel

1.02 REFERENCES

A. NECA Standard of Installation (National Electrical Contractors Association)

B. NFPA 70 - National Electrical Code

1.03 SUBMITTALS

A. Product Data: Provide manufacturers catalog data for fastening systems.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of products.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Materials and Finishes:
   1. Corrosion resistant.
   2. Select materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Anchors and Fasteners:
   1. Concrete Structural Elements: Use expansion anchors and preset inserts.
   2. Steel Structural Elements: Use beam clamps and welded fasteners.
   3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
   5. Solid Masonry Walls: Use expansion anchors and preset inserts.
   6. Sheet Metal: Use sheet metal screws.
   7. Wood Elements: Use wood screws.

2.02 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Globe Strut
   2. Uni-Strut
   3. Kindorf
   4. Power-Strut
   5. Engineer approved equal.

B. Description: Galvanized steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions and utility company regulations where applicable.

B. Provide anchors, fasteners and supports in accordance with NECA "Standard of Installation".

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
2. Do not use spring steel clips and clamps.
3. Do not use powder-actuated anchors.
4. Do not drill or cut structural members.

C. Fabricate supports from structural steel or formed steel members or steel channel. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

D. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

E. All pathways and hangers shall be independently hung.

END OF SECTION 26 0529

SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit requirements

B. Conduit types

C. Box types

D. Surface metal raceway types

1.02 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated

C. ANSI C80.5 - Rigid Aluminum Conduit

D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

E. ANSI/NFPA 70 - National Electrical Code

F. NEMA 250 - Enclosures for Electric Equipment

G. NEMA WD 6 - Wiring Device Configurations

H. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

I. NECA (National Electrical Contractor's Association) Standard of Installation

J. NEMA WD 6 - Wiring Device Configurations

K. TIA-569-B - Commercial Building Standard for Telecommunications Pathways and Spaces

L. NEMA OS 2 – Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2013 (ANSI/NEMA OS2)

M. UL 514C- Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions

1.03 RELATED SECTIONS

A. Specification Section 27 0526 - Grounding and Bonding for Communications Systems

1.04 PROJECT RECORD DOCUMENTS

A. Accurately record actual routing of conduits larger than two inches.

B. Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 SUBMITTALS

A. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.07 QUALIFICATIONS

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

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to the site.

B. Accept products on site. Inspect for damage.

C. Protect products from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.09 PROJECT CONDITIONS

A. Verify that field measurements are as shown on the drawings.

B. Verify routing and termination locations of conduit prior to rough in.

C. Conduit routing is shown on the drawings in approximate locations unless dimensioned. Route as required completing the wiring system.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Minimum Size: 3/4 inch for power wiring and 1 inch for low voltage wiring unless noted otherwise.

B. Size conduit per ANSI/NFPA 70.

C. Above Grade Outdoor Locations: Use rigid steel and aluminum conduit. Aluminum conduit shall not contact concrete mortar or block.

D. Wet and Damp Locations:
   1. Use rigid steel conduit and intermediate metal conduit.

E. Dry Locations:
   1. Concealed: Use rigid steel conduit, intermediate metal conduit or electrical metallic tubing.
   2. Exposed: Use rigid steel conduit, intermediate metal conduit or electrical metallic tubing.

2.02 CONDUIT TYPES

A. Metal Conduit:
   1. Rigid Steel Conduit: ANSI C80.1
   2. Rigid Aluminum Conduit: ANSI C80.5
   3. Intermediate Metal Conduit (IMC): Rigid steel
   4. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

B. Flexible Metal Conduit:
   1. Description: Interlocked steel construction.
   2. Fittings: ANSI/NEMA FB 1.

C. Liquidtight Flexible Metal Conduit:
   1. Description: Interlocked steel construction with PVC jacket.
   2. Fittings: ANSI/NEMA FB 1.

D. Electrical Polyvinyl Chloride (PVC):
   1. Description: Synthetic Thermoplastic
   2. Fittings: NEMA TC3/UL 651
   3. Joints: ASTM D2855 solvent weld with ASTM D2564 solvent cement.

E. Electrical Metallic Tubing (EMT):
   1. Description: ANSI C80.3; galvanized tubing.
   2. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression type with steel lock nut, and ring or steel setscrew fittings. Install compression type fittings in all wet and damp areas.

F. Pre-manufactured Fixture Whips:
   1. Manufacturers:
      a. Southwire
      b. EPCO
      c. Engineer approved equal.
   2. Description: UL listed flexible conduit with conductors and die-cast screw connectors on the end.
   3. Size: no longer than 6', 3/8" diameter.
   4. Wire: 14 AWG minimum for lighting and required by the load.
   5. Install between junction box and light fixture only in concealed and unfinished spaces. Use interior raceway or surface raceway where exposed in finished spaces.

G. Fittings and Conduit Bodies:
   1. NEMA TC 3
   2. Install offsets at surface boxes.
   3. Install single hole strap connectors on all exposed conduit one inch (1") and smaller.

2.03 BOX TYPES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide a low voltage partition divider plate for applications where low voltage and line voltage circuits share the same outlet box.

B. Outlet Boxes:
   1. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
      a. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported. Include 1/2 inch male fixture studs where required.
      b. Concrete Ceiling Boxes: Concrete Type.
   2. Sheet Metal Communications Boxes: ANSI/NEMA OS 1, galvanized steel. Minimum of 4-11/16 inch square with a depth of 2-1/8 inch.
      a. Refer to the drawings for plaster ring size/opening.

C. Cast Boxes: NEMA FB 1, type #FD, cast alloy. Provide gasket cover by box manufacturer.

D. Pull and Junction Boxes:
   1. Sheet Metal Boxes: NEMA OS 1 galvanized steel.
   2. Surface Mounted Cast Metal Box: NEMA 250, type #4 and #6, flat-flanged, surface mounted junction box:
      a. Material: Galvanized cast iron.
   3. Cover: Furnish with ground flange, neoprene gasket and stainless steel cover screws.
   4. Fiberglass Hand Holes:
      a. Die molded fiberglass hand holes.
      b. Cable Entrance: Precut 6" x 6" cable entrance at center bottom of each side.
      c. Cover: Fiberglass weatherproof cover with nonskid finish and light traffic rating.

2.04 SURFACE METAL RACEWAY TYPES

A. Surface Metal Raceway:
   1. Manufacturers:
      a. Wiremold #V500 or #V700
      b. Hubbell
      c. Engineer approved equal.
   2. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
   3. Size as required or as indicated on drawings.

4. Finish is to be selected by the archtect
5. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories.
6. Combination Device Box: Furnish Wiremold #V5748 Series.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation."

B. Arrange supports to prevent misalignment during wiring installation.

C. Support conduit using coated steel, malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related conduit support using conduit rack. Construct rack using steel channel and provide space on each for 25% additional conduits.

E. Fasten conduit supports to building structure and surfaces.

F. Do not support conduit with perforated pipe straps. Remove wire used for temporary supports.

G. Do not use spring steel clips and clamps for support.

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route exposed conduit parallel and perpendicular to walls.

K. Route conduit installed above accessible ceilings, parallel and perpendicular to walls.

L. Route the conduit in and under slab from point-to-point.

M. Do not cross conduits in slab.

N. Maintain adequate clearance between conduit and piping.

O. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degree F.

P. Cut conduit square using saw or pipe cutter; de-burr cut ends.

Q. Bring conduit to shoulder of fittings; fasten securely.

R. Use conduit hubs to fasten conduit to cast boxes.

S. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360 degrees), including those bends located immediately at the outlet or body. Use conduit bodies to make sharp changes in direction (as around beams). Use hydraulic one-shot bender to fabricate bends in metal conduit larger than two inch (2") size. All conduit shall be held right to structure.

T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

V. Provide suitable pull string in each empty conduit except sleeves and nipples.

W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Ground and bond all conduits.

Y. Identify conduit.

Z. Use flexible and liquidtight conduits where required by NEC.

AA. Flexible conduit up to six feet (6') in length can be used to connect mechanical equipment with motors, compressors, light fixtures or unless directed by engineer.

AB. Install insulated bushings on all conduits and sleeves serving low voltage wiring prior to pulling wire unless otherwise noted.

AC. Install grounded insulated bushings on all conduits and sleeves serving data wiring prior to pulling wire unless otherwise noted.

AD. All low voltage conduits shall be sized to have less than 40% fill. Each penetration through a surface of any kind shall have a conduit sleeve with insulated bushings.

AE. Junction boxes shall not be installed over four foot (4') above accessible ceiling without prior written approval by owner.

AF. Conduits which enter communications entrance facilities shall extend 4 inches above the finished floor or 3 inches through the wall.

AG. Minimum bend radius for communications conduits:
1. For conduits 2" or less, maintain a minimum bend radius of (6) times the actual inside diameter of the conduit.
2. For conduits greater than 2", maintain a minimum bend radius of (10) times the actual inside diameter of the conduit.

AH. Communications 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.
1. A third bend is acceptable if:
   a. The total run is not longer than (33) feet.
   b. The conduit size is increased to the next trade size.

AI. No continuous section of conduit may exceed 100 feet. Utilize pull boxes as necessary. Refer to the pull box execution section for more information.

AJ. All wiring in the same conduit shall be from the same source and have the same voltage except where approved by the owner.

AK. Exterior rooftop pathways shall be supported above roofing membrane utilizing rubber type support bases with 12 ga. galvanized channel supports (Copper B-Line Dura-Block or equivalent). Adjust height as necessary for compliance with NEC.

AL. For conduit installed in precast concrete walls or floors, it shall be acceptable to utilize Schedule 40 PVC conduit in lieu of EMT.

AM. All exposed conduit and surface raceway routing in common and public areas shall be coordinated prior to rough-in at an on-site construction meeting between the design team and contractor.

3.02 BOX INSTALLATION

A. Install boxes in accordance with NECA "Standard of Installation."

B. Install electrical boxes in locations as shown on the drawings and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

C. Set wall mounted boxes at elevations to accommodate mounting heights as indicated.

D. Electrical boxes are shown on the drawings in approximate locations unless dimensioned. Adjust box location up to ten foot (10') if required to accommodate intended purpose. Verify with architectural drawings and elevations for additional information.

E. Orient boxes to accommodate wiring device orientation.

F. Maintain headroom and present neat mechanical appearance.

G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Junction boxes shall not be installed over four foot (4’) above accessible ceilings.

H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than six inches (6") from ceiling access panel or from removable recessed luminaire.

I. Fire-stop boxes to preserve fire resistance rating of partitions and other elements. Boxes may be installed within a minimum of 24 inch separation with written approval prior to installation.

J. Coordinate mounting heights and locations of outlets mounted above counters, benches, and back splashes.

K. Locate outlet boxes to allow luminaires positioned as shown on the drawings. If light fixture locations conflict with ceiling plans, the electrical contractor shall document discrepancies and send to the engineer for clarification.

L. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

M. Use flush mounting outlet box in finished areas.

N. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

O. Do not install flush mounting box back-to-back in wall, provide minimum six inch (6") separation.

P. Provide minimum 24 inch separation for receptacles in acoustic rated walls. Provide sound blocking putty where lighting control devices are located in the same stud cavity.

Q. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

R. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

S. Use adjustable steel channel fasteners for hung ceiling outlet box.

T. Do not fasten boxes to ceiling support wires.

U. Support boxes independently of conduit.

V. Use gang box where more than one device is mounted together. Do not use sectional box.

W. Use gang box with plaster ring for single device outlets.

X. Use cast outlet box in exterior locations exposed to the weather and wet locations.

Y. Use cast iron floor boxes for installation in slab on-grade, formed steel boxes are acceptable for other installations unless otherwise noted.

Z. Set floor boxes level.

AA. Large Pull Boxes: Use set screw enclosure in interior dry locations, surface-mounted cast metal box in other locations.

AB. Use stamped steel bridges to fasten flush mounting outlet box between studs.

AC. Group devices associated with each other eight inches (8") on center (i.e. receptacle, data, voice outlet).

AD. All floor mounted device locations shall have a dimensioned drawing from the Architect prior to installation.

3.03 SURFACE RACEWAY INSTALLATION

A. Install products in accordance with manufacturer's instructions. Provide all trim and accessories.

B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.

C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

D. Wire Way Supports: Provide steel channel.

E. Close ends of wire way and unused conduit openings.

F. Ground and bond raceway and wire way.

G. Install surface metal raceway in exposed existing finished areas where indicated on the drawing. Coordinate all raceway routing with architect.

H. Install insulated bushings on all Wiremold terminated above accessible areas serving low voltage wiring prior to pulling wire unless otherwise noted.

3.04 PULLBOXES

A. Size communications cabling pull boxes according to the following:

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit
1"	4"	16"	3"	2"
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	28"	4"	4"
2"	8"	36"	4"	5"
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	6"

B. Directional changes within a pullbox shall not be allowed. Conduit entering the box shall have conduit leaving the box from the opposite side. Do not use a pull box to make 90 degree turns.

C. Install pullboxes in conveniently accessible locations.

D. Where identified on drawings as lockable, key all pullboxes the same.

E. Label all pull boxes. Handwritten labels shall not be accepted.

3.05 INTERFACE WITH OTHER PRODUCTS

A. Install conduit using materials and method to preserve fire resistance rating of partitions and other elements.

B. Piping and Ductwork: Route conduits through roof openings or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified.

C. Coordinate installation of outlet and junction boxes for equipment connection.

3.06 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

C. Adjust floor box flush with finish flooring material.

3.07 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 26 0533

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels

B. Identification

1.02 REFERENCES

A. NFPA 70 - National Electrical Code

B. NFPA 70E - Standard for Electrical Safety in the Workplace

1.03 SUBMITTALS

A. Product Data: Provide catalog data for nameplates, labels and markers.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates:
   1. Normal power: Engraved three-layer laminated plastic white letters on black background.

B. Locations:
   1. All electrical distribution and control equipment enclosure.
      a. Switchboards and Panelboards: Line 1 shall state "Panel Name"; Line 2 shall state "Fed by Panel Name" as required by NEC section 408.4(B).
   2. Fire alarm devices.

C. Letter Size:
   1. Use 1/8 inch letters for identifying individual equipment and loads.
   2. Use 1/4 inch letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations, and communication outlets.

2.02 IDENTIFICATION

A. Identify All Junction Boxes With Appropriate Marker As Follows:
   1. 208 Volt System: Black (circuit name and number)
   2. Fire Alarm System: Red

B. Write the circuit number of each device inside the device box (not ON the device cover). All receptacles and light switches (new and existing) shall have the final circuit number installed on each device cover with a nylon label. Coordinate exact requirements with the owner prior to installation.

C. Temporary label all outlets and switches with circuit numbers.

D. Label all outlets and switches with an adhesive label identifying panel and circuit the device is energized by.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

END OF SECTION 26 0553

SECTION 26 2717
EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cord and caps

1.02 RELATED SECTIONS

A. Specification Section 26 0519 - Electrical Power Conductors and Cables

B. Specification Section 26 0533 - Raceway and Boxes for Electrical Systems

1.03 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices

B. NEMA WD 6 - Wiring Devices - Dimensional Requirements

C. NFPA 70 - National Electrical Code

D. Product Data: Provide wiring device manufacturers catalog information showing dimensions, configurations, and construction.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 SUBMITTALS

A. Product Data: Provide catalog data for nameplates, labels and markers.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams and manufacturer’s instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 CORDS AND CAPS

A. Provide and install, as required, for the installation of equipment for this project. Verify that equipment scheduled for others to provide or install requires installation of cord and caps prior to bidding.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD 6, match receptacle configuration at outlet provided for equipment.

D. Cord Construction: ANSI/NFPA 70, type #SO multi-conductor flexible cord with identified equipment-grounding conductor, suitable for use in damp locations.

E. Size: Suitable for connected load of equipment, length of cord and rating of branch circuit over current protection.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.

C. Make wiring connections using wire and cable with insulation suitable for temperature encountered in heat producing equipment.

D. Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field supplied an attachment plug is indicated.

E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices as indicated or required by code.

G. Provide interconnecting conduit and wiring between devices and equipment where indicated.

END OF SECTION 26 2717

SECTION 26 2726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches

B. Occupancy sensors

C. Duplex receptacles

D. Ground fault circuit interrupting receptacles

E. USB charge duplex receptacles

F. Simplex receptacles

G. Wall plates

1.02 RELATED REQUIREMENTS

A. Specification Section 26 0533 - Raceway and Boxes for Electrical Systems

B. Specification Section 26 0923 - Lighting Control Devices

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010

B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005)

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R 2008)

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2011

E. UL Standard 943 - Standard for Safety for Ground-Fault Circuit Interrupters (GFCIs)

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions.
   1. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.
   2. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Wall Plates: One of each style, size, and finish.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

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

C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WALL SWITCHES

A. Description:

1. Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
2. Body and Handle: Impact-resistant plastic with toggle handle. Auto-grounding strap.
3. Ratings: Match branch circuit and load characteristics. Default rating is 20A, 120/277V, 1HP.
4. Wiring: Back and side wire connections. Accepts #14-#10 AWG solid and stranded copper conductors.
5. Provide #12 AWG solid pigtails at each device. Splice to building wire within outlet box.
6. Color: Selected during submittal phase. Provide color chart upon request.

B. Types:
   1. Toggle Switches
      a. Approved Manufacturers and Models:
         1) Pass & Seymour #PS20AC
         2) Cooper #2221
         3) Hubbell #1221
         4) Leviton #1221-2
      b. Description: Single pole, double pole, 3-way, and 4-way toggle switches as indicated on plans.
   2. 0-10V Wall Switches and Dimmers
      a. Refer to the Lighting Control sequence of Operations located on the drawings for model numbers and additional information

2.02 OCCUPANCY SENSORS (LINE VOLTAGE)

A. Refer to the lighting sequence of operations for additional requirements.

B. Description
   1. Self-configuring, auto-adapting, calibrated wall or ceiling mounted; passive infrared (PIR), ultrasonic or dual technology.
   2. Sensors shall be able to self adapt in the field with the ability to adjust the sensitivity and time delay.
   3. Sensor shall have adjustable re-trigger time for all manual-on loads.
   4. Coverage: 2000 SF minimum, 360 degree view for ceiling type and 180 degree view for wall mount types.
   5. Wire all per manufacturer's recommendations.
   6. Wire multiple sensors serving the same area to operate as a single unit.
   7. Sensors shall be configured to be MANUAL ON/AUTO OFF unless noted otherwise on the drawings and also have the capability to be configured to function AUTO ON/ AUTO OFF.
   8. Colors: Verify final color selection during submittal process.

C. Types:
   1. Wall Mount Dual Tech Occupancy Sensor Switch
      a. Approved Manufacturers and Models:
         1) Leviton OSSMT-MDW
         2) Approved equivalent.
   2. Ceiling Mount Dual Tech Occupancy Sensor Switch
      a. Approved Manufacturers and Models:
         1) Leviton ODC20-MDW
         2) Approved equivalent.

D. Additional Information
   1. Refer to the Lighting Control Sequence of Operations located on the drawings for model numbers and additional information.

2.03 DUPLEX RECEPTACLES

A. Description
   1. Style: Hard use specification grade

2. Device Body: Impact resistant plastic with impact-resistant nylon face. Auto-grounding strap.
3. Configuration: NEMA WD 6, type as specified and indicated.
4. Rating: Match branch circuit and load characteristics. Default rating is 5-20R, 125V, 20A.
5. Standards: Receptacles comply with NEMA WD 6 and WD 1.
6. Wiring: Back and side wire connections. Accepts #14-#10 AWG solid and stranded copper conductors.
7. Provide #12 AWG solid pigtails at each device. Splice to building wire within outlet box.
8. Color: Selected during submittal phase. Provide color chart upon request.

B. Types
   1. Tamper-Resistant Duplex Receptacles
      a. Manufacturers:
         1) Pass & Seymour #TR5362
         2) Cooper #TRSGF
         3) Hubbell #HBL5362TR
         4) Leviton #5362-SG
      b. Description: UL listed tamper-resistant receptacle with thermoplastic shutters.
      c. Receptacles in all areas as noted in NEC Article 406.
   2. Weather-Resistant Receptacles
      a. Manufacturers:
         1) Pass & Seymour #2097TRWR
         2) Cooper #WRSGF20
         3) Hubbell #GFTWRST20
         4) Leviton #GFWT2
      b. Description: UL listed weather-resistant receptacle.
      c. Provide weather-resistant receptacles for all receptacles located in wet and damp locations as described in NEC Article 406.

2.04 GROUND FAULT CIRCUIT INTERRUPTING RECEPTACLES

A. Receptacles: Complying with NEMA WD 6 and WD 1. Class A GFCI rated.
   1. Style: Hard use specification grade
   2. Device Body: Impact resistant plastic with impact-resistant nylon face. Auto-grounding strap.
   3. Configuration: NEMA WD 6, type as specified and indicated.
   4. Rating: Match branch circuit and load characteristics. Default rating is 5-20R, 125V, 20A.
   5. Standards: Receptacles comply with NEMA WD 6 and WD 1.
   6. Wiring: Back and side wire connections. Accepts #14-#10 AWG solid and stranded copper conductors.
   7. Provide #12 AWG solid pigtails at each device. Splice to building wire within outlet box.
   8. Color: Selected during submittal phase. Provide color chart upon request.

B. Types
   1. GFCI Tamper Resistant Receptacles
      a. Manufacturers:
         1) Pass & Seymour 2097TR
         2) Cooper TRSGF20
         3) Hubbell GFTRST20
         4) Leviton GFTR2
      b. Description: Specification grade tamper-resistant duplex GFCI receptacle.
      c. Receptacles in all areas as noted in NEC Article 406.
      d. Receptacles noted as "GFI" on plans.

2.05 USB CHARGE DUPLEX RECEPTACLES

A. Receptacles: Complying with NEMA WD 6 and WD 1.

1. Style: Hard use specification grade. Dual USB charging ports rated at a minimum of 3.5A.
2. Device Body: Impact resistant plastic with impact resistant nylon face. Auto grounding strap.
3. Ratings: Match branch circuit and load characteristics. Default rating is 5-20R, 125V, 20A.
4. Wiring: Three (3) pre-stripped 6” wire leads for line, neutral, and ground. Splice to building wire within outlet box.
5. Color: Selected during submittal phase. Provide color chart upon request.

B. USB Duplex Receptacle: Type A & C
1. Manufacturers:
   a. Hubbell USB20
   b. Eaton
   c. Pass & Seymour
   d. Leviton
2. Receptacles in all areas as noted in NEC Article 406.
3. Receptacles shall be tamper-resistant

2.06 SIMPLEX RECEPTACLES

A. Description
1. Style: Hard use specification grade
2. Device Body: Impact resistant plastic with impact-resistant nylon face. Auto-grounding strap.
3. Configuration: NEMA WD 6, type as specified and indicated.
4. Rating: Match branch circuit and load characteristics. Default rating is 5-20R, 125V, 20A.
5. Standards: Receptacles comply with NEMA WD 6 and WD 1.
6. Wiring: Back and side wire connections. Accepts #14-#10 AWG solid and stranded copper conductors.
7. Provide #12 AWG solid pigtails at each device. Splice to building wire within outlet box.
8. Color: Selected during submittal phase. Provide color chart upon request.
9. Receptacles shall be tamper-resistant

2.07 WALL PLATES

A. Standard Cover Plates:
1. Type 302 stainless steel cover plates. Cover plate style to be confirmed during submittal phase.
2. Basis of Design: Pass & Seymour #SS (Metal), to be confirmed during submittal phase.
3. Provide coverplate for all devices and provide multiple gang plates where required.

B. Jumbo Cover Plates:
1. Type 302 stainless steel oversize cover plates. Cover plate style to be confirmed during submittal phase.
2. Basis of Design: Pass & Seymour #SSO (Metal) to be confirmed during submittal phase.
3. Provide coverplate for all devices and provide multiple gang plates where required.
4. Provide oversize plates on all masonry rough-ins. Verify with architect prior to work being performed.

C. Weatherproof Box & Cover:
1. Basis of Design: Pass & Seymour #WIUC10.
   a. Description: Heavy-duty polycarbonate NEMA 3R “While-In-Use” weatherproof box and cover. Installed horizontally.
   b. Complies with NEC Article 406 requirements for wet location covers.
   c. Provide with plate kits as required.
   d. Provide multi-gang or deep cover configurations as required for application.
   e. Cover shall be capable of accepting a standard size padlock.
   f. Color shall be gray, to be confirmed during submittal phase.

g. Indicated by "WP" on plans.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that outlet and switch boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that floor boxes are adjusted properly.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

A. Provide extension rings as needed to bring outlet and switch boxes flush with finished surface.

B. Clean debris from outlet and switch boxes prior to device installation.

3.03 INSTALLATION

A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

E. Install receptacles with grounding pole on top.

F. Connect wiring device grounding terminal to outlet box with bonding jumper.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Connect wiring devices by wrapping conductor around screw terminal.

I. Use oversize plates for outlets installed in masonry walls.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

K. The electrical contractor shall verify floor finish and location before ordering floor devices.

L. The feeding of receptacles downstream of GFI receptacles for protection in lieu of providing multiple GFI receptacles is NOT allowed.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 0533 to obtain mounting heights specified.

B. Install wall switches 48 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor.

D. Install above-counter convenience receptacle 6 inches above counter.

E. Install telephone jack 18 inches above finished floor.

F. In masonry walls, switches and receptacle heights shall be adjusted as required such that outlets are at nearest mortar joint to specified height.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify that each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

3.08 EXTRA MATERIALS AND LABOR

A. The electrical contractor shall include in their bid an allowance to install an additional five duplex receptacles including an average 50 feet of raceway, associated wiring, back box and labor, and all accessories required to energize each receptacle requested. Receptacle(s) may be added anytime during the construction process as requested by the owner or design team. Any unused devices shall be turned over to the owner at the final acceptance of building.

END OF SECTION 26 2726

SECTION 26 2816
ENCLOSED STARTERS AND SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Safety switches

B. Motor-Rated starters and switches

1.02 RELATED REQUIREMENTS

A. Specification Section 26 0529 - Hangers and Supports for Electrical Systems

B. Specification Section 26 0553 - Identification for Electrical Systems

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association

B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association

C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association

D. NFPA 70 - National Electrical Code; National Fire Protection Association

E. NECA - Standard of Installation (published by the National Electrical Contractors Association)

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide switch ratings and enclosure dimensions.

C. Project Record Documents: Record actual locations of enclosed switches.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 SAFETY SWITCHES

A. Manufacturers
   1. Square D
   2. General Electric
   3. Cutler-Hammer
   4. Siemens
   5. Engineer approved equal.
   6. No engineer approved equal.

B. Heavy duty safety switches shall be used for all motor loads over 1 HP and all non-motor loads 20 amps and greater.
   1. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
      a. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
      b. Handle lockable in OFF position.
   2. Enclosures: NEMA KS 1.
      a. Interior Dry Locations: Type 1 .

b. Exterior Locations: Type 3R.
c. Enclosures shall be provided with a method of opening the cover without opening the switch.

3. Enclosure shall include a grounding bar.

2.02 MOTOR-RATED STARTERS AND SWITCHES

A. Manufacturers
1. Square D
2. General Electric
3. Cutler-Hammer
4. Siemens
5. Cooper-Bussmann
6. Engineer approved equal.

B. Motor-rated starters and switches may be used for all motor loads 1 HP and less and all non-motor loads under 20 amps.
1. Nonfusible Motor-Rated Starter
a. Basis of Design: Square D "Type F".
b. Description: Fractional horsepower manual starter with melting alloy type thermal overload relay.
c. Handle lockable in OFF position.
d. Current rating: 16A
e. For use with single-phase motors only.
f. Provide and install thermal units sized per NEC 430.
2. Nonfusible Motor-Rated Switch
a. Basis of Design: Square D "Type K".
b. Description: Fractional horsepower manual switch with melting alloy type thermal overload relay.
c. Handle lockable in OFF position.
d. Current rating: 30A
e. For use with single or three phase motors.

C. Motor-rated starters may be used for all motor loads 1 HP and greater.
1. Nonfusible Motor-Rated Starter
a. Basis of Design: Square D "M Type"
b. Description: Integral horsepower manual starter switch with melting alloy type thermal overload with auxiliary contact.
c. ON-OFF position
d. For use with single-phase or three phase motors or pumps only.
e. Provide and install thermal units sized per NEC 430.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NECA "Standard of Installation."

B. Install in accordance with manufacturer's instructions.

C. Install plumb and provide in accordance with Specification Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Height to be five foot (5') to operating handle.

E. Provide adhesive label with white letters on black background for associated equipment.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01 4000.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.2.

END OF SECTION 26 2816

SECTION 26 5100

INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. LED Drivers

B. Light Emitting Diodes (LEDs)

1.02 REFERENCES

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 1994 (R 2003)

B. NECA/IESNA 500 - Recommended Practice for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association

C. NECA/IESNA 502 - Recommended Practice for Installing Industrial Lighting Systems; National Electrical Contractors Association

D. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association

E. NFPA 70 - National Electrical Code; National Fire Protection Association

F. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association

G. IESNA LM-79-08 - Approved Method for the Electrical and Photometric Measurement of Solid-State Lighting Products

H. IESNA LM-80-08 - Approved Method for Measuring Lumen Maintenance of LED Light Sources.

I. IESNA TM-21-11 - Projecting Long Term Lumen Maintenance of LED Light Sources

J. EU Directive 2002/95/EC - Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS), as amended by directive 2005/618/EC

1.03 SUBMITTALS

A. Provide cut sheet indicating dimensions and components for each luminaire.

B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Submit manufacturer's operation and maintenance instructions for each product.

D. All lighting submittals must be on Local Authorized Manufacturer Representative's letterhead and contain Project Name and Location.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

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

C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70 and 101

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

C. Products with Light Emitting Diodes:

1. Fixtures shall comply with LM-79-08: Electrical and Photometric Measurements of Solid-State Lighting Products.
2. Interior fixture diode arrays shall maintain +/-100 degrees Kelvin (K); exterior fixture diode arrays shall maintain +/- 500 K color temperature range through the life of the fixture.
3. Diode arrays shall be wired so that if one diode fails, at least 90% of the remaining diodes will operate.

PART 2 PRODUCTS

2.01 LED DRIVERS:

A. Drivers shall be provided with light emitting diodes as a modular replaceable system. The system shall be fully designed and tested for operation throughout warranted period.

B. Driver shall be Underwriters Laboratories (UL) listed, Class 2 Outdoor recognized.

C. Driver shall be suitable for damp locations.

D. Driver shall operate from -20 to 60 deg C.

E. Refer to fixture schedule on drawings for additional requirements.

F. Driver shall operate from 50 to 60 Hz input source of 120 V, 208 V, 240V, 277 V and/or 480 V, as required in plans, with sustained variations of +/-10% (voltage and frequency) with no damage to the driver.

G. Driver output shall be regulated to +/- 5% across published load range.

H. Driver shall have an “A” sound rating.

I. Driver shall have a power factor greater than 0.9.

J. Driver input current shall have Total Harmonic Distortion (THD) of less than +/-20% at all operating voltages.

K. Driver shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.

L. Driver shall carry a five-year warranty from the date of manufacture against defects in material or workmanship, including replacement for operation at a maximum case temperature of 90 deg C.

M. Driver shall have an efficiency greater than or equal to 85%.

N. Driver shall comply with Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, Non-consumer (Class A) for EMI/RFI (conductive and radiated).

O. Driver shall not contain any Polychlorinated Biphenyl (PCB).

2.02 LIGHT EMITTING DIODES (LEDS):

A. Manufacturers
   1. Nichia
   2. Lumileds
   3. Cree
   4. Samsung
   5. Citizen
   6. Engineer approved equal.

B. Light Emitting Diodes shall be provided with a driver as a modular replaceable system. The system shall be fully designed and tested for operation throughout warranted period.

C. Diode arrays shall maintain +/-100K color temperature through the life of the fixture.

D. Diodes shall have a minimum color rendering index of 78.

E. Diodes and associate circuitry shall be RoHS compliant.

F. Diodes shall be photometrically tested for compliance with IESNA LM-80-08, with projections calculated in accordance with IESNA TM-21-11.

G. Diode arrays shall maintain 70% lumen output through an average operating life of 50,000 hours.

H. Diodes and associated printed circuit boards shall be RoHS compliant.

I. Refer to Lighting Fixture Schedule for color temperature requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Furnish products as specified in schedule on the drawings.

C. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required suspending luminaire at indicated height.

D. Locate recessed ceiling luminaires as indicated on reflected ceiling drawing and electrical lighting drawings.

E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

F. Install recessed luminaires to permit removal from below.

G. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.

H. Install clips to secure recessed grid-supported luminaires in place.

I. Install recessed can luminaires to fit in ceiling. Provide all necessary trim ring extenders or other accessories for proper installation of luminaire in ceiling.

J. Install wall mounted luminaires, emergency lighting units and exit signs at height as scheduled.

K. Install accessories furnished with each luminaire.

L. Fixture whips utilizing THHN/THWN-2 wire in flexible metal conduit shall be used to connect all luminaires, emergency lights, and exit signs. Minimum wire size for all fixture whips shall be 14 AWG. Fixture whips shall be wired directly from the luminaire to an accessible junction box. Fixture to fixture whips are not allowed. Maximum length for any fixture whip shall be 6'.

M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

N. Bond products and metal accessories to the branch circuit equipment grounding conductor.

O. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.

P. Support luminaires larger than 2' x 4' size independent of ceiling framing.

3.02 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.03 ADJUSTING

A. Aim and adjust luminaires as directed.

B. Position exit sign directional arrows as indicated.

3.04 WARRANTIES

A. All warranties shall remain as an agreement between the installing contractor and the manufacturer. No third parties shall be involved with warranty repairs or replacements of installed products without the written consent of the installing contractor and the owner or their representative.

B. Labor for warranty repairs shall be billed by the contractor directly to the manufacturer or distributor during the duration of the labor warranty on the originally installed products. Labor work required on warrantied parts, but outside of the 1-year labor warranty shall be the responsibility of the owner.

3.05 CLEANING

A. Clean all electrical parts to remove all of the conductive and deleterious materials.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.06 SCHEDULES

A. See the drawings.

3.07 EXTRA MATERIAL AND LABOR

A. The electrical contractor shall include in their bid an allowance to install an additional two emergency lights and two emergency exit signs of each type as scheduled including an average 50 feet of raceway, associated wiring, back box and labor, and all accessories required to energize each device requested. Fixture(s) may be added anytime during the construction process as requested by the owner or design team. See schedule on drawings for types. Any materials that are not used during construction shall be turned over to the owner at the final acceptance of the building.

END OF SECTION 26 5100

SECTION 27 0050
BASIC COMMUNICATIONS REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Communications Requirements specifically applicable to Electrical Division Specification Sections.

B. Division 27 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

C. Division 27 Specification requirements also include, by reference, Specification Section 08 7100 - Door Hardware. Review and inclusion of the electrical requirements of this specification section are included as a part of this contract.

1.02 WORK BY OWNER

A. The Following Work or Sub Contracts Will Be Supplied and Furnished By The Owner:
   1. Phone System and Phone set installation
   2. WAP installation
   3. Network equipment installation
   4. Access Control installation (besides AiPhone)
   5. Camera Installation

B. The Following Products Will Be Furnished By The Owner:
   1. Phone system including handsets
   2. Wireless Access Points (WAPs)
   3. Network equipment (servers, switches, UPS, etc.)
   4. TV'S, Projectors, and A/V equipment.

C. Owner's Responsibility:
   1. Arrange for and deliver owner reviewed shop drawings, product data and samples to contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with contractor.
   4. Submit claims for transportation damage and replace damaged, defective or deficient items.

D. Contractor's Responsibility:
   1. Review owner reviewed shop drawings, product data and samples.
   2. Review and unload owner purchased materials at site, inspect for completeness and/or damage jointly with the owner.
   3. Handle, store, install and finish products. Install electrical wiring and devices.
   4. Repair and/or replace items damaged after receipt.

1.03 OWNER OCCUPANCY

A. The owner will occupy the premises during the construction period.

B. Limit use of site and premises to allow owner occupancy.

C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.

D. Schedule the work to accommodate this requirement.

1.04 REGULATORY REQUIREMENTS

A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.

B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by

themselves, by their employees or through any operation under their charge, whether in the contract or extra work.

C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.

E. All work shall comply with the applicable recommendations of:
   1. The National Board of Fire Underwriters
   2. The ANSI-NFPA 70 National Electrical Code
   3. The National Fire Protection Association (NFPA)
   4. The Occupations Safety and Health Act (OSHA)
   5. IBC Building Code (current) and any current applicable city building and or electrical codes.
   6. Fire Protection: Conform to International Fire Code (IFC) and NFPA
   7. International Energy Conservation Code (IECC)
   8. ANSI/NFPA 70 National Electrical Code

F. Obtain permits and request inspections from authority having jurisdiction.

G. Conform to latest approved versions of codes.

1.05 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.

C. This contractor shall, before submitting their bid, visit the site of the project to familiarize themselves with locations and conditions affecting their work.

D. It is the intent of this specification that the contractor furnishes all labor and material required to complete the installation as outlined in the drawings and specifications. No additions to the contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.

E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing wiring conduits, electrical panels, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.

F. This contractor shall provide holes as necessary for the installation of their work and in accordance with materials other than the structure.

1.06 SEQUENCING AND SCHEDULING

A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.

B. This contractor shall be kept informed as to the work of other trades engaged in this project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.

C. Where space for electrical lines and conduit is limited, it is imperative that all such trades coordinate their work so as to insure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.07 GUARANTEE

A. This contractor shall guarantee all of the apparatus, materials, equipment furnished and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.

B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.08 ENGINEER APPROVED EQUAL PRODUCTS

A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.

B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.

C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".

D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.09 OWNER'S RIGHT OF SALVAGE

A. Before beginning construction, the contractor shall check and verify with the owner each item of existing equipment that must be removed.

B. The owner will designate which items of material or equipment not reused that he may wish to keep. The contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.

C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from the site.

1.10 TELECOMMUNICATIONS UTILITY COMPANY

A. The contractor is required to assist in coordination with the owner of final telecommunications utility connections that will serve the building with telephone, internet and cable television services.

1.11 PROTECTION AND MAINTENANCE

A. The work covered by these drawings and specifications involves all work in the existing building.

B. Where necessary to connect to any existing utility service, this electrical contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.

C. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.

D. This contractor shall protect existing equipment in finished areas from dirt, dust, and damage as a result of their work.

E. Coordinate protection requirements with department heads before beginning construction.

F. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.12 DEMOLITION

A. This contractor shall be responsible for the demolition and removal of all existing system elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be reused".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.
   4. All elements to be removed are subject to the Owner's Right of Salvage.

B. Preserve services to the existing facility. Extend/reroute/reconnect the existing systems as required providing for the continued function of these systems.

1.13 CUTTING AND PATCHING

A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.

B. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, this contractor shall be responsible to patch and/or seal openings as necessary to maintain and/or return fire separation to rating as required by applicable codes.

C. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.14 CLEANING AND RUBBISH

A. This contractor, upon completion of their work, shall remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.

B. As far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.

C. This contractor shall maintain the work area each day to prevent hazardous accumulation of waste from their work.

1.15 SEALING AND PENETRATION

A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.

B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.

C. Manufacturer offering products to comply with the requirements include the following:
   1. Dow Corning "Silicone RTV Foam"
   2. 3-M Corporation "Fire Barrier Caulk and Putty"
   3. Specified Technologies "EZ-Path"

D. Installation of these products are to be in strict accordance with the manufacturer's recommendations.

E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.16 HAZARDOUS MATERIALS

A. If the contractor stores any hazardous solvents or other materials on the site, he shall obtain copies of the safety data sheets for the materials and post them at the site. He shall inform the owner and all employed of any potential exposure to this material.

B. At no time shall any product containing asbestos be incorporated into the work.
   1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.17 AS-BUILT DRAWINGS

A. This contractor shall provide (at the conclusion of the project) one clean, non-torn, neat and legible "as-built" set of drawings to the owner. These drawings shall show the routing of conduit, wiring and equipment drawn in at scaled locations. All cabling, devices, and endpoints shall be labeled and conform to head end programming and system drawings. All dimensions indicated shall be referenced to a column line. A set of construction blue prints will be furnished for this work.

B. All system head-end equipment and devices shall be shown on the "as-built" drawings.

C. Refer to Architectural Specification Sections for additional requirements.

D. This contractor shall update these drawings during the project at least every week.

1.18 ALTERNATES

A. Refer to description of alternate bids under Architectural Specification Sections.

1.19 REVIEW OF MATERIALS

A. This contractor shall submit to the engineer, for review one (1) electronic copy giving a complete list of materials, fixtures, devices and panels he proposes to furnish. The brochure shall contain complete information as to the make of equipment, type, size, capacities, dimensions, and illustration. One of the returned copies shall be kept on the job at all times.

B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless he notifies engineer, in writing, of such deviation at time such drawings are furnished.

C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.

D. This contractor shall mark the date and sign each set. This indicates that each of them have been checked in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the electrical contractor.

1.20 TEST OF SYSTEMS

A. This contractor, before concealed, shall test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.

B. This contractor shall coordinate all testing of systems within Division 27 specification section. Follow manufacturer's recommended testing procedures as a minimum unless the following related specification section has further detail of testing procedures. The more stringent testing procedure shall be used.

1.21 SCOPE OF WORK

A. This contractor shall furnish all the labor and material necessary to install a complete electrical system for the remodeled building.

B. This contractor shall furnish all the labor and material to install a complete communication system in the new building. The system shall include all items of work as outlined in these specifications and on the drawings.

C. All work shall be performed by a well-qualified, licensed or certified technician with a thorough knowledge of the various systems involved in this building. It shall be this contractor's

responsibility to see that their technicians are familiar with all the various codes, installation procedures and tests applicable to this work.

D. All equipment shall be new and of the type specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.

E. The intent of the specifications and drawings is for complete installation of the systems outlined in the specifications and drawings so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation. The specifications and drawings cannot deal individually with the many minute items that may be eventually required by the nature of the systems.

F. This contractor is required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type.

G. This contractor, shall before proceeding with any work, review the architectural drawings and specifications. Any conflict between the electrical and architectural drawings and specifications shall be reported to the engineer for clarification.

H. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer's attention and an addendum is issued for clarification.

I. The cable that is installed without using raceway shall be neatly routed and supported every three foot (3') by j-hooks or use existing cable tray.. All wiring in mechanical rooms shall be in conduit. All exposed wiring shall be in raceway. No cable shall be allowed to lie on the accessible ceiling tile.

1.22 DAILY HOUSEKEEPING AND CLEANING

A. At the end of each workday, the contractor shall remove all of their debris, rubbish, tools, and surplus materials from the project work area. The work area shall be broom cleaned and left in a neat and orderly condition. The contractor, for the removal of debris from the project, shall not use the owner's waste disposal facility.

B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.23 OWNER'S RIGHT OF WORK CESSATION

A. The owner reserves the right to order an immediate cessation of work without giving advance notice.

1.24 WALL CONTINUITY (1 HR.)

A. All items mounted in 1 hr. rated walls requiring an opening larger than a four inch (4") square (16 sq. inches) require the 1 hr. rating not be degraded.

B. Any system panels in a 1 hr. wall will require the exterior of the recessed panel be covered with 5/8 inch fire rated gypsum board. This is true for any device requiring more than a 16 sq. inch opening.

1.25 LOW VOLTAGE CABLE INSTALLATION

A. This contractor is to install if they are licensed to, or contract with a licensed electrician to install conduit serving low voltage cables located in all mechanical rooms and non-accessible areas and exposed structural areas. Use cable trays in other areas as indicated on the drawings. Where cable trays are not accessible, use J-hooks equal to Caddy Cable CAT. Provide hooks with closure holes and cable ties. Mount hooks 3 foot on center.

1.26 DIGITAL MEDIA AGREEMENT

A. Computer Aided Drafting (CAD) documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.

B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is $100.00 per CAD sheet.

1.27 SECURE NETWORKABLE DEVICES

A. Update network devices to the most current software/firmware.

B. Change default password of all networkable devices.
   1. Passwords shall have at least eight characters.
   2. Include uppercase and lowercase letters, numerals, and special characters

C. Supply MAC address and serial number of all networkable devices.

D. Work with the Owner's IT department to align to existing IT standards.

E. Provide to the owner a printed and/or electronic spreadsheet log of all network information including, IP addresses, MAC addresses, logins and password information during system training.

1.28 SYSTEM CONFIGURATION AND PROGRAMMING FILES

A. Supply system configuration and programming files where export is available.

B. Supply uncompiled programming for systems applicable.

C. All configuration and programming shall be property of the owner at conclusion of the project.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 27 0050

SECTION 27 0080
COMMUNICATION SCHEDULE OF VALUES

PART 1 GENERAL

1.01 FORM COMPLETION

A. The successful Communications Contractor shall complete this form in its entirety within 30 days of receipt of signed contract from the General Contractor, and submit directly to MODUS.

B. This information is confidential and will not be disclosed to any individual outside of MODUS. Data collected will be used in evaluating pay applications.

1.02 OVERALL CONTRACT

Base Communication Bid	$ _____
Add or deduct accepted alternates, negotiated changes, or other modifications to the contract	$ _____
Total Communication Bid	$ _____

1.03 SCHEDULE OF VALUES

Telecommunication Cabling Infrastructure - Material and Labor	$ _____
Total Communication Bid (Sum of Schedule of Values)	$ _____

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 27 0080

SECTION 27 0090

MINOR COMMUNICATION DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 26 0050 - Basic Electrical Requirements "General Provisions" apply to this section.

1.02 SCOPE

A. This contractor shall be responsible for the demolition and removal of all existing communication elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be relocated".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.

B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.

C. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.

D. This contractor shall remove all abandoned equipment, cabling and boxes associated with the remodeled area unless noted otherwise.

E. This contractor is responsible for providing communication cabling protection for all existing systems to remain during this project.

1.03 MATERIALS

A. All elements to be removed are subject to the Owner's Right of Salvage.

B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.

C. The owner may designate and have salvage rights to any material herein demolished by this contractor. It will be the owner's responsibility to designate such salvageable items and remove them prior to the contractor working in that area.

1.04 EXISTING CONDITIONS

A. Demolition plans are based on casual field observations and existing record documents. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.

B. If any existing equipment, cabling or devices that are to remain are disturbed by operations under this contract, this contractor is required to re-establish continuity of such systems according to owner approved standards and methods.

C. This contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to removal of equipment and conduit.

D. This contractor shall furnish all required labor and material for extension of existing systems.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Beginning of demolition means installer accepts existing conditions.

B. Verify existing structured cabling, special systems wiring topology, and reconnect as necessary.

C. Verify that abandoned cabling being removed is disconnected from the source and is not actively serving other areas of the existing building. Reconnect as required to prevent any system downtime.

D. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing existing installation.

3.02 PREPARATION

A. Disconnect structured cabling and special systems components in walls, floors, and ceilings scheduled for removal. Disconnect circuits at the source.

B. Coordinate any service outage with all of the owner's existing telecommunications service providers.

C. Existing Communication Network: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchover connections. Obtain permission from the owner, at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections as required.

D. Maintain all existing communication lines to the building fire alarm system, elevators and intrusion system.

3.03 DEMOLITION AND EXTENSION OF EXISTING COMMUNICATIONS WORK

A. Demolish and extend existing communications work under provisions of this section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Disconnect abandoned cable and remove devices. Provide a blank cover for abandoned devices that have been removed.

E. Disconnect and remove abandoned patch panels, cross connect fields and special systems distribution equipment.

F. Disconnect and remove devices and equipment serving abandoned special systems.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Extend existing installation using materials and methods compatible with existing communications installations or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials that remain or are to be reused.

3.05 INSTALLATION

A. Install relocated materials and equipment.

END OF SECTION 27 0090

SECTION 27 0526
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding clamps

B. Grounding lugs

C. Communications grounding rods

D. Telecommunications bonding backbone

E. Wall-mount busbars

F. Rack mount grounding strip

1.02 RELATED SECTIONS

A. Specification Section 26 0526 - Grounding and Bonding for Electrical System

B. Specification Section 27 0528 - Pathways for Communication Systems

C. Specification Section 27 1005 - Telecommunications Cabling Infrastructure

1.03 REFERENCES

A. ANSI/NFPA-70 2014 National Electrical Code (NEC)

B. ANSI/IEEE Std. 1100-2005 - Recommended Practice for Powering and Grounding Electronic Equipment

C. TIA-607-B Telecommunications Grounding (Earthing) and Bonding for Customer Premises

D. ANSI/TIA-606-B Administration Standard for Telecommunications Infrastructure

E. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

1.04 SUMMARY

A. Provide a communications bonding and grounding system as described within this specification and drawings. System shall be in compliance with the above cited Codes, Standards and Agencies.

B. Comply with the requirement for Section 26 0526 - Grounding and Bonding for Electrical System.

C. Bond the following items within the telecommunications grounding system:
   1. All communications system active equipment.
   2. All PDU and surge protection equipment.
   3. Metallic raceway systems, including metallic cable trays.
   4. Communications equipment enclosures (cabinets) or cross-connect frames.
   5. Broadband passive devices.
   6. Metallic splice cases.
   7. Metallic cable screens, armor or shields.
   8. All metal cable conduit.
   9. Electrical service panels in entrance facilities, telecommunications and equipment rooms.
   10. Wall and rack mounted grounding busbars.
   11. Exposed building steel that is within 6 feet of equipment racking systems.
   12. Building steel extending to earth in outside-plant.
   13. All related bonding accessories.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

2. Grounding to conform to applicable building codes.
3. Methods of construction that are not specifically described or indicated in the contract documents to be subject to the control and approval of the owner or their official representatives.
4. Equipment and materials specified shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed.
5. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to written approval by the owner per the substitution policy listed within these specifications.
6. Materials and methods shall comply in every way with above cited Standards and Codes.

1.06 SUBMITTALS

A. Shop drawings shall be submitted showing construction details and locations of components, and description and routing of interconnecting cabling.

B. Manufacturer’s data on all products, including but not limited to:
1. Catalog cut sheets.
2. Roughing in diagrams.
3. Installation instructions.
4. Typical wiring diagrams and risers.
5. Drawings showing device locations.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable building code for requirements applicable to work specified herein.

1.08 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact. Deliver items in their original factory shipping cartons.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1.09 APPROVED MANUFACTURERS

A. Panduit

B. Chatsworth Products, Inc.

C. Hoffman

D. Engineer approved equal.

PART 2 PRODUCTS

2.01 GROUNDING CLAMPS

A. Bronze Grounding Clamps for Conduit:
1. Used to ground copper code conductor parallel to, or at a right angle to a rod, tube, or pipe.
2. Made from high strength, electrolytic cast bronze.
3. Accommodates a wide range of pipe, tube, rod and conductor sizes.
4. UL 467 Listed for grounding and bonding with AWG conductor and suitable for direct burial in earth or concrete.

2.02 GROUNDING LUGS

A. Copper and Aluminum One-Hole Grounding Lay-in Lug for Bonding Ladder Rack:
1. Used for quick installation of a continuous grounding conductor.
2. UL 467 Listed for grounding and bonding, copper lugs. UL Listed for direct burial in earth or concrete.
3. UL 467 Listed for use up to 600V and temperature rated 90 degree C.

B. Two-hole, Long-barrel Copper Compression Lugs for Grounding Conductors:
1. Meets TIA-607-B requirements for network systems grounding applications.

2. Tested by Telcordia - meets NEBS Level 3 with AWG conductor.
3. For use up to 35KV and temperature rated 90 degree C when crimped with manufacturer rated crimping tools and dies.
4. Color-coded barrels marked with manufacturer's die index numbers for proper crimp die selection.
5. Have long barrel to maximize number of crimps and provides premium wire pull-out strength and electrical performance.
6. Have "inspection window" over tongue to visually assure full conductor insertion.
7. Be tin-plated to inhibit corrosion.
8. Available with NEMA and BISCI hole-sizes and spacing.

2.03 COMMUNICATIONS GROUNDING RODS

A. Standard Grounding Rod:
   1. Material: Copper-clad steel.
   2. Size: 3/4 -inch by 8 feet long.
   3. Standards: Meet requirements of ANSI/UL 467-1984, CSA and ANSI/NEMA GR-1.
      a. Used for quick installation of a continuous grounding conductor.
      b. UL 467 Listed for grounding and bonding, copper lugs. UL Listed for direct burial in earth or concrete.
      c. UL 467 Listed for use up to 600V and temperature rated 90 degree C.

2.04 TELECOMMUNICATIONS BONDING BACKBONE (TBB) GROUNDING CONDUCTORS

A. To be bare or insulated copper, of minimum conductor size #6 AWG and sized at 2 kcmil per linear foot up to a maximum of 750 kcmil. For details on TBB sizing see "Execution" section at end of this document.

B. Where un-insulated, to be identified with green tape at termination location.

C. Labeled in accordance with recommendations set forth in ANSI/TIA-606-B Administration for Telecommunications Infrastructure.

2.05 WALL MOUNT BUSBARS (TMGB/TGB)

A. Meet BICSI and TIA-607-B requirements for network systems grounding applications.

B. Employ BICSI hole spacing to 2-hole lugs.

C. Be made of high conductivity copper and tin-plated to inhibit corrosion.

D. Come pre-assembled with brackets and insulators attached for quick installation.

E. Use labels to identify busbars to meet TIA/EIA-606-A.

PART 3 EXECUTION

3.01 GENERAL

A. It shall be the responsibility of this contractor to adapt the following general guidelines and principles for the requirements of the actual environments where the grounding and bonding systems are to be implemented..

B. System shall provide equipment ground connections (bonds) from the premises entrance facility and outside-plant earthing system to each telecommunication room ground busbar, through the racking systems to bond the network equipment.

C. Entire grounding link from equipment to earth should be visually verifiable except where hidden by walls, conduit or pathways.

D. Installing contractor shall label all elements of the communications bonding network according to guidelines defined in TIA-607-B and ANSI/TIA 606-B.

E. It is the responsibility of the installer to be knowledgeable of all previously cited Standards and Codes and to bring to the attention of the engineer any conflicts discrepancies to achieve a fully functioning, standards-compliant earthing system.

3.02 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. Bonding and grounding conductors may be insulated or un-insulated and shall not decrease in size as the grounding path moves closer to earth.

B. Connections (bonds) between the telecommunications grounding network and associated electrical panels shall be done by a qualified electrician in accordance with guidelines in TIA 607-B and applicable electrical codes.

C. Bonding Conductors should be continuous and routed in the shortest possible straight line path, avoiding changes in elevation and sharp bends.

D. TBB conductors shall be protected from mechanical damage and built so as to minimize splicing. Where splicing is unavoidable they shall be done using irreversible compression splices (C-TAPS) built to that purpose. See the Materials section of this document for appropriate compression splices.

E. TBB in multi-story buildings with multiple risers shall employ a grounding equalizer (GE) between vertical grounding backbones at the top floor of the building and minimally at every third floor in between to the lowest floor level. The GE shall be no smaller than the largest sized TBB.

F. Routing grounding conductors through ferrous metal conduit should be avoided, but if it is necessary due to building constraints, any grounding conductor running through ferrous conduit longer than 3 feet shall be bonded at the end using appropriately sized HTAP.

G. Conductors used to bond TBB to conduit ends shall be of #6 AWG size or larger.

H. Provide appropriately sized TBB conductor using the pathway distances and the chart found in TIA 607-B.

3.03 ENTRANCE FACILITIES AND TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

A. TMGB shall be located in the entrance facility, near the electrical panel to which it will be bonded but installed to maintain clearances required by applicable electrical codes.

B. TMGB shall be sized according to the anticipated number of bonded connections needed.

C. TMGB shall have tinned surface to restrain oxidation and be cleaned and antioxidant paste applied prior to fastening conductors.

D. Connectors on TBB which attach to TMGB shall be of two-hole, long-barrel compression lugs as specified in the Materials section of this document.

E. Building steel within six feet of the communications grounding system should be bonded into the system with appropriate hardware.

F. All cables containing a metallic shield or armor shall have that shield properly bonded into the communications grounding system using appropriately sized grounding kits from the approved manufacturers.

3.04 BONDING WITHIN RACKS AND CABINETS

A. Racks and cabinets shall be bonded into the communications bonding network with conductors of #6 AWG or larger.

B. Depending on size of the telecommunications room, rack bonding conductors (RBC) may tap into underfloor or overhead grounding conductors, or for smaller TRs (3-5 racks or cabinets), may go directly from the rack to the wall mounted busbar.

C. Racks, cabinets and similar enclosures shall not be attached serially but must have individual RBC into the grounding system.

D. Newly installed racks and cabinets shall have vertical grounding busbars installed along one rail to provide clean bonding landing point for all rack mounted equipment. Grounding busbars shall not be isolated from the rack or cabinet.

E. All painted components of racks/cabinets shall be assembled using serrated grounding washers and thread-forming screws to ensure electrical continuity between the different structural components of the rack/cabinet.

F. Larger equipment with integral grounding terminals or pads shall be bonded to the vertical busbar with equipment grounding kits attached to those terminals and bonding them to the rack-mounted busbars.

G. Anywhere two metallic surfaces are to be bonded, contractor shall clean the contact areas of paint or oxidation using abrasive pads, and apply film of anti-oxidation compound between surfaces prior to bonding.

H. All cable fittings shall be of two-hole compression-type. Mechanical screw-lugs on racking systems will not be accepted and must be removed and replaced at contractor's expense.

I. All screws used to affix compression lugs to rack-mounted vertical busbars shall be of the thread forming type made specifically for electrical bonding.

J. Smaller equipment not having integral grounding pads must be bonded to the rack through the equipment mounting flanges using green thread-forming grounding screws with serrations under the head to cut through pain, coatings and oxidation that may be present on the equipment flange. Such equipment shall have minimally one grounding screw per piece of equipment.

3.05 FIELD QUALITY CONTROL

A. On installations confined to a single telecommunications room, the installing contractor shall visually verify continuity of communications bonding system from equipment, through racking systems, to overhead underfloor backbone to the wall mounted busbar in that telecommunications room.

B. Contractor shall further verify the use of all appropriate bonding accessories in the racking systems such as grounding washers and thread-forming grounding screws.

C. Installation of a building-wide telecommunications backbone, installing contractor is further responsible for visually verifying sizing and sound installation of the telecommunications bonding backbone including presence of properly sized and installed grounding equalizer conductors between backbones contained in separate risers.

D. Inspecting contractor shall verify that any conduit larger than 3 feet through which a grounding conductor passes is properly bonded to the grounding conductor as described in this document.

E. During inspections contractor shall verify compliance with all stipulations specified in this document and compliance with all regulatory references cited.

F. All openings or gaps in the bonding system during inspections will be recorded in the inspection report and remedied.

G. During inspections, contractor shall check all grounding and bonding system conductors and connections for tightness and proper installation, including checking proper dies were used on compression taps and fittings by checking embossed die numbers on those connections.

END OF SECTION 27 0526

SECTION 27 0528
PATHWAYS FOR COMMUNICATION SYSTEMS

PART 1 GENERAL

1.01 RELATED SECCTIONS

A. Specification Section 26 0536 - Cable Trays for Electrical Systems

B. Specification Section 27 0526 - Grounding and Bonding for Communications Systems

C. Specification Section 27 10058 Telecommunications Cabling Infrastructure

1.02 REFERENCES

A. EIA/TIA-568B - Commercial Building Wiring Standard

B. EIA/TIA-569B - Commercial Building Standard for Telecommunication Pathways and Spaces

C. NFPA 70 - National Electrical Code

1.03 SUBMITTALS

A. Product Data: Provide catalog data for nameplates, labels and markers.

B. Samples: Submit two nameplates 4" x 4" in size illustrating materials and engraving quality.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 SYSTEM DESCRIPTION

A. Pathway: Conform to EIA/TIA 569B, using raceway as indicated.

B. Premises Wiring: By owner.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

4.01 INSTALLATION

A. Support raceways, backboards and cabinets.

B. Install termination backboards and cabinets plumb, and attach securely to building wall at each corner.

C. Install polyethylene pulling string in each empty conduit over ten feet (10') in length or containing a bend.

D. This contractor shall provide blank cover plates for all indicated telephone and computer outlets.

E. All conduit sizes shall be verified with the owner prior to installation.

F. Provide 1 inch conduit with box from each outlet location to above nearest accessible ceiling.

END OF SECTION 27 0528

SECTION 27 1005

TELECOMMUNICATIONS CABLING INFRASTRUCTURE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal copper

B. Patch panels

C. Work area outlets

D. Grounding and bonding products

1.02 SUMMARY

A. Work included, but not limited to:
   1. Data network horizontal cable installation
   2. Infrastructure cabling management
   3. Data patch cables
   4. Ground and bonding
   5. Testing requirements

1.03 GENERAL REQUIREMENTS

A. The drawings and specifications indicate the intent and direction of the installation. Items and their location are shown diagrammatic and are to be field verified by the cabling contractor prior to completing work associated with the item.

B. All cabling work shall be performed in strict accordance with all applicable laws, ordinances, codes of local, state and federal government, or other authorities having lawful jurisdiction. The cabling contractor is required to verify all requirements.

C. The cabling contractor shall furnish all required labor, material, and associated tools to facilitate the installation of all the infrastructure cables and associated items specified herein and with respect to the infrastructure design drawings without damage to the cables, associated items, and/or facilities.

D. Qualified personnel, utilizing state-of-the-art equipment and techniques shall complete all installation work.

E. All cables routed outside of the cable runway installed shall be properly supported.

F. All wall and/or floor penetrations shall be via metal conduit sleeves properly sized, supported and fire stopped.

G. All materials shall be installed in accordance with the manufacturer's specified recommendations and practices.

1.04 QUALITY ASSURANCE

A. Standards: All telecommunications wiring, cabling devices, and other associated items and work shall conform to the most recent requirements of the following codes, standards, and organizations where applicable:
   1. American National Standards Institute (ANSI)
   2. Electronic Industries Association (EIA)
   3. Federal Communications Commission (FCC)
   4. Institute of Electrical and Electronic Engineers (IEEE)
   5. International Organization for Standardization (ISO)
   6. National Electric Code (NEC)
   7. National Fire Protection Association (NFPA)
   8. BOCA National Building Code
   9. Underwriter's Laboratories (UL)
   10. Telecommunications Industry Association (TIA)
   11. Building Industry Consulting Services International

12. Society of Cable Telecommunications Engineers (SCTE)

B. The copper data infrastructure cable system shall have a manufacturer's material and labor performance certification for the installed cable and components. The certification shall be that UTP Category 6 cabling infrastructure will perform to TIA's specifications for that Category. A manufacturer's written certification document shall be submitted at the completion of the project.

C. A matched solution shall be provided end-to-end for all cabling infrastructure. No third party components shall be provided unless otherwise noted elsewhere in the project specification or drawings.

D. The installer must be able to provide a warranty to the owner. Duration of the warranty shall be a minimum of ten years from the date of project completion and acceptance. It shall cover all of the product as well as their performance for the warranty period.

E. The cabling contractor shall be in business for a minimum of five (5) years.

F. The contractor must be registered with BICSI and have at least one Registered Communications Distribution Designer (RCDD) on full-time staff or be approved by the project engineer during the bidding process. Prospective contractors shall seek written approval from project engineer no later than seven days prior to bidding. Include in request to project engineer a list of full-time staff with certifications and references to three projects of similar size and scope in previous two years.

G. The contractor must possess current liability insurance certificates.

H. Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified, 30 days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.05 SUBMITTALS

A. The cabling contractor shall not begin any installation of materials that require a material fact sheet and/or sample to be submitted and approved by the project engineer. If material is installed prior to approval, the bidder is liable for the cost of removal and replacement if the material is not approved.

B. The cabling is to provide material cut-sheet for all products (including cabling) listed in this specification, and any other material not listed but required for proper installation.

C. Provide both the manufacturer's certification for all installers and technicians that will have a role in this project as well as all BICSI certifications as outlined in the sections above.

D. Provide most recent calibration certificate for testing equipment indicating the period of calibration.

1.06 CLOSE-OUT AND FINAL ACCEPTANCE

A. Operations and Maintenance Manuals
   1. Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of this project. Submit operations and maintenance data not later than 2 months prior to the date of occupancy.

B. Drawings and As-Builts
   1. Provide drawings including documentation on cables and termination hardware in accordance with TIA/EIA-606. Drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. Drawings shall be provided in hard copy format and on electronic media for project engineer's review and final delivery to owner. Provide the following drawing documentation as a minimum:
      a. Cables - A record of installed cable shall be provided in accordance with TIA/EIA-606. The cable records shall include only the required data fields in accordance with TIA/EIA-606. Include manufacture date of cable with submittal.

b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with TIA/EIA-606. Documentation shall include the required data fields only as a minimum in accordance with TIA/EIA-606.
c. Working Red Line Drawings - A hand completed set of drawings indicating the general cable routing of the backbone cables and the primary routes of the horizontal cables shall be provided. Also indicate all wall and floor sleeves utilized. The drawings for this information shall be a non-working, clean set of drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The cabling contractor shall coordinate all delivery, storage and handling concerns with the general contractor.

B. Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.08 APPROVED CABLING VENDORS

A. All cabling and connectivity products provided by the structured cabling contractor shall be part of the following complete end-to-end systems:
1. Panduit
2. Belden
3. Commscope
4. BerkTek
5. Superior Essex
6. Engineer approved equal.

B. All components in the cabling channel shall be of the same manufacturer with performance that meets or exceeds the characteristics of the horizontal cabling.

1.09 JACKET TYPE

A. As per NEC, this building is to have plenum-rated cable and products used exclusively. No “non-plenum” parts shall be installed.

1.10 COLORS

A. The owner shall determine all colors of cables, jack inserts, and other visible components during the submittal process from the standard colors available by each individual manufacturer. No custom colors will be used.

PART 2 PRODUCTS

2.01 HORIZONTAL COPPER

A. Data and Voice:
1. Provide unshielded Twisted Pair (UTP), Category 6 4/pair, 23 AWG to locations identified on the plans.
a. Panduit - TX6000
b. Commscope Uniprise - UltraMedia 7504
c. Belden - Data Twist 3600
d. BerkTek - LANmark 1000
e. Superior Essex - DataGain 6+
f. Engineer approved equal
g. Color to be determined by the owner.

B. Patch Cables - Data Racks (Copper):
1. Provide pre-connectorized copper patch cables that match performance and configuration of horizontal data and voice cabling. Length as required for installation per BICSI standards.
2. Quantity: Structured cabling subcontractor shall provide sufficient patch cords for 75% of horizontal cable runs. For bidding purposes, use an average cord length of 10 feet for patch cords.

3. Color and exact length shall be determined by the owner.

C. Patch Cables - Workstations:
   1. Match performance and configuration of horizontal data and voice cabling. Length as required for installation per BICSI standards
   2. Quantity: Structured cabling subcontractor shall provide a workstation patch cord quantity equal to 50% of all wall-terminated data outlets. For bidding purposes, use an average cord length of 10 feet for patch cords. Patch cords shall be turned over to owner.
   3. Color and exact length shall be determined by the owner.

2.02 PATCH PANELS

A. Data and Voice:
   1. Modular 24 or 48 position, 19 inch rack, 1U or 2U, UTP angled patch panel. Panel to meet performance standards of horizontal cabling manufacturer. Patch panel bracket shall accept RJ45 modular jacks that are utilized at the work area outlet.
      a. Product shall be a matched solution from cabling manufacturer
      b. Quantity as needed for all connections in contractor plus 25% at each rack for future growth.

2.03 WORK AREA OUTLETS

A. Work Area Data/Voice Jacks:
   1. Jacks shall be modular RJ-45 style and meet performance requirements of horizontal cabling.
      a. Product shall be a matched solution from cabling manufacturer.

B. Work Area Outlet Cover Plate:
   1. Telecommunications cover plates shall comply with TIA-568-C.1 and shall be flush design constructed of stainless steel and match the style and color of receptacles and switch cover plates. Provide any blank inserts as required for all unused openings.
      a. Product shall be a matched solution from cabling manufacturer.

2.04 GROUNDING AND BONDING PRODUCTS

A. Provide in accordance with UL 467, TIA J-STD-607, and NFPA 70. Components shall be identified as required by TIA/EIA-606. Provide ground rods, bonding conductors, and grounding busbars as specified in specification section 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

PART 3 EXECUTION

3.01 GENERAL

A. The drawings and specifications are considered to reflect the intent and direction for a complete data cable system.

B. Quantities shown are for general information and may be incorrect. The bidder is to verify all quantities and is to report any count differences to the engineer prior to submission of their installation response. The cabling contractor will be held responsible for all required quantities to complete the project to the intent and direction of the drawings and specifications.

C. Material description and manufacturer's part numbers are shown. The cabling contractor is expected and has the responsibility to verify that the part number matches the description. Any discrepancy is to be noted to the engineer prior to response submittal. The cabling contractor is responsible for the correct materials being furnished and installed.

D. Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with TIA-568-C.1, TIA-568-C.2, TIA-569, NFPA 70 and UL standards as applicable. Provide cabling in a star topology network. Pathways and outlet boxes shall be installed as specified in specification section 26. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall

not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.

E. Install UTP telecommunications cabling system as detailed in TIA-568-C.1. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection tool kit for copper cable terminations. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall all be terminated. There shall be no cable with unterminated elements. Cabling shall be continuous with no splices. Label cabling in accordance with paragraph titled LABELING.

3.02 HORIZONTAL CABLING

A. Install horizontal cabling as indicated on drawings. Do not untwist Category 6/6A UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide slack cable in the form of a figure eight (not a service loop) on each end of the cable, 10 feet in the telecommunications room, and 12 inches in the work area outlet.

3.03 PATHWAYS

A. Provide in accordance with TIA-569 and NFPA 70. Provide building communications cabling pathway as specified in Section 26 0533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS and Section 26 0536 CABLE TRAYS FOR ELECTRICAL SYSTEMS.

3.04 WORK AREA OUTLETS

A. Terminate UTP cable in accordance with TIA-568-C, TIA-568-C.2 and wiring configuration as specified. All fiber optic cabling shall be terminated in accordance with TIA-568-C.3. Follow manufacturer's installation guidelines for all specific requirements related to work area outlet termination.

3.05 COVER PLATES

A. As a minimum, each outlet shall be labeled as to its function and a unique number to identify cable link in accordance with the section titled LABELING.

3.06 PULL CORDS

A. Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.07 PATCH PANELS

A. Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 25 percent spares. Copper entering a patch panel shall be secured to the panel as recommended by the manufacturer to prevent movement of the cable.

3.08 EQUIPMENT RACKS, BRACKETS AND CABINETS

A. All equipment racks, brackets and cabinets hosting telecommunications equipment shall all be installed in accordance with the manufacturer's recommendations. Permanently anchor all racks to the floor.

3.09 GROUNDING AND BONDING

A. Provide in accordance with TIA J-STD-607, NFPA 70 and as specified in Section 26 0526 GROUNDING & BONDING FOR ELECTRICAL SYSTEMS.

3.10 LABELING

A. Provide labeling in accordance with TIA/EIA-606. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using either thermal ink transfer or laser printing.

B. Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA/EIA-606.

C. Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with TIA/EIA-606.

3.11 WIRELESS SYSTEM - POST INSTALL

A. The environment shall be reliant on the stability, performance and facilities-wide coverage of this new wireless network. It shall be this contractor's responsibility to perform a post-installation signal strength test to verify complete coverage is being provided in each of the new project areas.

B. The wireless access system shall be tested at project substantial completion. Provide a report with readings and layout showing detected coverage by Ekahau or AirMagnet analyzers. Deliver in electronic format for engineer review.

C. The wireless system coverage report may result in some adjustments to the wireless access point layout. This contractor shall assist in a one-time device relocation to achieve full coverage, so far as the installed cable will allow.

D. No hand-written test results will be accepted.

3.12 CABLE TESTING

A. General: Cables are to be tested after installation is complete with Fluke DTX tester or equivalent and delivered in electronic format for engineer review. If for any reason, the drop location, raceway and/or drop location box is removed for additional work of any nature, the drop location is to be re-tested if previously tested. All cables associated with the drop location are to be re-tested. The cost of re-testing is the responsibility of the cabling contractor.
   1. The field-test instrument shall be within the calibration period recommended by the manufacturer, typically 12 months.

B. Category 6 Data - Unshielded Twisted Pair (UTP) Cable:
   1. Each UTP CAT 6 data cable installed shall be tested and a test result printout sheet shall be furnished at the completion of the project.
   2. The test shall be performed after the final cable and device termination has been completed and the faceplate installed. The test shall be of the "Basic Link" from completed end to completed end.
   3. The test shall be conducted utilizing a scanner that will generate a sweet frequency 1-250 megahertz signal on all pairs of the cable and test each pair of the cable for:
      a. Pair mapping
      b. Cable length
      c. Insertion loss
      d. Near-End-Cross Talk (NEXT)
      e. Attenuation to Near-End-Cross Talk Ration (ACR)
      f. Return loss (RL)
      g. Power Sum Near-End-Cross Talk (PSNEXT)
      h. Power Sum Equal Level Far-End-Cross Talk (PSELFEXT)
      i. Far End Cross Talk (FEXT)
      j. Propogation Delay & Delay Skew
      k. Impedance
      l. Capacitance
      m. Resistance
   4. Each data cable shall be tested to EIA/TIA-568, Category 6, compliance for acceptance.
   5. Each test result shall indicate the cable number, test date and tester name. All test results are to be submitted to the project engineer in electronic format for review during closeout and final acceptance.
   6. No hand written test results will be accepted by the project engineer.

3.13 EXTRA MATERIALS AND LABOR

A. This contractor shall include in their bid an allowance to install five (5) additional data outlets with an average length of 200 feet as directed by the project engineer at any time during the construction process. Any materials that are not used during construction shall be turned over to the owner at the final acceptance of the building.

END OF SECTION 27 1005

SECTION 28 0050

BASIC ELECTRONIC SAFETY AND SECURITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Electronic Safety and Security Requirements specifically applicable to Electrical Division Specification Sections.

B. Division 28 Specification requirements also include, by reference, all Division 00 and 01 specification sections. This contractor is responsible to review these specification sections. Requirements of these specification sections are included as a part of this contract.

C. Division 28 Specification requirements also include, by reference, Specification Section 08 7100 - Door Hardware. Review and inclusion of the electrical requirements of this specification section are included as a part of this contract.

1.02 OWNER OCCUPANCY

A. The owner will occupy the premises during the construction period.

B. Limit use of site and premises to allow owner occupancy.

C. Cooperate with the owner to minimize conflict and to facilitate owner's operations.

D. Schedule the work to accommodate this requirement.

1.03 REGULATORY REQUIREMENTS

A. This contractor shall give proper authorities all requisite notices relating to work in their charge, obtain official permits, licenses for temporary construction and pay proper fees for it.

B. This contractor is to be solely answerable for and shall promptly make good all damage, injury or delay to other contractors, to neighboring premises or to persons or property of the public by themselves, by their employees or through any operation under their charge, whether in the contract or extra work.

C. No attempt has been made to reproduce in these specifications any of the rules or regulations contained in city, state or federal ordinances and codes pertaining to the work covered by these specifications that the contractor be thoroughly familiar with all such ordinances and codes.

D. The fact that said various rules, regulations and ordinances are not repeated in this specification does not relieve the contractor of the responsibility of making the entire installation in accordance with the requirement of those authorities having jurisdiction.

E. All work shall comply with the applicable recommendations of:
   1. The National Board of Fire Underwriters
   2. The ANSI-NFPA 70 National Electrical Code
   3. The National Fire Protection Association (NFPA)
   4. The Occupations Safety and Health Act (OSHA)
   5. IBC Building Code (current) and any current applicable city building and or electrical codes.
   6. Fire Protection: Conform to UFC and NFPA
   7. ANSI/NFPA 70 National Electrical Code

F. Obtain permits and request inspections from authority having jurisdiction.

G. Conform to latest approved versions of codes.

1.04 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of owner and architect/engineer before proceeding.

C. This contractor shall, before submitting their bid, visit the site of the project to familiarize themselves with locations and conditions affecting their work.

D. It is the intent of this specification that the contractor furnishes all labor and material required to complete the installation as outlined in the drawings and specifications. No additions to the contract price shall be allowed due to the failure of this contractor to properly evaluate the effect of existing conditions on the work to be done under this contract.

E. Whenever renovation or remodeling or relocation of existing equipment is included in the contract, it is imperative that all locations of existing wiring conduits, electrical panels, equipment, services and grades be noted on the job site before bid is submitted and that all elevations and grades be verified before roughing in new work.

F. This contractor shall provide holes as necessary for the installation of their work and in accordance with materials other than the structure.

1.05 SEQUENCING AND SCHEDULING

A. This contractor shall arrange their work in order that it progresses along with the general construction of the building.

B. This contractor shall be kept informed as to the work of other trades engaged in this project and shall execute their work in such a manner so as not to delay or interfere with progress of other contractors.

C. Where space for electrical lines and conduit is limited, it is imperative that all such trades coordinate their work so as to insure concealment in space provided. Where conflict exists, the engineer shall decide priority of space. If work is not properly coordinated, the engineer may require removal and relocation of work without additional compensation.

1.06 GUARANTEE

A. This contractor shall guarantee all of the apparatus, materials, equipment furnished and labor installed under this contract for a period of one year after date of final acceptance, unless a longer period is specified.

B. Neither final certificate of payment nor any provisions in the contract documents nor partial or complete occupancy of premises by owner shall constitute an acceptance for work not done in accordance with contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

C. Should any defects arise as the result of defective workmanship or material within the guarantee period set forth, this contractor shall make the necessary correction at their own expense.

1.07 ENGINEER APPROVED EQUAL PRODUCTS

A. When the engineer, at the request of the interested parties, including the contractor, supplier and manufacturer approved "engineer approved equal" products for this project, such products are approved on the assumption that they will equal or exceed the performance of the products specified.

B. If such products do not do so after being installed on this project, this contractor shall replace or modify the particular product as necessary to equal the performance of the products specified at no expense to the owner, architect or engineer.

C. Request for "engineer approved equal" products shall be received by the architect/engineer prior to the last addendum being issued. Requests for substitutions received after this date will not be considered. Substitution requests shall clearly state which products are being considered for substitution. Substitution requests shall include all pertinent product information needed to evaluate the substitution as an "equal".

D. Similar products shall be all of the same manufacturers and style. There is no exception to this unless prior approval has been granted from engineer.

1.08 OWNER'S RIGHT OF SALVAGE

A. Before beginning construction the contractor shall check and verify with the owner each item of existing equipment that must be removed.

B. The owner will designate which items of material or equipment not reused that they may wish to keep. This contractor shall then remove these items with care and store in a location designated by the owner for the owner's disposal.

C. All other items of equipment to be removed and not specified for reuse in new construction or reserved by the owner for their use shall become the property of the contractor and shall be removed from the site.

1.09 PROTECTION AND MAINTENANCE

A. The work covered by these drawings and specifications involves all work in the existing building.

B. Where necessary to connect to any existing utility service, this contractor shall contact the owner and shall coordinate any building service connection with the owner so that normal operation to the building is disrupted as little as possible.

C. Any work to be done in existing structures shall be coordinated with the owner and arrangements made so that traffic flow may be maintained and areas finished where possible before other areas are begun.

D. This contractor shall protect existing equipment in finished areas from dirt, dust and damage as a result of their work.

E. Coordinate protection requirements with department heads before beginning construction.

F. Protect any building openings from unauthorized entry. Coordinate with owner where building entry must be controlled.

1.10 DEMOLITION

A. This contractor shall be responsible for the demolition and removal of all existing electrical elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be reused".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.
   4. All elements to be removed are subject to the Owner's Right of Salvage.

B. Preserve services to the existing facility. Extend/reroute/reconnect the existing systems as required providing for the continued function of these systems.

1.11 CUTTING AND PATCHING

A. This contractor shall do all cutting and patching necessary for the installation of their work in all existing and new buildings unless otherwise noted.

B. In areas where the integrity of new or existing fire separation assembly/wall is compromised by the work, this contractor shall be responsible to patch and/or seal openings as necessary to maintain and/or return fire separation to rating as required by applicable codes.

C. This contractor shall do all cutting and patching required for their work beyond the remodeled areas unless otherwise noted. All finish work shall include patching to match existing adjacent surfaces. Painting shall be by others.

1.12 CLEANING AND RUBBISH

A. This contractor, upon completion of their work, shall remove all rubbish and debris resulting from their operation and shall remove it from site at their own expense.

B. As far as their work is concerned, all equipment shall be cleaned and the premises left in first class condition.

C. This contractor shall maintain the work area each day to prevent hazardous accumulation of waste from their work.

1.13 SEALING AND PENETRATION

A. Clearance around the piping passing through fire or smoke rated construction shall be sealed to maintain the rated integrity of the construction (1 hr. 2 hrs. etc.). One and two-hour rated assemblies are to be patched on both sides of the assembly.

B. This contractor shall verify rating and location of all such construction with the architectural drawings and seal all penetrations.

C. Manufacturer offering products to comply with the requirements include the following:
   1. Dow Corning "Silicone RTV Foam"
   2. 3-M Corporation "Fire Barrier Caulk and Putty"
   3. Thomas & Betts "Flame Safe Fire Stop System"

D. Installation of these products are to be in strict accordance with the manufacturer's recommendations.

E. This contractor shall submit shop drawings showing approved sealing assemblies to be utilized on this project.

1.14 HAZARDOUS MATERIALS

A. If this contractor stores any hazardous solvents or other materials on the site, they shall obtain copies of the safety data sheets for the materials and post them at the site. The contractor shall inform the owner and all employed of any potential exposure to this material.

B. At no time shall any product containing asbestos be incorporated into the work.
   1. If asbestos materials are encountered, report to the owner. The owner will be responsible for asbestos removal.

1.15 AS-BUILT DRAWINGS

A. This contractor shall provide (at the conclusion of the project) one clean, non-torn, neat and legible "as-built" set of drawings to the owner. These drawings shall show the routing of conduit, wiring and equipment drawn in at scaled locations. All cabling, devices, and endpoints shall be labeled and conform to head end programming and system drawings. All dimensions indicated shall be referenced to a column line. A set of construction blue prints will be furnished for this work.

B. All electrical panels and electrical installed equipment shall be shown on the "as-built" drawings.

C. Refer to Architectural Specification Sections for additional requirements.

D. This contractor shall update these drawings during the project at least every week.

1.16 ALTERNATES

A. Refer to description of alternate bids under General Specification Sections.

1.17 REVIEW OF MATERIALS

A. This contractor shall submit to the engineer for review one (1) electronic copy giving a complete list of materials, fixtures, devices and panels they propose to furnish. The brochure shall contain complete information as to the make of equipment, type, size, capacities, dimensions, and illustration. Three copies reviewed by the engineer shall be returned to the contractor. One copy shall be kept on the job at all times.

B. Checking of submittal drawings by the engineer does not relieve the contractor of the responsibility for the accuracy of such drawings and for their conformity to drawings and specifications unless the contractor notifies engineer, in writing, of such deviation at time such drawings are furnished.

C. All submittals shall have the date marked on them when the contractor receives them from the supplier. Submittals shall be submitted through the contractor and shall not come direct from the supplier to the architect or engineer.

D. This contractor shall mark the date and sign each set. This indicates that each of them have been checked in their entirety before submitting to the engineer. Submittals that are not dated and signed by the contractor will not be accepted, or checked and will be marked "resubmit" and sent back to the electrical contractor.

1.18 TEST OF SYSTEMS

A. This contractor, before concealed, shall test all systems installed under this contract as called for in these specifications and as required by local codes. Tests shall be made in the presence of the engineer, local authorities or their duly authorized representative. Any defects discovered in testing shall be corrected and the tests repeated until all defects are eliminated.

B. This contractor shall be held responsible for all damage resulting from defects in the system.

C. Each individual feeder circuit shall be tested at the panel and in testing for insulation resistance to ground; the power equipment shall be connected for proper operation. In no case shall the insulation resistance to ground be less than that required by the National Electrical Code (NEC).

1.19 SCOPE OF WORK

A. This contractor shall furnish all the labor and material necessary to install a complete safety and security system for the remodeled building.

B. This contractor shall furnish all the labor and material to install a complete safety and security system in the new building. The system shall include all items of work as outlined in these specifications and on the drawings.

C. All work shall be performed by a well-qualified and licensed technician with a thorough knowledge of the various systems involved in this building. It shall be this contractor's responsibility to see that their electricians are familiar with all the various codes and tests applicable to this work.

D. All equipment shall be new and of the type specified by the engineer unless otherwise noted in these specifications or on the drawings to remain and or be reused.

E. The intent of the specifications and drawings is for complete installation of the systems outlined in the specifications and drawings so that at the conclusion of construction the system will be turned over to the owner complete and ready for safe and efficient operation. The specifications and drawings cannot deal individually with the many minute items that may be eventually required by the nature of the systems.

F. This contractor is required to furnish and install all such items normally included on systems of this type, which, while not mentioned directly herein or on the drawings are obviously essential to the installation and operation of the system and which are normally furnished on quality installation of this type.

G. This contractor, shall before proceeding with any work, review the architectural drawings. Any conflict between the electrical and architectural drawings shall be reported to the engineer for clarification.

H. If there is a discrepancy between the drawings and the specifications or within either document, the more stringent requirement shall be estimated unless brought to the engineer’s attention and an addendum is issued for clarification.

I. The cable that is installed without using raceway shall be neatly routed and supported every three foot (3’) by j-hooks. All wiring in mechanical rooms shall be in conduit. All exposed wiring shall be in raceway. No cable shall be allowed to lie on the accessible ceiling tile.

1.20 DAILY HOUSEKEEPING AND CLEANING

A. At the end of each workday, the contractor shall remove all of their debris, rubbish, tools, and surplus materials from the project work area. The work area shall be broom cleaned and left in a neat and orderly condition. The contractor, for the removal of debris from the project, shall not use the owner’s waste disposal facility.

B. At end of construction, all equipment shall be cleaned and the premises left in first class condition as far as this contractor's work is concerned.

1.21 OWNER'S RIGHT OF WORK CESSATION

A. The owner reserves the right to order an immediate cessation of work without giving advance notice.

1.22 WALL CONTINUITY (1 HR.)

A. All items mounted in 1 hr. rated walls requiring an opening larger than a four inch (4") square (16 sq. inches) require the 1 hr. rating not be degraded.

B. Any branch panel in a 1 hr. wall will require the exterior of the recessed panel be covered with 5/8 inch fire rated gypsum board. This is true for any device requiring more than a 16 sq. inch opening.

1.23 CABLE

A. The fire alarm system manufacturer shall approve low voltage cable. All low voltage electrical cable, installed as part of a new fire alarm system, shall be plenum rated cable.

B. Cable installed without using raceway shall be neatly routed and supported every 32 inch by no less than a nylon wire tie or supported in bridle rings. All wiring in mechanical rooms shall be in conduit. All exposed wiring shall be in raceways. No cable shall be allowed to lie on the accessible ceiling tile.

1.24 LOW VOLTAGE CABLE INSTALLATION

A. This contractor is to install if they are licensed to, or contract with a licensed electrician to install conduit serving low voltage cables located in all mechanical rooms and non-accessible areas and exposed structural areas. Use cable trays in other areas as indicated on the drawings. Where cable trays are not accessible, use J-hooks equal to Caddy Cable CAT. Provide hooks with closure holes and cable ties. Mount hooks 32 inch on center.

1.25 DIGITAL MEDIA AGREEMENT

A. Computer Aided Drafting (CAD) Documents may be available to the contractor for some uses. Contact the engineer prior to bidding to determine what information is available to be transmitted to the contractor in digital form.

B. When documents are determined to be available, and as requested by the contractor, they will be transmitted upon the completion and execution of the MODUS digital media agreement. A service fee for each document transmitted will be assessed to the contractor. Documents will be transmitted upon payment receipt. Current service fee is $100.00 per CAD sheet.

1.26 SECURE NETWORKABLE DEVICES

A. Update network devices to the most current software/firmware.

B. Change default password of all networkable devices.
   1. Passwords shall have at least eight characters.
   2. Include uppercase and lowercase letters, numerals, and special characters

C. Supply MAC address and serial number of all networkable devices.

D. Work with the Owner’s IT department to align to existing IT standards.

E. Provide to the owner a printed and/or electronic spreadsheet log of all network information including, IP addresses, MAC addresses, logins and password information during system training.

1.27 SYSTEM CONFIGURATION AND PROGRAMMING FILES

A. Supply system configuration and programming files where export is available.

B. Supply uncompiled programming for systems applicable.

C. All configuration and programming shall be property of the owner at conclusion of the project.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 28 0050

SECTION 28 0080

ELECTRONIC SAFETY AND SECURITY SCHEDULE OF VALUES

PART 1 GENERAL

1.01 FORM COMPLETION

A. The successful Electrical Contractor shall complete this form in its entirety within 30 days of receipt of signed contract from the General Contractor, and submit directly to MODUS.

B. This information is confidential and will not be disclosed to any individual outside of MODUS. Data collected will be used in evaluating pay applications.

1.02 OVERALL CONTRACT

Base Electronic Safety and Security Bid	$ _____
Add or deduct accepted alternates, negotiated changes, or other modifications to the contract	$ _____
Total Electronic Safety and Security Bid	$ _____

1.03 SCHEDULE OF VALUES

Video Door Intercom System - Material and Labor	$ _____
Fire Alarm System - Material and Labor	$ _____
Total Electronic Safety and Security Bid (Sum of Schedule of Values)	$ _____

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION 28 0080

SECTION 28 0090

MINOR ELECTRONIC SAFETY AND SECURITY DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The requirements of the Contract Forms, the Conditions of the Contract, Division 1 - General Requirements and Specification Section 26 0050 - Basic Electrical Requirements "General Provisions" apply to this section.

1.02 SCOPE

A. This contractor shall be responsible for the demolition and removal of all existing electrical elements within the project area except as follows:
   1. Elements shown on the drawings as "existing to remain and/or to be relocated".
   2. Elements serving adjacent areas.
   3. Elements required for the support of the newly remodeled areas.

B. Preserve services to the existing facility. Extend, reroute, and reconnect existing systems as required providing for the continued function of these systems.

C. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.

D. This contractor shall remove all abandoned equipment, conduit, and supports associated with the remodeled area unless noted otherwise.

E. This contractor is responsible to provide temporary electronic safety and security protection during this project.

1.03 MATERIALS

A. All elements to be removed are subject to the Owner's Right of Salvage.

B. All materials removed shall be the property of the removing contractor and shall be removed from the site by them, unless otherwise specified.

C. The owner may designate and have salvage rights to any material herein demolished by this contractor. It will be the owner's responsibility to designate such salvageable items and remove them prior to the contractor working in that area.

1.04 EXISTING CONDITIONS

A. If any existing devices that are to remain are disturbed by operations under this contract, the contractor is required to re-establish continuity of such systems.

B. This contractor shall arrange for the general contractor to repair and patch all construction with material necessary to match surrounding due to removal of equipment and conduit.

C. This contractor shall furnish all required labor and material, where required, to extend new work to connect to similar work for extension of existing systems.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. **Beginning of demolition means installer accepts existing conditions.**

B. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the owner before disturbing the existing installation.

C. Verify field-circuiting arrangements and reconnect as necessary.

D. Verify that abandoned wiring and devices serve only abandoned facilities. Reconnect circuits, as required, to prevent de-energizing of remaining receptacles of lights.

3.02 PREPARATION

A. Disconnect safety & security in walls, floors, and ceilings scheduled for removal.

B. Coordinate service outage with local utility company, inspectors, owners, and design team.

C. Provide temporary wiring and connections to maintain existing systems in service during construction.

D. Existing safety and security services: Maintain existing system in service until new systems are complete and ready for deployment. Disable systems only to make switchover connections. Obtain permission from the owner, at least 24 hours before partially or completely disabling any system. To minimize outage, duration, make temporary connections as required.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switch over and connections. To minimize outage, duration, make temporary connections to maintain service within construction areas and in areas adjacent to work area.

F. Existing, Door Access, and Fire Alarm Systems:
   1. Maintain existing system in service until new systems are accepted.
   2. Disable system only to make switch over and connections
   3. Obtain permission from the owner at least 24 hours before partially or completely disabling system.
   4. Minimize outage duration.
   5. Make temporary connections to maintain service in areas adjacent to work areas.

3.03 DEMOLITION AND EXTENSION OF EXISTING SAFETY AND SECURITY

A. Demolish and extend existing safety and security work under provisions of this section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

E. Disconnect abandoned cable and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide a blank cove for abandoned devices that have not been removed.

F. Disconnect and remove abandoned control panels and head end equipment.

G. Disconnect and remove devices and equipment service abandoned safety and security system.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing safety and security installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installation using materials and methods compatible with existing electrical installations or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials that remain or are to be reused.

B. Control Panels: Clean exposed surfaces and check tightness of all connections. replace damaged items and equipment. Provide typed directory showing revised changes or programming.

3.05 INSTALLATION

A. Install relocated materials and equipment.

END OF SECTION 28 0090

SECTION 28 3100
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm and smoke detection control panel

B. Peripheral devices

C. Fire alarm wire and cable

D. Monitor and control modules

1.02 RELATED SECTIONS

A. Specification Section 08 7100 - Door Hardware

B. Specification Section 21 1300 - Fire Suppression Sprinkler System

C. Specification Section 26 0533 - Raceways and Boxes for Electrical Systems

1.03 REFERENCES

A. NFPA 70 - National Electrical Code

B. NFPA 72 – National Fire Alarm Code

C. NFPA 101 - Life Safety Code

D. International Building Code

E. International Existing Building Code

F. International Fire Code

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems

1.04 SYSTEM DESCRIPTION

A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system.

B. Fire alarm system shall include the system wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm and supervisory signal initiating devices, alarm notification appliances and other accessories required for a complete operating system.

1.05 SUBMITTALS

A. Shop Drawings: Provide a building layout showing each device and wiring connection required.

B. Product Data: Provide electrical characteristics and connection requirements.

C. Test Reports: Indicate satisfactory completion of required tests and inspections.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation and starting of products.

E. Contractor shall submit software logic, flow diagrams, battery calculations and one line diagrams illustrating device loops.

F. Contractor shall be responsible for submitting a copy of these documents to the local Authority Having Jurisdiction or state for required review.

G. Submit copies of NICET certifications as described in this specification section.

1.06 PROJECT RECORD DOCUMENTS

A. Record actual locations of initiating devices, signaling appliances, shut down relays, power supplies, and end-of-line devices.

B. Indicate device addresses on this drawing.

C. Deliver to owner as both hard copy and electronic file.

1.07 OPERATION AND MAINTENANCE DATA

A. Operation Data: Operating instructions.

B. Maintenance Data: Maintenance and repair procedures.

C. Configuration Data: Printouts of configuration settings for all devices.

D. Routine Maintenance Checklist.

1.08 QUALIFICATIONS

A. Contractor: The contractor shall have a fully equipped, factory trained, and manufacturer certified service and installation organization.

B. Supervisor: The job supervisor shall be a NICET Level II (or higher) technician and be a full-time employee of the certified reseller. Supervisor shall be responsible for programming and testing.

C. A job site supervisor is to be present on-site at all times during installation. The supervisor shall be a NICET Level II (or higher) technician.

D. Installer: All work relating to the fire alarm shall be performed by a NICET Level I (or higher) technician.

E. A list of technicians with any level of responsibility with this project shall be submitted for review and acceptance during the submittal process. A copy of their NICET Certification and manufacturer's training certificate for the system to be installed shall also be included.

F. Installer shall be capable of answering trouble calls from a permanently maintained location less than 100 miles from project site.

1.09 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Furnish products listed and classified by UL, FM as suitable for purpose specified and indicated.

1.10 EXTRA LABOR AND MATERIALS

A. Provide 2 installed automatic smoke detectors including 40 feet of wiring each per device to be positioned by the owner or engineer.

B. Provide 2 installed audible/visual alarms including 40 feet of wiring each per device to be positioned by the owner or engineer.

C. Provide a minimum of six keys of each type.

D. Devices not installed at the direction of the owner or engineer shall be turned over to the owner at the completion of the project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Match existing. Notifier 5000

B. No engineer approved equal.

2.02 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

A. Main Control Panel: Existing panel to remain. Expand panel as necessary to provide sufficient initiating and indicating circuits.

B. Test and verify automatic telephone dialer module. Notify the design team of any issues.

2.03 PERIPHERAL DEVICES

A. Thermo-Detectors: Area thermo-detectors shall be 135 deg F rate of rise and fixed. They shall cover 2500 sq. ft. Detectors shall be compatible with existing fire alarm control panel.

B. Automatic Smoke Detectors: Area smoke detectors shall operate on the photo-electric principle using a stable LED light source and a silicone photodiode to form a very highly accurate means

of smoke detection and shall be so designed for a 360 degree smoke entry for optimum response. Regardless of sensitivity setting the detector stability shall be unaffected by high air velocity. Detectors shall be compatible with existing fire alarm control panel.

C. Horn/Strobe Indicators: Wall mounted shall comply with Americans with Disabilities Act and compatible with existing fire alarm control panel.

D. Horn/Strobe Combination Unit: Flush mounted combination unit with red thermoplastic faceplate, "FIRE" in white letters.

E. Strobe Only Unit: Xenon light.

F. Duct Smoke Detectors: Furnished and install duct smoke detectors in supply and return air ducts for all the air handling units with fan shutdown relays. Provide remote key re-sets for these detectors.

2.04 FIRE ALARM WIRE AND CABLE

A. Power Alarm Power Branch Circuits: Building wire as specified by the manufacturer.

B. Initiating Device and Indicating Appliance Circuits: All fire alarm wiring shall be in metallic conduit or open raceway system concealed in finished areas as specified. Wiring shall be as specified by the manufacturer.

2.05 MONITOR AND CONTROL MODULES

A. This contractor is responsible to provide all necessary components and wiring for service to approved HVAC equipment 2000 cfm (and larger), approved kitchen hoods and approved fire suppression services. Coordinate exact requirements with HVAC, kitchen equipment, and fire suppression contractors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Make conduit and wiring connections to door release, devices, sprinkler flow switches, and sprinkler valve tamper switches. This contractor is responsible for all wiring and conduit to the sprinkler system post indicating valve, when this valve is provided. See drawings for location.

C. Automatic Detector Installation: Conform to NFPA 72.

D. This contractor shall relocate all existing devices from existing ceilings and mount on new ceilings. New ceilings are indicated on the drawings.

E. Detector should not be located in areas with excessive exhaust fumes, kitchen areas, near fireplaces or furnace rooms and within three feet (3') of air supply ducts, air diffusers, or ceiling fans.

F. This contractor shall be responsible for installing an indication system that results in a tone reaching 15 dB over ambient or louder. Horns shall not reach a volume that is greater than 105dB in any room.

G. This contractor shall be responsible for installing an indication system that meets or exceeds the required strobe intensity per NFPA 72.

H. Existing devices may be reused where appropriate.

I. This contractor is responsible to provide all necessary components and wiring for service to approved HVAC equipment 2000 cfm (and larger), approved kitchen hoods and approved fire suppression services. Coordinate exact requirements with HVAC, kitchen equipment, and fire suppression contractors.

3.02 ELECTRICAL REQUIREMENTS

A. All wiring shall be concealed within walls. No exposed raceways except areas with exposed structure. Coordinate conduit routing with the architect. Provide conduit for wiring located in non-accessible areas. In areas with accessible ceilings, use j-hooks as specified. Provide sleeves through walls and floors (3/4 inch minimum). Do not exceed a 40% pipe fill.

B. Fire alarm cable installed in conduit shall not be shared by any other low voltage system cable.

C. All cable terminations shall be located within the device itself or in a junction box. Exposed splices are not acceptable.

D. Provide and Install insulated bushing on end of raceways.

E. All fire alarm devices, junction and pull boxes shall be installed so they are easily accessible without removing light fixtures, equipment, conduits, junction boxes or other items.

3.03 FIELD QUALITY CONTROL

A. Test in accordance with NFPA 72.

B. Upon completion of the fire alarm system installation, this contractor shall provide a written statement advising the architect of completion and to be in compliance with fire and electrical codes and in accordance with wiring diagrams, instructions and directions provided by the manufacturer.

C. Representative of the manufacturer shall certify the system complete and that the owner has received adequate instructions in system operation.

3.04 MANUFACTURER'S FIELD SERVICES

A. Prepare and start system.

B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.05 ADA HEIGHT

A. The new fire alarm devices will require new back boxes for the new audio/visual alarm signals. Install at the new ADA height of 80 inches to the center of the flashing light. ADA requires 48 inches to the operating mechanism of any pull station, which is newly installed in order to comply with a wheel chair bound person’s forward reaching.

B. The devices mounted below 80 inches shall not protrude from the wall over four inch (4") to comply with ADA.

3.06 CABLE

A. The fire alarm system manufacturer shall approve the low voltage cable. All low voltage electrical cable that is installed as part of the new fire alarm system shall be plenum rated cable where required.

B. The cable that is installed without using raceway shall be neatly routed and supported every three foot (3’) by no less than a nylon wire tie or supported in bridge rings. All wiring in mechanical rooms shall be in conduit.

C. All exposed wiring shall be in raceway.

D. No cable shall be allowed to lie on the accessible ceiling tile.

E. Cable associated with smoke control or stairwell pressurization systems shall be installed in continuous raceway.

3.07 EXISTING FIRE ALARM STATUS

A. The electrical contractor shall document all alarms associated to the fire alarm system and contact owner prior to performing general demolition.

B. Electrical contractor shall respond to and resolve any nuisance trouble conditions from fire alarm system due to related construction project. Nuisance troubles shall be resolved with maintenance staff within 24 hours of notification of trouble.

END OF SECTION 28 3100