Central Connecticut State University
1615 Stanley Street - New Britain, CT 06050

DR. ZULMA R. TORO
PRESIDENT

MR. SAL CINTORINO
CHIEF OPERATIONS OFFICER

PROJECT MANUAL

COUNSELING DEPARTMENT RENOVATIONS

JANUARY 29, 2021

CCSU PROJECT No.: 05-101
STATE PROJECT No.: N/A

CENTRAL CONNECTICUT STATE UNIVERSITY, OFFICE OF THE UNIVERSITY ARCHITECT
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1.01 DEFINITIONS

Whenever the following terms, or pronouns are used in lieu of them, the intent and meaning shall be as follows:

A. Agency: Central Connecticut State University
   1615 Stanley Street
   New Britain, CT 06050

A.1 Agency Representative: Mr. Sal Cintorino
   Chief Operations Officer
   Central Connecticut State University
   1615 Stanley Street, East Hall
   New Britain, CT 06050

A.2 Project Coordinator: Karen Arborio
   Coordinator of Capital Projects and Facilities
   Central Connecticut State University
   1615 Stanley Street, East Hall
   New Britain, CT 06050
   Tel: (860) 832-2311
   Fax: (860) 832-2329

B. Project, COUNSELING DEPARTMENT RENOVATIONS
   STATE PROJECT # N/A- CCSU Project No.05-101, with documents date of January 29, 2021

1.02 COMMENCEMENT, DELAY AND COMPLETION OF THE WORK

A. The Contractor shall begin work under this Contract on the Project Start Date as indicated herein, and only after the Agency's issuance of a Purchase Order for the Project. In the event that the issuance of the Purchase Order is delayed for reasons beyond the control of the Agency, the Agency may issue a Letter of Intent to the Contractor indicating the Agency's desire to proceed with the project. The Contractor may elect to commence work upon receipt of said Letter of Intent, pending receipt of a formal Purchase Order from the Agency. In all cases, the Contractor shall complete all Work required by this Project within ninety (90) calendar days as stated in the Form of Proposal.

B. Should the Contractor be denied a Workday, as specified in Article 1.34 of these GENERAL CONDITIONS, or delayed in the execution of the Contract by what the Contractor believes to be, a valid cause beyond its control, such as fire, rain, flood or other acts of God, the Contractor may submit a claim for an extension of the Project's Date of Substantial Completion. To receive consideration, each claim must be filed in writing, with a full statement of the reasons therefore, with the Project Coordinator, within seven (7) days of the occurrence of the delay.
1.03 COOPERATION OF TRADES

A. The Contractor shall be responsible for the control of the activities of its subcontractors. The Contractor hereby warrants that they shall consult, cooperate and coordinate with one another and other general contractors requested by others and the Contractor shall lay out and install its work in a manner that will avoid any delays in, or interference with, the work of others. Any increase in the cost of, or delay in the Project incurred by the failure of the Contractor to insure the cooperation of its subcontractors, shall be borne by the Contractor.

1.04 PREVAILING WAGE RATES

A. On all new projects in excess of $400,000.00 and on all renovation or repair projects in excess of $100,000.00; the wages paid to any mechanic, laborer or workman employed upon the Work, herein contracted to be done, shall be equal to the rate of wages specified in the Schedule of Prevailing Rates a part of the "Minimum Rates and Classifications for Building Construction", specifically published for this Project by the State of Connecticut Labor Department.

Should this Project be estimated to cost in excess of that specified above, a copy of the Schedule of Prevailing Wage Rates will be enclosed in the Purchasing Department Insert.

Each Contractor, who is awarded a contract on or after October 1, 2002, shall be subject to provisions of the Connecticut General Statues, Section 31-53, as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages". These provisions should be used in determining bid price. Wage rates will be posted each July 1st on the Department of Labor website: www.ctdol.state.ct.us. Such prevailing wage adjustment will not be considered a matter for an annual contract amendment.

B. In the event it becomes necessary for the Contractor or any subcontractor to employ any mechanic, laborer or workman in a trade or occupation for which no minimum wage rate is set forth, the Contractor must immediately notify the Agency, who will ascertain the minimum applicable wage rate and thereupon notify the Contractor accordingly. The rate so determined will be applicable from the time of the initial employment of the person affected and during the continuance of such employment.

C. The Contractor shall submit to the Labor Department a properly executed "CONTRACTOR'S WAGE CERTIFICATION FORM", with a copy to the Agency, certifying the Contractor's compliance with the prevailing wage rates for this Project. A copy of said form is enclosed in the Purchasing Department Insert.

D. The Contractor shall, in accordance with Public Act 93-392, submit monthly to the Agency, a certified payroll and compliance statement on form FOW-CP 1 available from the Connecticut State Department of Labor, Regulation of Wages Division, 200 Folly Brook Boulevard, Wethersfield, CT 06109. The certified payroll and compliance statement shall be considered a public record, and every person shall have the right to inspect and copy such records in accordance with the provisions of Section 1-15 of the State's General Statutes. Federal certified payroll forms do not meet the requirements of this public act and are not acceptable.

E. The Contractor shall post, at a conspicuous point on the wall of the job trailer, or the Job
Site(s): the schedule specifying all wage rates and authorized deductions, if any, from all wage categories required for this Project.

1.05 CONTRACTOR’S PAYMENT OBLIGATION TO SUBCONTRACTORS

A. The following section of the general statutes is inserted as information concerning the bonds furnished under Section 49-41 of the general statutes and under the Notice to Bidders section of the Project Manual:

1. Sec. 49-41a. Enforcement of payment by the General Contractor to subcontractor.

   a. When any public work is awarded by a contract for which a payment bond is required by Section 49-41, the contract for the public work shall contain the following provisions: (1) A requirement that the General Contractor, within thirty days after payment to the Contractor by the State or a municipality pay any amounts due any subcontractor, whether for labor performed or materials furnished, when the labor or materials have been included in requisition submitted by the Contractor and paid by the State or a municipality: (2) a requirement that the General Contractor shall include in each of its subcontracts a provision requiring each subcontractor to pay any amounts due any of its subcontractors, whether for labor performed or materials furnished, within thirty days after such subcontractor receives a payment from the General Contractor which encompasses labor or materials furnished by such subcontractor.

   b. If payment is not made by the General Contractor of any of its subcontractors in accordance with such requirements, the subcontractor shall set forth its claim against the General Contractor and the subcontractor of a subcontractor shall set forth its claim against the subcontractor through notice by registered or certified mail. Ten days after the receipt of that notice, the General Contractor shall be liable to its subcontractor for interest on the amount due and owing at the rate of one per cent per month.

In addition, the General Contractor, upon written demand of its subcontractor, shall be required to place funds in the amount of the claim, plus interest of one per cent, in an interest bearing escrow account in a bank in this state, provided the General Contractor or subcontractor may refuse to place the funds in escrow on the grounds that the subcontractor has not substantially performed the Work according to the terms of its or its employment. In the event that such General Contractor or subcontractor refused to place such funds in escrow, and the party making a claim against it under this section is found to have substantially performed its work in accordance with the terms of its employment in any arbitration or litigation to determine the validity of such claim, then such General Contractor or subcontractor shall pay the attorney’s fees of such party.
c. No payment may be withheld from a subcontractor for work performed because of a dispute between the General Contractor and another contractor or subcontractor.

d. This section shall not be construed to prohibit progress payments prior to final payment of the Contract and is applicable to all subcontractors for material or labor whether they have contracted directly with the General Contractor or with some other subcontractor on the work.

1.06 SUIT ON BOND

A. The following section of the General Statutes is inserted as information concerning the bonds furnished under Section 49-42 of the general statutes and under the Notice to Bidders section of the Project Manual:

1. Sec. 49-42. Suit on bond; when and how brought.

   a. Every person who has furnished labor or material in the prosecution of the work provided for in such contract in respect of which a payment bond is furnished under the provisions of Section 49-41 of the Connecticut General Statutes and who has not been paid in full therefor before the expiration of a period of ninety days after the day on which the last of the labor was done or performed by him or material was furnished or supplied by him for which claim is made, may enforce its right to payment under the bond by serving a notice of claim within one hundred eighty days after the date of which the Contractor performed the last of the labor or furnished the last of the material for which the claim is made, on the surety that issued the bond and a copy of the notice on the contractor named as principal in the bond. The notice of claim shall state with substantial accuracy the amount claimed, the name of the party for whom the labor was performed or to whom the materials were furnished and shall provide a detailed description of the bonded public project for which the labor or materials were provided. Within ninety days after service of notice of claim, the surety shall make payment under the bond and satisfy the claim, or any portion of the claim which is not subject to good faith dispute, and shall serve a notice on the claimant denying liability for any unpaid portion of the claim.

   The notices required under this section shall be served by registered or certified mail, postage prepaid in envelopes addressed to any office at which the surety, principal or claimant conducts its business, or in any manner in which civil process may be served. If the surety denies liability on the claim, or any portion thereof, the claimant may bring action upon the payment bond in the superior court for such sums and prosecute the action to final execution and judgment. An action to recover on a payment bond under this section shall be privileged with respect to assignment for trial. The court shall not consolidate for trial any action brought under this section with any other action brought on the same bond unless the court finds that a substantial portion of the evidence to be adduced, other than the fact that the claims sought to be consolidated arise under the same general contract, is common to such actions and that consolidation will not result in excessive delays to any
claimant whose action was instituted at a time significantly prior to the motion to consolidate. In any such proceeding, the court judgment shall award the prevailing party the costs for bringing such proceeding and allow interest at the rate of interest specified in the labor or materials contract under which the claim arises or, if no such interest rate is specified, at the rate of interest as provided in section 37-3a upon the amount recovered, computed from the date of service of the notice of claim, provided, for any date of service of the notice of claim, such interest shall be computed from the date such portion became due and payable. The court judgment may award reasonable attorneys fees to either party if upon reviewing the entire record it appears that either the original claim, the surety's denial of liability or the defense interposed to the claim is without substantial basis in fact or law. Any person having direct contractual relationship with a subcontractor but no contractual relationship express or implied with the contractor furnishing the payment bond shall have a right of action upon the payment bond giving written notice of claim as provided in this section.

b. Every suit instituted under this section shall be brought in the name of the person suing, in the superior court for the judicial district where the contract was to be performed, irrespective of the amount in controversy in the suit, but no such suit may be commenced after the expiration of one year after the day on which the last of the labor was performed or material was supplied by the claimant.

c. The word "material" as used in sections 49-41 to 49-43, inclusive, includes the rental of equipment used in the prosecution of work provided for in the Contract.

END OF THE GENERAL CONDITIONS
THE PROJECT COORDINATOR – STATUS AND RESPONSIBILITY

A. CCSU Facilities Department is referred to in the Contract Documents as Project Coordinator or by pronouns which imply them.

1. Interpretations or decisions will be relayed through the Project Coordinator to the Contractor.

2. The Project Coordinator is responsible for review of Shop Drawings, material and equipment intended for the Work, in accordance with the Contract Documents.

Wherever the Architect/Engineer is mentioned in the Documents in connection with an administrative function, it will include the Project Coordinator in that function.

SUMMARY OF WORK

A. The Work of this Project comprises all work specified in the Contract Documents entitled Counseling Department Renovations, January 29, 2021. The Project is located in the campus of Central Connecticut State University, 1615 Stanley Street, New Britain, Connecticut.

B. The Scope of the Work is defined by the Contract Documents, including labor and material. The Scope of Works includes, but will not be limited to the following:


C. The Contractor will include in his bid, all items required in order to carry out the intent of the work as described, shown and implied in the Contract Documents.

D. It shall be the Contractor's responsibility upon discovery to immediately notify the Construction Administrator, in writing, of errors, omissions, discrepancies, and instances of noncompliance with applicable codes and regulations within the documents, and of any work which will not fit or properly function if installed as indicated on the Contract Documents. Any additional costs arising from the Contractor's failure to provide such notification shall be borne by the Contractor.
01012 PROJECT DOCUMENTS

A. The Specifications and Drawings describe and illustrate the materials and labor necessary for the Work of this Project.

B. The Contract Documents generally describe the materials, systems and procedures required to complete the Work. They are not inclusive and are meant to guide the Contractor in the prosecution of the Work.

C. The GENERAL CONDITIONS and SUPPLEMENTARY GENERAL CONDITIONS apply to each Section of the Specification. The Contractor will insure that each and every Subcontractor and Material Supplier is so informed. Additional provisions of the Specifications are supplementary, and in any case where general conditions are modified, remaining portions of the general article will remain in effect.

01013 DOCUMENTS FURNISHED

A. The Agency will provide three (3) sets of the Contract Documents for the Contractor's use. If more sets of the Contract Documents are required, the Contractor will bear all the costs incurred in their provision.

01014 EXISTING CONDITIONS AND DOCUMENTS

A. It is not the intent of the Contract Documents to show all existing conditions. All Bidders are required to examine the Site prior to submitting bids. Failure to do so will in no way relieve the Contractor from completing the Work as required.

B. The Contractor will make a pre-construction survey of the conditions of the Site and all adjacent areas in the vicinity of the Site which may reasonably be expected to be affected by the Work.

C. Prior to beginning the Work, the Contractor will advise the Project Coordinator, in writing, of all existing conditions which may affect the Work.

D. Where existing objects or conditions are uncovered and exposed, subsequent to the issuance of the Purchase Order, the Contractor and the Project Coordinator will jointly inspect these conditions and their findings will be recorded in writing by the Contractor. All corrective measures jointly agreed upon will be recorded in detail sufficient to prevent confusion and conflict at a later date.

E. The Contractor will proceed with the Work in these areas, taking into consideration these newly exposed conditions, and will adjust its working procedures to compensate for these conditions.

F. The Agency (CCSU) will make available for the Contractor's information, certain documents relating to the existing Site as it relates to the Work required under this Contract. These documents were not prepared for the purpose of providing information to the Contractor regarding the Work required by this Contract. They were prepared for other
purposes, and do not form a part of this Contract. The Agency and the Project Coordinator
make no representation or guarantee as to, and will not be responsible for, their accuracy,
completeness or pertinence and, in addition, will not be responsible for the conclusions to
be drawn therefrom. They are made available to the Contractor as they exist, whether or
not such information may be accurate, complete or pertinent or of any value to the
Contractor. The Contractor must interpret all information shown according to its own
judgement. The Contractor will conduct such investigations as the Contractor deems
necessary to verify the information shown as it affects the Work.

01015  CONTRACTOR'S USE OF PREMISES

A. The Contractor will confine its operations to the immediate area of the construction site
within the Contract Limit area as directed by CCSU. The Contractor will confine its storage
of materials, supplies and equipment to the areas specified by the Project Coordinator.

B. “Plan of Use”: The Contractor shall prepare a “Plan of Use” for the Project which shall
describe in detail the Contractor’s proposed use of the Site, both inside and outside the
Contract Limit Area. The Contractor shall prepare the Plan of Use on a 1”=20’ scale plan
of the Project Site. The Plan of Use shall include, but not be limited to the following:
proposed vehicle and equipment access routes, scaffold and ladder locations, locations of
proposed staging and storage areas, office trailer and dumpster locations, location of
perimeter construction fencing and gates, other ground level protection measures around
the building(s) (scaffold frames & planks), proposed pedestrian traffic flows around each
building, proposed building access points, proposed protection measures for trees, shrubs
and plantings. The Contractor shall submit the “Plan of Use” to the agency for approval
within three (3) days of the issue of the PURCHASE ORDER, and Work on the Project
shall not commence until an acceptable “Plan of Use” has been approved by the Agency.
Any delay in the Project caused by the Contractor’s failure to submit an acceptable “Plan
of Use” shall not alter the Contractor’s responsibility to complete the Work in the specified
number of calendar days as set for in the FORM OF PROPOSAL.

C. The Contractor will keep the Building(s) in a clean and orderly condition. The Contractor
will keep the Building(s) accessible to Agency Maintenance Personnel at all times.

D. Existing walks, driveways, access routes to each building, adjacent lawn and parking areas
are to be kept free of construction materials and debris for the Contract Term.

E. The Contractor will keep each roof area and surrounding premises clean and will pick up
construction debris DAILY, and will comply with all requirements of Section 105690
"Cleaning”.

F. The Contractor will move any stored products, under the Contractor’s control, which
interfere with the operations of the Agency. The Contractor will obtain and pay for the use
of additional storage or work areas as needed to carry out the Contract.

01016  OCCUPANCY  N/A
A. Unoccupied Building

01017 SUPERVISION

A. The Contractor will submit a resume for the proposed Project Superintendent and all other pertinent information required to obtain the Agency’s written approval of the Project Superintendent. The Project Superintendent will be approved by the Agency and will be on the Site whenever scheduled or significant work is being performed. The Contractor will not change the Project Superintendent without the written consent of the Agency. The Project Superintendent will attend all scheduled project meetings. The Contractor will list "Field Supervision" as a separate line item on the Schedule of Values. The Agency reserves the right to withhold money from the Contractor's monthly Application for Payment for any unauthorized deviation from the full-time supervision requirement set forth above.

01018 EMERGENCY RESPONSE

A. The Contractor shall designate a 24-hour emergency contact person for the duration of the project and shall provide the Project Coordinator with the name, address and telephone number of that individual. The individual, or firm, so named will respond within one (1) hour of an emergency call. The Contractor will be capable of rectifying any problem that pertains to the Work of this Project. The Contractor will have the authority to enter into a contract with other individuals as may be required to resolve the problem creating the emergency, to the satisfaction of the Agency’s Representative at the scene of the emergency.

1. The Contractor will post the individual's name and telephone number and appropriate clarification of all emergency response procedures, in a waterproof transparent display, on the door of the Job trailer, and in the immediate vicinity of the current area(s) of work.

01019 ALLOWANCES

A. The Contractor will include in the Lump Sum Bid Proposal each Allowance stated in the Contract Documents. Items covered by Allowances will be supplied for such amounts and by such persons or entities as the Agency may direct.

B. The general provisions of the Contract Documents, including GENERAL CONITIONS and GENERAL REQUIREMENTS, apply to each listed Allowance item.

C. Unless otherwise provided in the Contract Documents:

1. Materials and equipment under the Allowance will be selected promptly by the Agency to avoid delay in the Work.

2. Allowances will cover the cost to the Contractor of materials and equipment delivered to the site and all required taxes, less applicable trade discounts.
3. The Contractor's costs for unloading and handling, labor, installation costs, overhead and profit and other expense related to the Allowance item will be included in the Lump Sum Bid Price and not in the Allowance.

4. The Contractor will insure that the Work performed under the Allowance section is complete and operable in every respect.

5. If the actual cost of an Allowance item is more or less than the given amount, the Contract Sum will be adjusted by a Change Order.

6. NOTE: Items not specified in the allowance necessary for the proper operation and completion of work stated in the allowances are to be performed by the General Contractor (conduits, boxes, etc.)

D Coordination

The G.C. will coordinate all fire work with CCSU Fire Lt. and TPC Archie Santos.

E. Schedule of Allowances:

1- Modifications to existing Sprinkler System: $20,170.00

   Vendor: Mack Fire Protection, 15 Industrial Place, Middletown, CT 06457
   Phone: 860-632-8053. Contact person: Jon Wells.

   Summary Scope of Work: Provide and install concealed pendant sprinkler coverage. Shut down, drain and restore sprinkler system back to operation at the end of each work day. Existing sprinkler mains and branch lines will be raised to accommodate the new ceiling heights.

2- Modification to existing Fire Alarm System and Programming: $26,880.00

   Vendor: TPC Associates, Inc. 261 Pepe’s Farm Road; Milford, CT 06460
   Phone 203-878-1321. Contact person: Archie Santos.

   Summary Scope of Work: Provide fire alarm equipment, labor, programming and final testing. Equipment to include: smoke detectors, base, mounting plate, ceiling speaker/strobe and dual input module (quantities per quotation). Labor to include: Parts, installation, system programming, final testing.

01020 EMERGENCY REPAIRS

A. Should the individual designated for emergency response in the above article fail to respond in the specified period of time, or fail to effect adequate repairs in a timely manner,
the Project Coordinator may take whatever action necessary to alleviate the problem, repair any damage incurred and/or clean up the immediate and adjacent areas. The cost of the corrective measures specified above, including the Agency Representative's or Coordinator's time and expenses, will be billed directly to the Contractor. Should the Contractor not bear the cost of these measures, they will be assigned to the Project and its Contract Sum will be reduced by that amount.

01030 SUPPLEMENTAL BIDS

Not Applicable

01040 COORDINATION

A. The Contractor will coordinate the Work of the several trades to assure the efficient and orderly sequence of installation of construction elements.

B. The Contractor will verify that characteristics of interrelated equipment are compatible. The Contractor will coordinate work of various Sections having interdependent responsibilities for installing, connecting and placing equipment in service.

C. The Contractor will coordinate space requirements and installation of mechanical work; follow routing shown for pipes, ducts and conduits as closely as practicable; make runs parallel with lines of building; use spaces efficiently to maximize accessibility for other installations and for maintenance repairs.

D. The Contractor shall coordinate work to avoid interruption or interference to any utility line servicing any building on campus.

E. See also Article 1.03 of the GENERAL CONDITIONS.

01045 CUTTING AND PATCHING

A. Openings and chases may not be shown on the Drawings. It is the responsibility of the Contractor to examine the Drawings and to provide openings where needed.

B. The Contractor will install sleeves, inserts and hangers furnished by the trades needing same.

C. After installing work into openings, the Contractor will close same. If finishes are to be restored, the new work will match the original and will be done by the trade customarily responsible for the particular kind of work.

D. The Contractor will obtain permission from the Project Coordinator before cutting beams, arches, lintels or other structural members if necessary.

E. The Contractor will perform all cutting and patching to integrate elements of work, uncover ill-timed, defective and non-conforming work. The Contractor will provide necessary
penetrations of existing surfaces, seal penetrations through floors, walls, ceilings and roofs, as applicable and restore or preserve fire-rated and smoke barrier construction. Construction and finishes will match original work. The Contractor will provide any necessary samples for testing.

01050 SURVEY/LAYOUT AND RECORD DOCUMENTS DURING CONSTRUCTION

A. Record Drawings during Construction:

1. Contract Documents: The Contractor will maintain at the Site, one copy of the Contract Documents, Addenda, approved Shop Drawings, Change Orders, etc., in good order, with up-to-date project information. The Contract Documents will be available to the Architect/Engineer and Project Coordinator at all times.

2. Record Drawings: The Contractor will maintain at the Project Site one set of the Contract Documents which will be entitled "Record Drawings", on which the Contractor will record any and all changes to the Contract Documents, as soon as they occur. The Record Drawings will be updated on a weekly basis, at a minimum, and will be available to the Project Coordinator at all times. The Contractor will carry a separate line item for "Record Drawings" on the Schedule of Values. The Contractor's failure to update the "Record Drawings" will result in a reduction in the Contractor's monthly Application for Payment.

3. Record Survey: Not applicable.

01052 DIMENSIONS AND MEASUREMENTS

A. The Contractor and each Subcontractor will verify all new and existing dimensions for all built-in work and/or work adjoining that of other trades, before ordering any material or doing any work. They will be responsible for the correction of all dimensions found to be in error. Any discrepancy in dimensioning will be submitted, in writing, to the Project Coordinator for transmittal to the Architect/Engineer for its consideration, before proceeding with the Work.

01054 CONSTRUCTION STAKES (N/A)

01056 CALL BEFORE YOU DIG" (N/A)

01090 STANDARDS, CODES AND SPECIFICATIONS

A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. References to standard specifications and codes refer to the editions current at the Bid Due Date. References include their addenda and errata, if any, and will be considered a part of these specifications as if they were printed herein in full.

C. The manufacturers' standard warranties or guarantees will apply when their products are
used on this project.

01095 SUBCONTRACTOR LIST

A. Upon request by the Agency, the Contractor will submit a list of all Subcontractors on the Project, including all Subcontractors previously listed during the Bid Phase. The Contractor will include the following information for each Subcontractor: a) company name & address; b) telephone and fax numbers; c) contact person; d) division section; e) subcontract amount; f) trade license number; g) Federal Employer Identification Number and h) SBE, MBE or WBE status.

01100 SPECIAL PROJECT PROCEDURES

The G.C. might be required to work the night shift for project activities that are very noisy (e.g. jack-hammering of the existing concrete floor).

01121 SALVAGEABLE MATERIALS/REUSE OF EXISTING MATERIAL

A. All items on the plans to be removed will become the property of the Contractor.

B. Except as specifically indicated or specified, materials and equipment removed from the existing Work Site will not be used in the completed work.

1210 PRECONSTRUCTION CONFERENCE

A. The Project Coordinator will organize a Pre-construction Conference and notify the parties concerned.

01220 PROJECT MEETINGS

A. Scheduled Project Meetings will be held once (1) each week during the construction of this Project, unless otherwise specified by the Architect/Engineer. The day and time of these meetings will be determined by mutual agreement of the parties in attendance. If a time and date cannot be agreed upon, the Project Coordinator will establish them. Meetings will commence seven (7) calendar days from the issue of the Purchase Order and terminate the week of the Substantial Completion of this Project. Attendance at these meetings by the Contractor's Project Manager and Construction Supervisor is mandatory. Meetings will be held in the Temporary Office Trailer, or a location approved by the Architect/Engineer.

B. Special Project Meetings may be called by any regular attendee of Scheduled Meetings, upon issue of two (2) days written notice. The parameters specified above for Scheduled Meetings will apply hereto.

C. Minutes of the above meetings will be produced by the Project Coordinator and distributed to all parties.
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01340 SHOP DRAWINGS

A. The Contractor will forward, after detailed checking in its office, with a transmittal letter, six (6) prints of each Shop Drawing and/or Product Data Sheet to the Architect/Engineer for review, and one (1) set of each to CCSU within seven (7) days of receipt of same.

B. The submittals specified herein will show all the work in detail. Product data submittals will be edited and all data irrelevant to this Project and its conditions will be eliminated. Details will be drawn to a scale of 1½" = 1'-0" or larger.

C. The Contractor will review the Shop Drawings, stamp with its approval and submit them in orderly sequence so as to cause no delay in its work or in the work of any Subcontractor. Shop Drawings will be properly identified regarding the Specification Section and article, material and Project. At the time of submission, the Contractor will inform the Project Coordinator, in writing, of any deviation in the Shop Drawings from the requirements of the Contract Documents.

D. The Project Coordinator will review Shop Drawings for conformance with the design concept of the Project, and will return corrected and/or approved Shop Drawings to the Contractor within seven (7) days of the receipt of same.

E. The Contractor will make any corrections required by the Project Coordinator. The Contractor will resubmit the specified number of corrected copies of the Shop Drawings until accepted by the Project Coordinator.

F. The Project Coordinator’s review of a Shop Drawing submittal will in no way relieve the Contractor of its responsibility in fulfilling the letter and the intent of the Contract Documents.

G. When the Shop Drawing review process has been satisfactorily completed, the Contractor will provide a total of six (3) prints of each Shop Drawing to the Project Coordinator for distribution and filing. The Project Coordinator will retain one (1) set of each submittal for its files and return two (2) sets to the Contractor with a transmittal letter.

H. Long Lead Time Items: It is the responsibility of the Contractor to ensure that all materials, products, etc. required for the Project are ordered in a timely manner so as not to delay its work or that of any Subcontractor. Long Lead Time Items will be reviewed in the same way as other items as described above.

01341 SAMPLES

A. Submit Samples of all items so specified.

B. Legibly mark all Samples as follows:
   
   1. Name or trade, type, quality or grade and any further designation required to identify the item.

   2. Manufacturer or fabricators name, address and telephone number.

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3. Contractor and Subcontractor’s name, person to contact, address and telephone number.

4. Project name and designation.

C. Submit Samples of sufficient size and in sufficient numbers to clearly show the quality, type, range of color, texture of the surface and other important features of the item.

D. All materials, fabrications and equipment provided for the Project will be as specified, identical to the Samples submitted.

01380 CONSTRUCTION PHOTOGRAPHS

A. The Project Coordinator may take progress photographs at any time during the construction process. The Contractor will, at all times, allow unobstructed access to the Work for this purpose.

01400 QUALITY CONTROL

A. Comply with manufacturers’ and association or trade instructions and specifications for storage and use of their products.

B. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with the Contract Documents, request clarification from the Architect/Engineer before proceeding.

C. When specified, require manufacturer to provide qualified personnel to observe field conditions, installation, quality of workmanship and to test, adjust and balance equipment, as applicable.

D. Where required by the Specifications, submit certificates to the Project Coordinator, executed by a responsible officer of the manufacturer, warranting that product meets or exceeds specified requirements.

01511 TEMPORARY ELECTRICITY AND LIGHTING

A. The Contractor may take electrical power and lighting from the nearest available outlets or panels on the Site. The Contractor will comply with all applicable codes that govern electrical usage or distribution on the Site.

B. The Agency will pay the cost of the electricity used. The Contractor will take measures to conserve electrical usage. If the Contractor’s demand proves to be a hardship, the Agency reserves the right to terminate its provision of electrical power, or to measure the quantity of electrical energy provided and to charge the Contractor for its consumption at 1.2 times the cost to the Agency.

01513 TEMPORARY HEAT
A. N/A

01514 TEMPORARY TELEPHONE
A. N/A

01515 TEMPORARY WATER
A. N/A

01516 TEMPORARY SANITARY FACILITIES
The Contractor can use designated restrooms within the Barnard Hall building ONLY.

01518 FIRE PROTECTION
A. The Contractor will assume all responsibility for loss or damage by fire to the Site, until the substantial completion of this Project. No flammable or explosive materials will be stored on the Project Site at any time. The Contractor will assign a responsible employee to be in charge of fire protection measures.

B. Hot Works: Follow FM Global Fire Watch procedures which requires a minimum 4-hour watch AFTER the hot work is completed.

01520 CONSTRUCTION EQUIPMENT
A. The Contractor will furnish and maintain, at its own expense and risk, all tools, apparatus and appliances necessary to insure the timely, convenient and safe execution of this Contract. All the above will comply with applicable OSHA requirements and all other applicable codes, regulations and statutes, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by The Associated General Contractors of America, and the standards of the State Labor Department.

01535 PROTECTION
A. Safe Work Environment: The Contractor shall cooperate with the Agency in creating a safe work environment for workers, building occupants and members of the university community during all construction operations. The Contractor shall employ work practices and safety measures in accordance with standards established by U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), National Fire Protection Association (NFPA), State and Local Building Codes, and the Department of Health. The Contractor shall maintain safe and protected means of egress to the buildings at all times and shall protect adjacent walkways, as required, to provide for the safe flow of pedestrian traffic around each building.

B. The Contractor shall enroll in the onsite Safety and Health Consultation Program offered by the Connecticut Occupational Safety and Health Administration located with the Connecticut Department of Labor, 200 Folly Brook, Wethersfield, CT.
SECURITY

A. The Contractor will be solely responsible for the protection and safekeeping of products stored or installed under this Contract until the Date of Substantial Completion of the Project.

A. The Contractor will be solely responsible for damage, loss or liability due to theft or vandalism. The Contractor will bear full responsibility for the protection and safekeeping of products stored on site under this contract.

TRAFFIC WAYS

A. The Contractor may use on-site paved roads and parking areas, as approved by the Agency, but will not block, encumber or otherwise obstruct the same. Public roadways will not be blocked by standing trucks, parked cars, material storage, construction operations or in any other manner. The Agency will designate an area(s) within or outside of the Contract Limit Lines in which construction vehicles, dumpsters, etc may be located.

B. The Contractor will keep public roads and existing paved roads, drive and parking areas on the Agency’s property, free of scrap or debris due to construction operations. The Contractor will repair, at the Contractor’s expense, any damage to the surface of the roadways caused by the Contractor’s construction operations.

C. If the Work of the Contract affects public use of any street, road or highway, the Contractor will confer with the police authority having jurisdiction to determine if and how many police are needed for public safety in addition to any barriers and signals that may be needed. The Contractor will be responsible for payment of any required police or traffic control services.

TEMPORARY CONTROLS

A. During the progress of the Work, the Contractor will conduct its operations and provide adequate pollution controls to minimize the creation and dispersion of noise, odors, dust, dirt and/or mud within and beyond the Site. The controls will be implemented to the satisfaction of the Project Coordinator, to the extent required to assure the Agency’s continued use of its facilities.

B. Should the Agency's use of its facilities be denied or interrupted by the Contractors not providing adequate controls, as specified above, the Contractor will be required to cease operations until adequate controls are provided. All costs incurred in such a cessation of operations will be born by the Contractor. No extension of time will be granted due to such a cessation in operations.

CLEANING
A. The Contractor will keep the Site clean, free from excessive soiling, staining, the excessive accumulation of debris and other substances and conditions that, in the opinion of the Architect/Engineer, or the Construction Coordinator, are detrimental to the safety of the public and the appearance of the Site. The Contractor will employ whatever cleaning measures are required to achieve the above. They will include, but are not limited to, the following:

1. Remove and legally dispose of off-site all items scheduled for demolition and removal. Stockpiling of demolition items within or outside the Contract Limit Lines is prohibited.

2. Maintain all areas under the Contractor's control free of waste, debris and rubbish.

3. Remove waste, debris and rubbish from the Site daily and legally dispose of off-site. Maintain the Site in a clean and orderly condition.

4. Provide on-site containers for the collection of waste materials, debris and rubbish. USE OF AGENCY WASTE CONTAINERS, COMPACTORS, DUMPSTERS AND TRASH RECEPTACLES IS PROHIBITED.

5. Remove debris and rubbish from closed or remote spaces prior to closing the space.

6. Periodically clean interior building areas until Substantial Completion.

01580 PROJECT SIGN
A. Not Required

01590 FIELD OFFICE
A. Contractor can use one of the rooms in the building as an office as determined by CCSU (the Agency).

01592 PARKING PERMITS
A. Parking is by permit only. The Contractor will meet with a representative of the Agency’s Police Department to arrange for parking permits for all construction personnel, including Subcontractors and employees of Subcontractors. Parking will be permitted on the top level of Welte Garage. Vehicles without permits will be ticketed, tagged and towed at the vehicle owner’s expense. Parking will not be permitted in front of the building.

01594 RESTRICTIONS
A. Weapons or Intoxicants: No person employed on this Project will bring intoxicants or any type of weapons onto the Campus.
B. **Fraternization or Harassment:** The Contractor is advised to avoid personal contact and fraternization with facility occupants and the general campus population.

## 01600 MATERIAL AND EQUIPMENT

A. Material and equipment incorporated into the Work will conform to applicable specifications and standards and comply with size, make, type and quality specified.

B. For manufactured and fabricated products:
   1. Design, fabricate and assemble in accordance with the best engineering and shop practices.
   2. Manufacture like parts of duplicate units to be standard sizes and gages, to be interchangeable.
   3. Two or more items of the same kind will be identical, by the same manufacturer.
   4. Products will be suitable for service conditions.
   5. Equipment capacities, sizes and dimensions shown or specified will be adhered to, unless variations are specifically approved in writing.

C. Do not use material or equipment for any purpose other than for which it is designed or is specified. All material, equipment and product will be fit for their intended purpose.

D. Project Coordinator will consider requests for Substitutions only within 15 days after date established in Notice to Proceed. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents. A request constitutes a representation that the Contractor:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the Substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
F. Substitution Submittal Procedure:
   1. Submit three copies of request for Substitution for consideration. Limit each request
to one proposed Substitution.
   2. Submit shop drawings, product data and certified test results attesting to the
proposed product equivalence.
   3. The Architect will notify Contractor, in writing, of decision to accept or reject request.

01604 MANUFACTURER'S INSTRUCTIONS

A. When the Contract Documents require that installation of any part of the Work will comply
with manufacturer’s printed instructions, the Contractor shall obtain and distribute copies
of such instructions to parties involved in the installation, including one copy to the
Architect/Engineer.
   1. Maintain one (1) complete set of instructions at the job Site during installation and
until the Date of Substantial Completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such
instructions, and in conformity with specified requirements.
   1. Should job conditions or specified requirements conflict with manufacturer's
instructions, consult with the Architect/Engineer for further instructions.
   2. Do not proceed with the Work without clear instructions.

C. Perform all Work in accordance with the manufacturer’s instructions. Do not omit any
preparatory step or installation procedure unless it is specifically modified or deleted by the
Contract Documents.

01610 TRANSPORTATION AND HANDLING

A. Materials and equipment will be delivered, stored and handled to prevent intrusion of
foreign matter and damage by weather or breakage. Packaged materials will be delivered
and stored in original, unbroken packages.

B. The contractor shall promptly inspect shipments to assure that products comply with
requirements, that quantities are correct and products are undamaged.

C. Packages, materials and equipment showing evidence of damage will be rejected and
replaced at no additional cost to the Agency.

01620 STORAGE AND PROTECTION

A. Store products in accordance with the manufacturer's instructions with seals and labels
intact and legible. Store sensitive products in watertight enclosures. Maintain within
temperature and humidity range required by the manufacturer.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

C. Store loose granular material on solid surfaces in a well-drained area; prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection. Periodically inspect to insure products are undamaged and are maintained under required conditions. Keep log showing date, time and problems, if any.

E. Stone, masonry units and similar materials will be stored on platforms on dry skids and will be adequately covered and protected against damage.

F. Provide substantial coverings, as necessary, to protect installed products from traffic and subsequent construction operations. Remove when no longer needed.

01710 FINAL CLEANING AND SITE RESTORATION

A. The Contractor, within one (1) week of the inspection required to establish the Substantial Completion of the Project, or any portion thereof, will perform a final cleaning of all Work. The Contractor will leave the Project clean and ready for occupancy. If the Contractor fails to perform a final cleaning to the satisfaction of the Architect/Engineer and the Project Coordinator, the Agency may do so, and the cost thereof will be charged to the Contractor.

B. This final cleaning will be complete in every manner, including but not limited to, the following:

1. The removal of all defacements both new and existing including, but not limited to, graffiti, putty, paint and adhesive residue, streaks, stains, finger prints, erection marks and construction notes.

2. The cleaning of all metal surfaces.

3. The cleaning of all outside areas including building surfaces (brick walls, window panes, frames and sills), sidewalks, roads and grass areas.

4. The cleaning of exposed and accessible concealed surfaces of the Project, including but not limited to walls, ceilings, carpeted surfaces, concrete flooring, mechanical and electrical fixtures, built-in equipment, etc.

5. Flooring: N.I.C.

C. Site Restoration: The Contractor will restore all grass areas, sidewalks and paved areas damaged or destroyed by construction operations in accordance with Agency Standards.

01720 PROJECT RECORD DOCUMENTS
A. “As-Built Drawings”: **Required.** Maintain one set of record drawings on site, updated, at all times.

B. “Record Survey”: **Not applicable**

C. “Campus Master Survey Map”: **Not applicable**.

D. “Data Base Building Plan(s)”: **Not Applicable**

01730 OPERATIONAL AND MAINTENANCE DATA

A. Submit **two (2) sets** of Operational Manuals of each of the Project’s systems in 3-ring loose-leaf binders, properly marked and indexed. Delete and remove from the manual all information not relevant to the purpose of the manual. Submit the above to the Architect/Engineer for approval, with all additional information that the Architect/Engineer may request and considers necessary for the proper servicing and maintenance of all equipment. The quality of all copies will be subject to approval by the Architect/Engineer.

B. Manuals will include, but will not be limited to the following:

1. **Operating Procedures:**
   
   a. Typewritten procedures indicating each mode of operation of each piece of equipment or system. Procedures will indicate the status of each component of a system in each operation mode.

   b. Procedures will indicate names, symbol numbers, valve tags, circuit numbers, schematic control and wiring diagrams, locations of thermostats, manual starters, control cabinets and other controls of each system.

   c. Emergency shut-down procedures for each piece of equipment in each system, both automatic and manual, as appropriate.

2. **Maintenance Schedule:**
   
   a. Provide a typewritten schedule describing the manufacturer’s recommended schedules of maintenance and a specification of those maintenance procedures.

3. **Catalog Cuts and Shop Drawings:**
   
   a. The catalog cuts will clearly indicate the exact model and type of each piece of equipment installed in the Project, including all options provided.

   b. The catalog cuts will fully describe equipment, including physical, performance, electrical, mechanical and other characteristics. They will also include installation or erection diagrams.
c. The catalog cuts will indicate spare parts numbers and the name, address and phone number of the manufacturer, and the name, address and phone number of the manufacturer's local representative or service department.

4. Provide a typewritten list of all Subcontractors on the Project, including the name, address and phone number of all local representatives or service departments.

5. All manuals will be indexed, with dividers separating each system or piece of equipment.

B. The Contractor will orient and instruct maintenance personnel, designated by the Agency, in the operation of all equipment. The date and time of the meeting will be mutually agreed upon. The Contractor will provide qualified instructional personnel for as long as necessary, to fully orient and instruct those designated.

**01740 Warranties and Guarantees**

A. The Contractor will guarantee all materials and warrant all workmanship for a period of one (1) year from the Date of Substantial Completion of the Project. Provide extended guarantees and warranties as specified in the Contract Documents, as per attached form.

B. Form of Guarantee/Warranty: See appendices.

C. All required bonds will be by their respective Surety Companies, made out to Central Connecticut State University.

D. All guarantees/warranties or bonds supplied by Subcontractors, Installers, Suppliers or Manufacturers will be countersigned by the General Contractor.

**01800 Confined Space Entry**

A. Confined Space Entry: The Agency has established a permit-required, confined space entry program. Confined spaces that affect the Work of this Project, will be defined in accordance with the requirements of OSHA, 29 CRF 1910.146 Appendix A and the Agency’s confined Space Entry Plan. In the event that the Contractor must perform work within a permitted "confined space" as defined by federal OSHA regulations or by the CCSU "Confined Space Entry Plan", the Contractor will comply with all safety and monitoring requirements imposed by OSHA and by the "CCSU Confined Space Entry Plan" relative to work within the permitted confined space.

B. All proposed entries must be reviewed and approved, in advance, by the Agency’s Environmental Health and Safety Compliance Officer, Mr. Domenic Forcella, telephone number (860) 832-2499, prior to the Contractor’s entry into a permitted confined space.

C. All such compliance measures will be at the Contractor’s expense and performed with the Contractor’s own equipment. The Agency reserves the right to suspend the Contractor’s operations for any violation of the above-mentioned confined space regulations.

**01805 OSHA Training**

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A. (Effective October 1, 2006) Public Act 06-175 (a) Each contract entered into on or after July 1, 2007, for the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public building project by the state or any of its agents, or by any political subdivision of the state or any of its agents, where the total cost of all work to be performed by all contractors and subcontractors in connection with the contract is at least one hundred thousand dollars, shall contain a provision requiring that, not later than thirty days after the date such contract is awarded, each contractor furnish proof to the Labor Commissioner that all employees performing manual labor on or in such public building, pursuant to such contract, have completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, in the case of telecommunications employees, have completed at least ten hours of training in accordance with 29 CFR 1910.268.

01810 OSHA COMPLIANCE/AIR-BORNE PARTICLES

A. Lead Paint: Not Applicable

B. Asbestos: Not Applicable

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Building demolition excluding removal of hazardous materials and toxic substances.
B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS
A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.
B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.03 CT HIGH PERFORMANCE BUILDING REQUIREMENTS
A. The mandatory and standard options and procedures for compliance, submittal requirements, and reporting forms are in the CT High Performance Building Requirements Summary in Division 1.

1.04 REFERENCE STANDARDS

1.05 SUBMITTALS
A. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

1.06 QUALITY ASSURANCE
A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE
A. Remove portions of the existing building as shown on the drawings.
B. Remove other items indicated, for salvage and relocation.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS
A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permit.
6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS
   A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
      1. Verify that construction and utility arrangements are as indicated.
      2. Report discrepancies to Project Coordinator before disturbing existing installation.
      3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
   B. Remove existing work as indicated and as required to accomplish new work.
      1. Remove items indicated on drawings.
   C. Protect existing work to remain.
      1. Prevent movement of structure; provide shoring and bracing if necessary.
      2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
      3. Repair adjacent construction and finishes damaged during removal work.
      4. Patch as specified for patching new work.

3.04 DEBRIS AND WASTE REMOVAL
   A. Remove debris, junk, and trash from site.
   B. Leave site in clean condition, ready for subsequent work.
   C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Wood blocking and nailers.
      2. Wood furring

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 QUALITY ASSURANCE
   A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL
   A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
      1. Factory mark each piece of lumber with grade stamp of grading agency.
B. Application: Treat items indicated on Drawings, and the following:

   1. Wood blocking and similar concealed members in contact with masonry or concrete. Insert other items that require treatment but are not likely to be indicated on Drawings.

C. Application: Treat items indicated on Drawings, and the following:

   1. Concealed blocking.

2.2 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

   1. Blocking.
   2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

   1. Hem-fir (north); NLGA.
   2. Mixed southern pine or southern pine; SPIB.
   3. Spruce-pine-fir; NLGA.
   4. Hem-fir; WCLIB or WWPA.
   5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
   6. Western woods; WCLIB or WWPA.
   7. Northern species; NLGA.
   8. Eastern softwoods; NeLMA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

3.3 PROTECTION

A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Finish carpentry items.
   B. Wood casings and moldings.

1.02 RELATED REQUIREMENTS
   A. Related Documents: General provisions of the Contract, including General and Supplementary
     Conditions and other Division 1 Specifications, apply to this Section.
   B. The Contract Documents are complementary. Examine all Drawings and all other Sections of
     the Specifications for requirements therein affecting the intent of this Section.

1.03 CT HIGH PERFORMANCE BUILDING REQUIREMENTS
   A. The mandatory and standard options and procedures for compliance, submittal requirements,
     and reporting forms are in the CT High Performance Building Requirements Summary in
     Division 1.

1.04 REFERENCE STANDARDS
   A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
     2016.
   D. PS 1 - Structural Plywood; 2009.

1.05 ADMINISTRATIVE REQUIREMENTS
   A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated
     and adjacent components.
   B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious
     manner.

1.06 SUBMITTALS
   A. Product Data:
      1. Provide instructions for attachment hardware and finish hardware.
      2. Provide manufacturer's product data for each composite wood product and laminating
         adhesive indicating no added urea formaldehyde in bonding agents.
   B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details,
      and accessories.
      1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   C. Samples: Submit two samples of finish plywood, 6 by 6 inch in size illustrating wood grain and
      specified finish.
   D. Samples: Submit two samples of wood trim 4 inch long.

1.07 QUALITY ASSURANCE
   A. Fabricator Qualifications: Company specializing in fabricating the products specified in this
      section with minimum five years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING
   A. Protect work from moisture damage.
PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS
   A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   B. Interior Woodwork Items:
      1. Hardwood Trim: Maple; prepare for stained finish.
   C. Engineered wood or composite wood and agrifiber product must contain no added urea-formaldehyde.

2.02 WOOD-BASED COMPONENTS
   A. Wood fabricated from old growth timber is not permitted.
   B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 60 00 - Product Requirements.

2.03 LUMBER MATERIALS
   A. Hardwood Lumber: Maple species, plain sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
   B. Engineered wood or composite wood and agrifiber product must contain no added urea-formaldehyde.

2.04 SHEET MATERIALS
   A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
   B. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.
   C. Engineered wood or composite wood and agrifiber product must contain no added urea-formaldehyde.

2.05 FASTENINGS
   A. Concealed Joint Fasteners: Wood biscuits.

2.06 FABRICATION
   A. Shop assemble work for delivery to site, permitting passage through building openings.
   B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.07 SHOP FINISHING
   A. Sand work smooth and set exposed nails and screws.
   B. Apply wood filler in exposed nail and screw indentations.
   C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
   D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
      1. Transparent:
         a. System - 11, Polyurethane, Catalyzed.
         b. Stain: As selected by Architect.
         c. Sheen: Flat.
   E. Back prime woodwork items to be field finished, prior to installation.
PART 3  EXECUTION

3.01 EXAMINATION
   A. Verify adequacy of backing and support framing.
   B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION
   A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
   B. Set and secure materials and components in place, plumb and level.
   C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 TOLERANCES
   A. Maximum Variation from True Position: 1/16 inch.
   B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation and vapor retarder in exterior and interior walls, ceiling as indicated.
B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
C. Foamed in place insulation for miscellaneous spot applications, hard to reach locations, and as indicated.

1.02 RELATED REQUIREMENTS

A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.
B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
B. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermal Insulation:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLICATIONS

A. Insulation Over Metal Stud Framed Walls, Continuous: Extruded polystyrene (XPS) carbon black board.
B. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.
2.03 BATT INSULATION MATERIALS

A. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   3. Manufacturers:
      b. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.
      c. ROCKWOOL (ROXUL, Inc); COMFORTBATT: www.rockwool.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Curtainwall Insulation: Semirigid fiberglass or mineral wool insulation
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   3. Provide foil facing on one side.
   5. Thickness: 3 inch.
   6. Manufacturers:

2.04 ACCESSORIES

A. Tape: Polyethylene self-adhering type, 2 inch wide.
B. Insulation Fatseners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BATT INSULATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
B. Install in exterior wall without gaps or voids. Do not compress insulation.
C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
D. Fit insulation tightly to exterior side of mechanical and electrical services within the plane of the insulation.
3.03 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Firestopping systems.
   B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS
   A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.
   B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.03 REFERENCE STANDARDS
   C. ITS (DIR) - Directory of Listed Products; current edition.

1.04 SUBMITTALS
   A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
   B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
   C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
   D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
   E. Certificate from the Office of the State Fire Marshall indicating approval of materials used.
   F. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE
   A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
      1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   B. Installer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   C. Installer Qualifications: Company specializing in performing the work of this section and:
      1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
      2. Verification of minimum three years documented experience installing work of this type.
      3. Verification of at least five satisfactorily completed projects of comparable size and type.
      4. licensed by local authorities having jurisdiction (AHJ).
1.07 FIELD CONDITIONS
   A. Comply with firestopping manufacturer’s recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
   B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Manufacturers:
      2. 3M Fire Protection Products; www.3m.com/firestop.
      4. Substitutions: See Section 01 60 00 - Product Requirements.
   B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 FIRESTOPPING FOR PERIMETER CONTAINMENT
   A. Perimeter Joint Systems That Have Movement Capabilities (Dynamic):
      1. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. AS200 Elastomeric Spray.

2.03 FIRESTOPPING FOR FLOOR-TO-WALL JOINTS
   A. Floor-To-Wall Joint System That Have Movement Capabilities (Dynamic):
      1. 2 Hour Construction: UL System FW-D-1069; Tremco, TREMstop Acrylic Firestop Sealant.

2.04 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION
   A. Penetrations Through Floors or Walls By:
      1. Multiple Penetrations in Large Openings:
         a. 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   B. Penetrations Through Floors By:
      1. Multiple Penetrations in Large Openings:
         b. 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   C. Penetrations Through Walls By:
      1. Uninsulated Metallic Pipe, Conduit, and Tubing:
         a. 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
         b. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      2. Insulated Pipes:
         a. 2 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
         b. 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2.05 FIRESTOPPING MATERIALS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: Use any system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

2. Provide within cavity wall construction where substrate consists of polystyrene to contain cavity to 2,000 SF or less.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES
   A. Sealants and joint backing.
   B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS
   A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.
   B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. Product Data: Provide data indicating sealant chemical characteristics.
   B. Samples: Submit two samples, 2 inches in width illustrating sealant colors for selection.
   C. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE
   A. Maintain one copy of each referenced document covering installation requirements on site.
   B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
   C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.07 FIELD CONDITIONS
   A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Preformed Compressible Foam Sealers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SEALANTS

A. Type B - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Match adjacent finished surfaces.
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.

B. Type C - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
   1. Applications: Use for:
      a. Joints between plumbing fixtures and floor and wall surfaces.
      b. Joints between kitchen and bath countertops and wall surfaces.

C. Type D - Acoustical Sealant for Concealed Locations:
   1. Composition: Acrylic latex emulsion sealant.
   2. Applications: Use for concealed locations only:
      a. Sealant bead between top stud runner and structure and between bottom stud track and floor.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that substrate surfaces are ready to receive work.
   B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION
   A. Remove loose materials and foreign matter that could impair adhesion of sealant.
   B. Clean and prime joints in accordance with manufacturer's instructions.
   C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
   D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION
   A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
   B. Perform installation in accordance with ASTM C1193.
   C. Perform acoustical sealant application work in accordance with ASTM C919.
   D. Install bond breaker where joint backing is not used.
   E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
   F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
   G. Tool joints concave.

3.04 CLEANING
   A. Clean adjacent soiled surfaces.

3.05 PROTECTION
   A. Protect sealants until cured.

END OF SECTION
SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hollow metal frames for wood doors.
B. Hollow metal borrowed lites glazing frames.
C. Accessories, including glazing and matching panels.

1.02 RELATED REQUIREMENTS

A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.
B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.03 REFERENCE STANDARDS

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
H. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
J. ITS (DIR) - Directory of Listed Products; current edition.
L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
P. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
1.04 SUBMITTALS
A. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
B. Samples: Submit two samples of metal, 2 inch by 2 inch in size showing factory finishes, colors, and surface texture.
C. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Hollow Metal Frames:
3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DESIGN CRITERIA
A. Requirements for Hollow Metal Frames:
1. Steel used for fabrication of frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
4. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
B. Hollow Metal Panels: Same construction, performance, and finish as doors.
C. 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 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. Exterior Door Frames: Full profile/continuously welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
   3. Weatherstripping: Separate, see Section 08 71 00.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

E. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.04 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Removable stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.05 FINISHES

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

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

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. Grout frames, if in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

D. Coordinate installation of electrical connections to electrical hardware items.

E. Touch up damaged factory finishes.
3.03 TOLERANCES
   A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING
   A. Adjust for smooth and balanced door movement.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Flush wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS
A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.
B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.03 REFERENCE STANDARDS
A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

1.04 SUBMITTALS
A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics. Provide manufacturer's product data for each composite wood product and laminating adhesive indicating no added urea formaldehyde in bonding agents.
B. 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.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
C. Specimen warranty.
D. Samples: Submit two samples of door construction, 12 by 12 inch in size cut from top corner of door.
E. Samples: Submit two samples of door veneer, 12 by 12 inch in size illustrating wood grain, stain color, and sheen.
F. Manufacturer's Installation Instructions: Indicate special installation instructions.
G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE
A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than five years of documented experience.

1.06 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. Inspect for damage.
C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.
1.07 WARRANTY
A. See Section 01 78 30 - Warranties and Bonds, for additional warranty requirements.
B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Wood Veneer Faced Doors:
   1. Algoma Hardwoods; Architectural Series: www.marshfielddoors.com
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND PANELS
A. Doors: Refer to drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Wood veneer facing for factory transparent finish.

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: Maple, 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.

2.05 DOOR CONSTRUCTION
A. Fabricate doors in accordance with door quality standard specified.
B. Cores Constructed with stiles and rails:
   1. Provide minimum 5” x 12” 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.
   1. Exception: Doors to be field finished.
F. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS
A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
a. System - 11, Polyurethane, Catalyzed.
b. Stain: As selected by Project Coordinator. Match existing new corridor doors.
c. Sheen: Flat.

B. Seal door top edge with color sealer to match door facing.

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.
   E. Coordinate installation of glazing.
   F. Install door louvers plumb and level.

3.03 TOLERANCES
   A. Conform to specified quality standard for fit and clearance tolerances.
   B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING
   A. Adjust doors for smooth and balanced door movement.
   B. Adjust closers for full closure.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.

C. Related Sections:
   1. Division 08 Section “Hollow Metal Doors and Frames”.
   2. Division 08 Section “Flush Wood Doors”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   5. NFPA 105 - Installation of Smoke Door Assemblies.

E. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.

D. Keying Schedule: By owner.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service
representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.


D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:

1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

3. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

b. Thresholds: Not more than 1/2 inch high.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store, if any, electronic access control hardware, software or accessories at Project site without prior authorization.
B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the “Keying Conference”.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Related Division 08 Sections (Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
1. Twenty five years for manual surface door closers.
2. Two years for electromechanical door hardware.
1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Acceptable Manufacturers:

a. Hager Companies (HA).
b. McKinney Products (MK).
c. Stanley Hardware (ST).
2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

   1. Acceptable Manufacturers:
      a. Burns Manufacturing (BU).
      b. Rockwood Manufacturing (RO).
      c. Trimco (TC).

B. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

   1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with square corners and beveled edges, secured with exposed screws unless otherwise indicated.
   2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
   3. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
      a. Acceptable Manufacturers:
         1) Burns Manufacturing (BU).
         2) Rockwood Manufacturing (RO).
         3) Trimco (TC).

2.4 CYLINDERS AND KEYING

CYLINDERS WILL BE PROVIDED BY THE OWNER

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified cylindrical (bored) locksets furnished in the functions as specified in the Hardware Sets. Lock chassis fabricated of heavy gauge steel, zinc dichromate plated, with through-bolted application. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2” (3/4” at rated paired openings) throw brass or stainless steel latchbolt. Locks are to be non-handed and fully field reversible.

   1. Acceptable Manufacturers:
a. Arrow (AW) – QL Series.


2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer’s standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated.

B. Standards: Comply with the following:
   1. Strikes for Bored Locks and Latches: BHMA A156.2.
   2. Dustproof Strikes: BHMA A156.16.

2.7 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
   1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
   2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
   3. Cycle Testing: Provide closers which have surpassed 10 million cycles in a test witnessed and verified by UL.
   4. Size of Units: Comply with manufacturer’s written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
   5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
      a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
      b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
      c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.

B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Acceptable Manufacturers:
   a. Arrow (AW) – 5016 Series.
   b. Norton Door Controls (NO) - 8500 Series.
   c. Sargent Manufacturing (SA) - 1431 Series.

2.8 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2” less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1” less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.
   a. Stainless Steel: 050-inch thick, with countersunk screw holes (CSK).

4. Fasteners: Provide manufacturer’s designated fastener type as specified in the Hardware Sets.

5. Acceptable Manufacturers:
   a. Burns Manufacxturing (BU).
   b. Rockwood Manufacturing (RO).
   c. Trimco (TC).
2.9 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

   1. Acceptable Manufacturers:
      
         a. Burns Manufacturing (BU).
         b. Rockwood Manufacturing (RO).
         c. Trimco (TC).

2.10 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

   B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

   C. Acceptable Manufacturers:

      1. Pemko Manufacturing (PE).
      2. Reese Enterprises, Inc. (RS).

2.11 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

   B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify Project Coordinator of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION


3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstalation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish, and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner’s maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and Project Coordinator. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the Project Coordinator with corrections made prior to the bidding process. Omitted
items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

Manufacturers Abbreviations:
1. MK - McKinney
2. AW - Arrow Lock
3. SA - Sargent
4. AA - ASSA High Security Locks
5. HS - HES
6. RO - Rockwood
7. NO - Norton
8. PE - Pemko

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All existing doors and frames are to be field reviewed by the GC and their supplier prior to submitting door hardware schedule for review. No extras will be allowed for missing parts required because this survey was not completed.

END OF SECTION 087100
SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Metal hat channel framing.
E. Gypsum wallboard.
F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS
A. Related Documents: General provisions of the Contract, including General and Supplementary
   Conditions and other Division 1 Specifications, apply to this Section.
B. The Contract Documents are complementary. Examine all Drawings and all other Sections of
   the Specifications for requirements therein affecting the intent of this Section.

1.03 REFERENCE STANDARDS
A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods,
   Wire, Profiles, and Tubes; 2014.
B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing
   Gypsum Board; 2015.
   Frame Construction and Manufactured Housing; 2012.
D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive
F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel
   Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84
   mm) in Thickness; 2015.
G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of
   Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2016.
H. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum
   Veneer Base; 2014a.
J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of
   Interior Coatings in an Environmental Chamber; 2016.
K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound
   Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
L. ASTM E413 - Classification for Rating Sound Insulation; 2016.
1.04 SUBMITTALS
A. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.
B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS
2.01 GYPSUM BOARD ASSEMBLIES
A. Provide completed assemblies complying with ASTM C840 and GA-216.
B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 FRAMING SYSTEMS
A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
B. Studs and Tracks: ASTM C 645.
   1. Steel Studs and Tracks:
      a. Minimum Base-Metal Thickness: 0.0329 inch.
      b. Depth: As indicated on Drawings.
C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: 0.0329 inch.
D. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
   1. Depth: 1-1/2 inches.
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base-Metal Thickness: 0.0329 inch.
   2. Depth: As indicated on Drawings.
2.03 BOARD MATERIALS

A. Gypsum-Based Board:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   4. Chemical hardening type compound.

E. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

I. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center.

C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking for support of:
   1. Wall mounted cabinets.
   2. AV Displays
   3. Wall mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls, ceilings or other areas specifically indicated.
2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
3. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES
   A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION
SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Acoustical tiles for interior ceilings.
   2. Fully exposed, direct-hung, suspension systems.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed girder component equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:

1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.

2. Basis of design: Armstrong, Ultima Tegular, fine texture 24” x 24” (and 48” #1914) x ¾” #1911 tile to be installed in 15/16” Prelude XL exposed ceiling grid.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less - Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 ACOUSTICAL TILES

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

1. Armstrong World Industries.
2. CertainTeed Corporation.
3. USG Corporation.

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide tiles as follows:

1. Type: Type III,
2. Form: Form 2

D. Color: White

E. Light Reflectance (LR): 0.90

F. Ceiling Attenuation Class (CAC): Not less than 35

G. Noise Reduction Coefficient (NRC): Not less than 0.70

H. Edge/Joint Detail: Beveled Tegular

I. Thickness: 3/4 inch

J. Modular Size: 2'x2' as indicated on drawings.

2.4 METAL SUSPENSION SYSTEM

A. Basis of design: Armstrong World Industries, Inc.; Prelude 15/16" XL Exposed Tee.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C 635/C 635M. 15/16"

1. High-Humidity Finish: In screen processing room, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized-steel sheet complying with ASTM A 653/A 653M,
2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.
   1. Finish: White

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
   1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
   2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings according to manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.
   1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:
   1. As indicated on reflected ceiling plans.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.
   1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
3.5 ADJUSTING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer’s written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and the general provisions of the Contract Documents, including the General Conditions and Division 1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. The extent of Painting Work is shown on the Drawings and specified herein. “Paint” shall mean all finish coating systems and materials, including primers, emulsions, enamels, special coatings, sealers, fillers, and other applied materials, whether used as prime, intermediate, or finish coats. Paint all exposed surfaces, except where the natural finish of the material is obviously intended, or specifically noted, as a surface not to be painted. Painting Work shall include, but shall not be limited to, the following:

1. Hollow Metal Frames
2. Exposed Conduits, Piping.
3. Concrete Masonry Unit Walls.
4. Gypsum Board Walls

1.03 WORK NOT INCLUDED

A. General: The following categories of substrata, or items, shall not receive a paint finish. They are considered to be surfaces that are not intended to be painted:

1. Metal Surfaces: Do not paint any anodized aluminum, stainless steel, chromium plate, copper, or bronze.

2. Operating Parts and Labels: Do not paint any moving parts of operating units. Do not paint over any code required labels, such as Underwriters’ Laboratories and Factory Mutual labels, or any equipment identification, performance rating, name or nomenclature plates.

3. Shop Priming: Do not apply the specified prime coat to any pre-primed substrate.

4. Do not paint pre-finished items, concealed surfaces, finished metal surfaces, operating parts and labels.

1.04 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products. Manufacturer to be one of the following:

1. Sherwin Williams
2. Benjamin Moore
3. PPG
B. **Applicator:** Company specializing in commercial painting and finishing with a minimum of three years of experience.

A. **Paint Coordination:** Provide finish coats which are compatible with prime paints used and produced by the same manufacturer as the prime coat. Review other sections of these Specifications in which prime paints are to be provided to ensure the compatibility of each coating system with its substrate. Provide barrier coats over all incompatible primers or remove and re-prime as required. Notify the Agency, in writing, of any anticipated problems in applying the specified coating systems.

1.05 **REFERENCES**

A. All Work of this Section shall be provided in accordance with the latest edition of the following standards which are considered to be a part of this specification the same as if bound herein:

1. **ANSI/ASTM D16:** Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

1.06 **SUBMITTALS**

A. **General:** Submit the following in accordance with the applicable provisions of Section 01300 of the General Requirements:

1. Product data for each material specified.
2. Manufacturer's application instructions for each material specified.

1.07 **REGULATORY REQUIREMENTS**

A. Conform to the applicable codes for flame, fuel, and smoke rating requirements for finishes.

B. All paint and finishes shall conform to ANSI A66.1 - 1964, "Specifications to Minimize Hazards to Children from Residual Coating Materials".

1.08 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver products to the Site in sealed and labeled containers.

B. Container labeling shall include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, clean up, color designation, and instructions for mixing and reducing.

C. Store paint materials at a temperature between 45 degrees F. and 90 degrees F., in a well ventilated area.

D. Take all precautionary measures required to prevent fire hazards and spontaneous combustion.
1.09 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation in, and heat, area to be painted as required to maintain ambient temperature above 45 degrees F. for 24 hours before, during, and 48 hours after the application of finishes.

B. Provide minimum lighting level of 80-ft. candles measured mid-height at the substrate surface.

C. Cover, or otherwise protect, finish work of other trades and surfaces not being painted concurrently, or not specified to be painted.

1.10 JOB CONDITIONS

A. Safety: Take all precautions required to ensure that the workmen, and work areas, are adequately protected from fire and health hazards resulting from the handling, mixing, and application of volatile finish coating systems.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Coatings: shall be ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating. Coatings shall have good flow and brushing properties, capable of drying or curing free of streaks and sags.

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

PART 3 - EXECUTION

3.01 INSPECTION

A. The installer shall inspect the substrata and the conditions prevailing at the time of installation. He shall immediately notify the Contractor in writing, with a copy to the Agency, of any condition detrimental to the timely execution of his work as specified herein. Failure to due so shall constitute acceptance of the substrata, the prevailing conditions and the risks inherent therein.

B. Verify that surfaces are ready to receive work as instructed by the Product Manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of the Work. Report any condition that may potentially affect proper application.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the maximums stated by the Manufacturer.

3.02 PREPARATION

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or applying any finish. Re-install the above after the Painting Work has been completed.
B. Correct minor defects and clean the surfaces that affect the Work of this Section in accordance with the Paint Manufacturers written instructions. Schedule the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly painted surfaces. Do not paint over dirt, scale, rust, grease, or conditions otherwise detrimental to the formation of a durable paint film.

C. Touch-up any shop-primed or galvanized steel surfaces which have been damaged. Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces as directed by Manufacturer.

3.03 PROTECTION

A. Protect: the work of other trades, whether it is scheduled to be painted or not, against any damage by the Work specified herein. Repair all damage as directed by Architect, at no cost to the Agency.

B. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other Work.

C. Remove empty paint containers from the Site and dispose of legally.

3.04 APPLICATION

A. General: Apply products in accordance with the Manufacturer’s written instructions. Do not apply finishes to surfaces that are not dry. Apply each coat to a uniform finish. Sand lightly and vacuum and/or wipe with tack cloths between coats. Allow applied coat to dry for the time period recommended by the Manufacturer before applying the next coat.

D. Minimum Coating Thickness: Apply each paint system at not less than the Manufacturer’s recommended wet/dry film thickness or spreading rate.

D. Additional Prime Coats: Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas, as required to assure a finish coat with no burn through, or other defects.

E. Additional Finish Coats: When undercoats, stains or other conditions show through the final coat of paint, apply additional finish coats of paint until the paint film is of uniform finish, color and appearance, and is acceptable to the Architect.

F. Application: Apply each coat of paint free of cloudiness, spotting, holidays, laps and brush marks, runs, sags, ropiness, or other surface imperfections. Apply by brush, spray, or roller as deemed needed for best finish.

3.05 MAINTENANCE

A. As the Work proceeds, promptly remove paint where spilled, splashed, or spattered.

B. During the progress of the Work, maintain the premises free of unnecessary accumulation of tools, surplus materials and debris.

B. Collect cotton waste, cloths, and other materials that constitute a fire hazard, place in closed metal containers, and remove daily from the Site.
3.06  CLEANUP AND PROTECTION

A.  **Clean Up:** Remove from the Site, on a daily basis, all discarded paint materials, rubbish, cans and rags. Upon the completion of the Painting Work, clean all window glass and other paint spattered surfaces. Remove spattered paint as directed by the Manufacturer of the product, using care not to scratch or otherwise damage any finished surfaces.

B.  **Provide "Wet Paint" signs:** as required to adequately inform the public of newly painted surfaces.

C.  **Protect:** newly painted surfaces from any kind of damage until the Date of Substantial Completion. If any painted surface should be damaged in any way, repair damaged areas by cleaning, sanding, priming and finish painting the surface as required by the Architect.

PART 4 - PAINT SYSTEMS

4.01  GENERAL

A.  Except as otherwise required to provide a specific type of coating, materials specified shall be equal to the products of Sherwin Williams, which is the standard paint for the University Paint Shop. Paint Systems for wall and ferrous metal surfaces are specified below. Refer also to the Room Finish Schedule. The Project Coordinator shall choose all Paint System Colors from the Manufacturer's complete range of colors.

1.  **Paint System # 1 All Walls:**
   a.  Apply one coat primer/sealer equal to ProMar 200 Zero VOC Interior Latex Primer.
   b.  Apply two coats of interior acrylic coating with eggshell finish equal to Sherwin Williams ProMar 200 HP Zero VOC

2.  **Paint System # 2 – Interior Shop-Primed Ferrous Metal (galvanized and non-galvanized):**
   a.  Touch-up galvanized finish on exterior ferrous metal in the field with Z.R.C. cold galvanizing material or approved equal.
   b.  Touch-up shop-primed finish in the field with a primer compatible with oil-based finish paint equal to Sherwin Williams Pro Industrial Pro-Cryl Universal Primer. Apply one coat of primer to ducts, piping and conduit that have not been factory primed.
   c.  Apply two coats finish paint equal to Sherwin Williams Pro industrial Waterbased Alkyd Urethane Enamel Semi-Gloss

++ END OF SECTION ++
SECTION 10 11 01
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Tackboards.
B. Markerboards

1.02 RELATED REQUIREMENTS
A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.
B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.03 REFERENCE STANDARDS
A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

1.04 SUBMITTALS
A. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories. Provide manufacturer's product data for each composite wood product and laminating adhesive indicating no added urea formaldehyde in bonding agents.
B. Samples: Submit color charts for selection of color and texture of markerboard, tackboard, and trim.
C. Test Reports: Show conformance to specified surface burning characteristics requirements.
D. Manufacturer's printed installation instructions.
E. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY
A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide five year warranty for chalkboard and markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Visual Display Boards:
   4. Substitutions: See Section 01 60 00 - Product Requirements.
2.02 VISUAL DISPLAY BOARDS

A. Whiteboards:
   1. LCS on 24 ga. steel, designed for markerboard application
   2. Core to be 3/8" particle board.
   3. Backer sheet to be 0.015" aluminum.
   4. Trim to be extruded aluminum, designed for concealed fastenings, clear anodized finish with tray.
   5. Size: as indicated on drawings.
   6. Color to be selected by the Architect from Manufacturer's full standard range

B. Tackboards: Fine-grained, homogeneous natural cork.
   1. Provide 1/4" thick vinyl impregnated cork tackboards.
   2. Provide 1/4" thick fiberboard core.
   3. Trim to be extruded aluminum designed for concealed fastenings, clear anodized finish.
   4. Color to be selected by the Architect from Manufacturer's full standard range
   5. Mounting Brackets: Concealed.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
B. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).
C. Fiber Board: ASTM C208, cellulosic fiber board.
D. Foil Backing: Aluminum foil sheet, 0.005 inch thick.
E. Steel Sheet Backing: 28 gage, 0.0149 inch, galvanized.
F. Engineered wood or composite wood and agrifiber product must contain no added urea-formaldehyde.

2.04 ACCESSORIES

A. Marker Tray: Extruded Aluminum; hollow box-type tray.
B. Map Rail: Furnish map rail at top of each unit, unless otherwise indicated, with the following accessories for each map rail:
   i. Display Rail: Continuous cork approx. 2" wide, integral with map rail.
   ii. End Stops: One at each end of map rails.
   iii. Map Hooks: 2 hooks for each 4 ft of map rail or fraction thereof.
   iv. Provide clips, anchors and fasteners required for complete installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.
B. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

END OF SECTION
PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.02 SUMMARY

A. This section includes the following:

1. Dimensional characters for interior use.

1.03 PERFORMANCE REQUIREMENTS

A. Performance: Signs shall be free from defects in materials and workmanship and effectively present specified message under both day and night viewing conditions. Sign faces shall be smooth, exhibit uniform color and brightness over entire background surface and not appear mottled, streaked, or stained when viewed either in ordinary daylight or artificial light.

1. Design: As indicated on Signage drawing.


3. Regulatory requirements: Comply with handicapped accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board’s “American with Disabilities (ADA), Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines”.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Contractor to submit Shop Drawings for All sign types in scale. Show fabrication and installation details for signs.

1. Show sign mounting heights, locations of supplementary supports to be provided by others and accessories.

2. Take field measurements prior to preparation of shop drawings to ensure proper fitting, mounting and sizes of signs affected by dimensions of surfaces on which they are installed, verify dimensions by field measurement and show recorded measurements on final shop drawings.

3. Provide message list, typestyles, and graphic elements, including layout for each sign.

C. Samples for initial selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each of the following products for color, texture, and sign material indicated, of sizes indicated: sign types B and B1.
E. Message Schedule: Sign Contractor to submit a Complete Sign Message Schedule for all signs. Use same designations indicated on Drawings.

F. Qualification Data: Submit Qualification statement for and names of any subcontractors who will provide any scope of this work.

G. Project Schedule: Sign Contractor to submit a Project Schedule to Owner signifying any changes to the agreed completion date.

H. Warranty: Special Warranty specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of signage manufacturer.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Signs: Obtain each type indicated from one source from a single manufacturer.

D. Pre-Installation Conference: Conduct Conference at Project site to comply with requirements in Division 01.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide custom-made to order product by Sign Pro Inc, 860-229-1812 or a Phenolic-Backed Photopolymer product by one of the following:
   1. APCO Graphics, Inc.
   2. Advance Corporation.
   3. Best Sign Systems, Inc.

B. Interior Signs: Provide smooth sign surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following:

C. Acrylic: Acrylic shall be cast sheet that is optically clear, with high impact resistance, weather resistant, formability and machinability. Acrylic to be Plexiglass G smooth by Rohm and Haas or approved equal. Clear non glare to be clear N2001 Non-Glare cell cast by Calask Corporation or approved equal.

D. Photo-etch: Phenolic-Backed Photopolymer Sheet: Provide light-sensitive, water wash photopolymer face layer bonded to a phenolic base layer to produce a composite sheet with overall, face layer, and thicknesses as shown on Signage drawings, and type D shore durometer hardness
of 80 and a shear cut in thickness up to 1/8" thick, reducing fabricating times by 33%. PETG waste (such as small, off cuts) can be sent to a recycling facility after the photopolymer has been removed. The photopolymer effluent is 100% biodegradable and can be disposed of into any public sewer system. Edge condition: Square cut; Corner condition: square.

E. Mounting and Adhesives: Wall mounted with two-faced tape with silicone as required by surfaces on which sign od to be installed. All adhesives and mounting shall be indicated on shop drawings. 3M VHB 4949 with Loc-Tite low VOC construction adhesive.

F. Color: Photoetched phenolic surface coated – sprayed – with acrylic polyurethane in a satin finish contrasting colors screen with vinyl inks on to raised graphics.

G. Paints shall be acrylic polyurethane satin as manufactured by Matthews Paint Company. All paint surface shall be cleaned, primed and pretreated according to manufacturer’s specifications.

H. Color as specified to match: Black

I. Fonts: Helvetica Character Proportion: Width to Height ratio between 3:5 and 1:1, and a stroke-width-to-height ratio between 1:5 and 1:10.

J. Finish and Contrast: Characters, Backgrounds to be matte or other non-glare finish. Characters and Grade 2 Braille to be raised 1/32 inch above surface.

2.02 FASTENERS AND SUPPORTS

A. Where mechanical fasteners and hardware are required, they shall be of adequate thickness, length and construction to properly secure the sign unit. Any visible portion of any mounting device shall be finished to match adjacent surface. All fasteners, adhesives and mounting shall be indicated on Shop Drawings.

B. Metal fasteners and hardware in contact with dissimilar materials shall have a protective coating or neoprene shields.

C. Use concealed fasteners fabricated from metals noncorrosive to sign material and mounting surface

D. Adhesives:

1. Install with adhesive and mechanical fasteners as required by surfaces on which sign is to be installed.

2. HITOHY 150 MAX Fast Cure Hybrid.

3. Wall mounted with two-faced tape with silicone as required by surface on which sign is to be installed. 3M VHB 4949.

4. Loc-Tite low VOC construction adhesive.

PART 3 - EXECUTION
3.01 EXAMINATION

A. Examine substrates, areas and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Installer to sign in at site each day prior to commencement of installation.

B. Locate signs and accessories where indicated, using mounting methods or types described and complying with manufacturer’s written instructions.

C. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

D. For 3M VHB Double faced tape and Loc-Tite low VOC construction adhesive, locate at 54” inches above the finished floor to the top of the sign unit.

E. When standard installs cannot be met, bring to the attention and coordinate with the Project Coordinator prior to install.

3.03 CLEANING

A. MSDS sheets for all chemicals used on site to be provided to Owner prior to installation.

B. Installer to remove all material and tools from the site at the end of each day.

C. After installation, clean soiled sign surfaces according to manufacturer’s written instructions. Protect product from damage until acceptance by Owner.

D. Do not use cleaning materials or processes that could damage the appearance of exposed finishes or damage adjacent materials.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 15 Sections, in addition to Division 1 - General Requirements.

1.2 SUBMITTALS

A. Submit under provisions of Division 1.
B. Include Products specified in the individual Sections.
C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
D. Mark dimensions and values in units to match those specified.

1.3 SEQUENCING AND SCHEDULING

A. Construct Work in sequence under provisions of Division 1.
B. Connections to existing systems shall be coordinated with Owner. Contractor shall notify Owner 48 hours in advance of making connections.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION
PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Pipe hangers and supports.
B. Sleeves.

1.2 RELATED SECTIONS

A. Division 7 - Thermal and Moisture Protection: Joint seals for piping and duct penetration of fire rated assemblies.
B. Section 078400 - Fire Stopping.
A. Division 9 - Finishes for Painting.
E. Section 152600 - Piping Insulation.

1.3 REFERENCES

A. ASME B31.1 - Power Piping.
B. ASME B31.2 - Fuel Gas Piping.
C. ASME B31.9 - Building Services Piping.
D. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
E. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
F. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
G. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
H. NFPA 13 - Installation of Sprinkler Systems.
I. NFPA 14 - Installation of Standpipe and Hose Systems.
J. UL 203 - Pipe Hanger Equipment for Fire Protection Service.

1.4 SUBMITTALS
A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data: Provide manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer’s Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULATORY REQUIREMENTS

A. All piping supports shall conform to ASTM F708, MSS SP58, MSS SP69, MSS SP89, Connecticut State Building Code and local building codes.

B. Supports for Sprinkler Piping: In conformance with NFPA 13.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Grinnell Corp. models listed below.
   2. Other acceptable manufacturers offering equivalent products:
      a) Mason Industries Inc.
      b) B Line Systems Inc.

B. Hangers: Carbon steel, adjustable, clevis; Grinnell Figure 260. Other acceptable manufacturers offering equivalent products:
   1. Mason Industries Inc.
   2. B Line Systems Inc.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers, hanger rods and U-bolt pipe clamp.

D. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron clamp; Grinnell Figure 126 or steel bracket and hanger. Other acceptable manufacturers offering equivalent products:
   1. Mason Industries Inc.
   2. B Line Systems Inc.

E. Wall Support for Pipe Sizes 3 Inches (76 mm) and Over: Welded steel bracket and hanger.

F. Vertical Support: Steel riser clamp; Grinnell Figure 261. Other acceptable manufacturers offering equivalent products:
   1. Mason Industries Inc.
   2. B Line Systems Inc.

G. Floor Support: Carbon steel adjustable pipe saddle, U-bolt, lock nut, nipple and floor flange; Grinnell Figure 191. Other acceptable manufacturers offering equivalent products:
1. Mason Industries Inc.
2. B Line Systems Inc.

H. Hanger Rods: Mild steel threaded both ends, or continuous threaded.

I. Beam Clamps: Carbon steel, center I-beam clamp for providing even distribution on "T" flanges; Grinnell Figure 133 or 134. Other acceptable manufacturers offering equivalent products:
   1. Mason Industries Inc.
   2. B Line Systems Inc.

J. Beam Clamps For Piping 2" Diameter and Less: Malleable iron C-clamp with locknut; Grinnell Fig 86. Provide retaining clip for piping to be seismically braced. Other acceptable manufacturers offering equivalent products:
   1. Mason Industries Inc.
   2. B Line Systems Inc.

K. Insulation Shields: Galvanized carbon steel; Grinnell Figure 167. Other acceptable manufacturers offering equivalent products:
   1. Mason Industries Inc.
   2. B Line Systems Inc.

2.2 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors, Beams, Walls and Footings: Schedule 10 carbon steel pipe or 18 gage (1.2 mm thick) galvanized steel or schedule 40 PVC.


C. Sleeves for Round and Rectangular Ductwork: Galvanized steel.

D. Firestopping Insulation: Glass fiber type, non-combustible; refer to Division 7.

E. Sealant: RTV Silicone; refer to Division 7.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

3.2 PIPE HANGERS AND SUPPORTS

A. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.

B. Place hangers within 12 inches (300 mm) of each horizontal elbow.

C. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
D. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.

E. Support vertical piping at every floor; maximum distance of 15 feet between vertical supports. Support vertical cast iron pipe at each floor at hub.

F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

G. Support riser piping independently of connected horizontal piping.

H. Design hangers for pipe movement without disengagement of supported pipe.

I. Provide insulation shields at all insulated piping.

J. Provide supplemental steel channels, unistrut, etc. supported from building structure as required.

3.3 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 floors one inch (25 mm) above finished floor level. Caulk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

3.4 SCHEDULE

HANGER SPACING

<table>
<thead>
<tr>
<th>Pipe Material &amp; Size</th>
<th>Max. Horizontal Spacing</th>
<th>Min. Hanger Rod Diameter</th>
<th>Max. Vertical Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel 1/4” thru 1-1/4”</td>
<td>7’</td>
<td>3/8”</td>
<td>12’</td>
</tr>
<tr>
<td>Steel 1-1/2”</td>
<td>9’</td>
<td>3/8”</td>
<td>12’</td>
</tr>
<tr>
<td>Steel 2”</td>
<td>10’</td>
<td>3/8”</td>
<td>12’</td>
</tr>
<tr>
<td>Steel 3”</td>
<td>12’</td>
<td>1/2”</td>
<td>12’</td>
</tr>
<tr>
<td>Steel 4”</td>
<td>14’</td>
<td>5/8”</td>
<td>12’</td>
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<td>Steel 5”</td>
<td>16’</td>
<td>5/8”</td>
<td>12’</td>
</tr>
<tr>
<td>Steel 6”</td>
<td>17’</td>
<td>3/4”</td>
<td>12’</td>
</tr>
<tr>
<td>Material</td>
<td>Length</td>
<td>Diameter</td>
<td>Length</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>Steel 8&quot;</td>
<td>19'</td>
<td>7/8&quot;</td>
<td>12'</td>
</tr>
<tr>
<td>Copper 1/4&quot; thru 3/4&quot;</td>
<td>5'</td>
<td>3/8&quot;</td>
<td>10'</td>
</tr>
<tr>
<td>Copper 1&quot;</td>
<td>6'</td>
<td>3/8&quot;</td>
<td>10'</td>
</tr>
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<td>Copper 1-1/4&quot;</td>
<td>7'</td>
<td>3/8&quot;</td>
<td>10'</td>
</tr>
<tr>
<td>Copper 1-1/2&quot; thru 2&quot;</td>
<td>8'</td>
<td>3/8&quot;</td>
<td>10'</td>
</tr>
<tr>
<td>Copper 3&quot;</td>
<td>10'</td>
<td>1/2&quot;</td>
<td>10'</td>
</tr>
<tr>
<td>Copper 4&quot;</td>
<td>12'</td>
<td>5/8&quot;</td>
<td>10'</td>
</tr>
<tr>
<td>C.I. 3&quot; thru 5&quot;</td>
<td>10' *</td>
<td>5/8&quot;</td>
<td>15'</td>
</tr>
<tr>
<td>C.I. 6&quot;</td>
<td>10' *</td>
<td>3/4&quot;</td>
<td>15'</td>
</tr>
<tr>
<td>C.I. 8&quot; thru 10&quot;</td>
<td>10' *</td>
<td>7/8&quot;</td>
<td>15'</td>
</tr>
<tr>
<td>PVC 2&quot; and smaller</td>
<td>4'</td>
<td>3/8&quot;</td>
<td>4'</td>
</tr>
<tr>
<td>PVC 3&quot; thru 6&quot;</td>
<td>4'</td>
<td>1/2&quot;</td>
<td>4'</td>
</tr>
</tbody>
</table>

* Spacing for C.I. Pipe assumes a 10’ length of pipe. Adjust spacing accordingly for shorter sections.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications, apply to this Section.

B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Makeup-water piping.
5. Air-vent piping.
7. Metering stations.

1.3 CT HIGH PERFORMANCE BUILDING REQUIREMENTS

A. The mandatory and standard options and procedures for compliance, submittal requirements, and reporting forms are in the CT High Performance Building Requirements Summary in Division 01.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Pressure-seal fittings.
2. Grooved end mechanical joint fittings.
3. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves.
4. Air control devices.
6. Hydronic specialties.

B. Shop Drawings: Detail, CAD-generated and drawn at 1/4-inch scale, the piping layout, fabrication of piping systems, pipe anchors, hangers, valves, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure and seismic restraints. Detail location of anchors, alignment guides, and expansion joints and loops.
1. Fabrication, assembly and installation including plans, elevations, sections, components, and attachments to other work.
2. Equipment installation based on equipment being used on project.
3. Piping accessories, including access panels.
4. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable style or series number.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Welding certificates.
C. Field quality-control test reports.
D. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.
E. Chemical Removal Certificates: Written and signed certificates from a licensed hazardous chemical removal company.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air control devices, hydronic specialties, and specialty-duty valves to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.
B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Grooved-End Mechanical Joint Systems: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings. Submit certifications or letter listing specific names of installers.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for hydronic systems 350 psig and/or 250 deg F and below, for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.9 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Initial water analysis and HVAC water-treatment recommendations.
2. Start-up assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
4. Quarterly certified laboratory technical analysis.
5. Annual certified laboratory legionella analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.
7. Monthly service to test all system levels along with written reports and coupon replacement.
8. Monthly maintenance on all equipment.
9. Handling of all chemicals (Owner will not handle chemicals).

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
C. Wrought-Copper Fittings: ASME B16.22.
D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

E. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

F. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

   a. Anvil International, Inc.
   b. Tyco International Company; Grinnell Mechanical Products.
   c. Victaulic Company.

2. Grooved Joint Fittings NPS 2 and Larger: ASTM A 536, Grade 65-45-12 ductile-iron; ASTM A 53/A 53M, Type F, E or S, Grade B fabricated steel; or ASTM A234, Grade WPB forged steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

3. Couplings NPS 2 and Larger: Two-piece, ductile-iron housing and synthetic rubber gasket of central cavity pressure-responsive design (similar to Grade "EHP" EPDM for water services rated -30 deg. F to +250 deg. F); with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

   a. Rigid: Provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9.
   b. Flexible: Use in locations where thermal stress relief is required (such as expansion loops or piping offsets) and vibration attenuation is required. In lieu of each flexible connector at major equipment, three (3) flexible style couplings may be used for vibration attenuation and shall be placed in close proximity to the vibrating source in accordance with published guidelines.

4. Flange Adapters: Ductile-iron housing, flat face, for use with grooved-end pipe and fittings, for mating directly with ANSI Class 125, 150 and 300 flanges.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

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

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Central Plastics Company.
   d. Jomar International Ltd.
   e. Matco-Norca, Inc.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   h. Wilkins; a Zurn company.

2. Description:
   b. Pressure Rating: 125 psig minimum at 180 deg F.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Central Plastics Company.
   c. Matco-Norca, Inc.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Wilkins; a Zurn company.

2. Description:
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Description:
   a. Nonconducting materials for field assembly of companion flanges.
   b. Pressure Rating: 150 psig.
   c. Gasket: Neoprene or phenolic.
   d. Bolt Sleeves: Phenolic or polyethylene.
   e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elster Perfection.
   b. Grinnell Mechanical Products.
   c. Matco-Norca, Inc.
   d. Precision Plumbing Products, Inc.
   e. Victaulic Company.

2. Description:
   a. Standard: IAPMO PS 66
   b. Electroplated steel nipple. complying with ASTM F 1545.
   c. Pressure Rating: 300 psig at 225 deg F.
   d. End Connections: Male threaded or grooved.
   e. Lining: Inert and noncorrosive, propylene.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."
C. Multi-Turn, Globe-Style, Balancing Valves, NPS 2 and Smaller:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong Pumps, Inc.
   b. Macon Balancing MMA.
   c. Tour & Andersson.
   d. Wheatley HVAC.

2. Body: Y-pattern, brass or copper alloy.
5. Seals: EPDM.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Threaded brass ports with check valves and gasketed caps.
8. Handle Style: Handwheel with lockable stop.
10. Maximum Operating Temperature: 250 deg F.
11. Factory molded insulation kit.
12. Provide "low flow type" valves and sizes for all terminal units (radiation, reheat coils, fan coil units, unit heaters, radiant panels, etc.) where flow rate is 1.5 gpm or less.

D. Multi-Turn, Globe-Style Balancing Valves, NPS 2 1/2 and Larger:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong Pumps, Inc.
   b. Tour & Andersson
   c. Wheatley HVAC

2. Body: Cast-iron or steel.
5. Seals: EPDM.
7. Pressure Gage Connections: Threaded brass ports with check valves and gasketed caps.
8. Handle Style: Handwheel with lockable stop.
9. CWP Rating: Minimum 125 psig
10. Maximum Operating Temperature: 250 deg F.
11. Factory molded insulation kit.

E. Multi-Turn, Globe-Style Balancing Valves, NPS 6 and Larger:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong Pumps, Inc.
   b. Macon Balancing MMA.
   c. Nexus Valve.
   d. Tour & Andersson
e. Wheatley HVAC

2. Body: Cast-iron or steel, globe or butterfly pattern.
5. Seals: EPDM.
7. Pressure Gage Connections: Threaded brass ports with check valves and gasketed caps.
8. Handle Style: Handwheel with lockable stop.
10. Maximum Operating Temperature: 250 deg F.
11. Factory molded insulation kit.

F. Diaphragm-Operated Safety Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump; a division of ITT Industries.
   d. Conbraco Industries, Inc.
   e. Spence Engineering Company, Inc.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
8. Inlet Strainer: Removable without system shutdown.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Griswold Controls.
   b. Nexus.
   c. Macon Balancing.
   d. Hays Fluid Controls.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel or corrosion resistant, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig
9. Maximum Operating Temperature: 200 deg F.

2.6 AIR CONTROL DEVICES

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

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
7. Maximum Operating Temperature: 225 deg F.

C. High Capacity Automatic Air Vents:

1. Body: Cast iron.
2. Internal Parts: Stainless steel.
7. Maximum Operating Temperature: 240 deg F.

D. Automatic Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
4. Inlet Connection: NPS 1/8 to NPS 1/2.
7. Maximum Operating Temperature: 240 deg F.

E. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
F. Coalescing-Type Air and Dirt Separators:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett; a Xylem brand.
   c. Taco
   d. Spirotherm, Inc.

2. Tank: Fabricated steel tank; ASME constructed and stamped for 125-psig working pressure and 270 deg F maximum operating temperature.

3. Coalescing Medium: Copper or Stainless steel.

4. Air Vent: Threaded to the top of the separator.

5. Inline Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; Class 150 flanged connections for NPS 2-1/2 (DN 65) and larger.

6. Blowdown Connection: Threaded to the bottom of the separator.

7. Size: Match system flow capacity.

2.7 CHEMICAL TREATMENT

A. Filtered Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Filters: Bag type, replaceable through top of feeder. Provide sets of 20 micron, 10 micron and 5 micron for cleaning and passivation and final.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers Less than 2-1/2 Inches:

1. Body: ASTM B62 C83600 threaded end or ASTM B584 C84400 solder end, cast bronze with bolted cover and bottom drain connection.

2. End Connections: Threaded or soldered ends for NPS 2 and smaller; flanged or grooved ends for NPS 2-1/2 and larger.

3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.


B. Y-Pattern Strainers 2-1/2 Inches and Greater:

1. Body: ASTM A 126, Class B, cast-iron with bolted cover and bottom drain connection.

2. End Connections: Flanged or grooved ends.

3. Strainer Screen: 40 mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.


C. Stainless-Steel Bellow, Flexible Connectors:


2. End Connections: Threaded or flanged to match equipment connected.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be the following:
   
   1. All Locations Unless Noted Otherwise: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
   
   1. All Locations Unless Noted Otherwise: Schedule 40 steel pipe, wrought-steel fittings and Class 150 forged-steel flanges and flange fittings, and welded and flanged joints.
   2. All Locations Unless Noted Otherwise: Schedule 40 steel pipe; Class 150, malleable-iron flanges and flange fittings; and threaded joints with cast-iron or steel fittings.
   3. Exposed and Accessible in Mechanical Rooms / Mechanical Areas: Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Hot-water heating piping installed belowground and within slabs shall be the following:
   
   1. Type K, annealed-temper copper tubing, wrought-copper fittings, and brazed joints. Use the fewest possible joints.

D. Chilled-water piping, aboveground, NPS 2 and smaller, shall be the following:
   
   1. All Locations Unless Noted Otherwise: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

E. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be the following:
   
   1. All Locations Unless Noted Otherwise: Schedule 40 steel pipe, wrought-steel fittings and forged-steel flanges and flange fittings, and welded and flanged joints.
   2. All Locations Unless Noted Otherwise: Schedule 40 steel pipe; Class 150, malleable-iron flanges and flange fittings; and threaded joints with cast-iron fittings.
   3. Exposed and Accessible in Mechanical Rooms / Mechanical Areas: Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings.

F. Chilled-water piping installed belowground and within slabs shall be the following:
   
   1. Type K, annealed-temper copper tubing, wrought-copper fittings, and brazed joints. Use the fewest possible joints.

G. Makeup-water piping installed aboveground shall be the following:
   
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
H. Makeup-Water Piping Installed Belowground and within Slabs: Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

I. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

J. Air-Vent Piping:
   1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer’s written instructions.
   2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

K. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer’s written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install check valves at each pump discharge and elsewhere as required to control flow direction.

C. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

D. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

E. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Install piping to allow application of insulation.
J. Select system components with pressure rating equal to or greater than system operating pressure.
K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
T. Install unions in pipes 2 inches NPS and smaller, adjacent to each valve, at final connections of each piece of equipment and elsewhere as indicated. Unions are not required at flanged connections.
U. Install flanges or grooved joint couplings on valves, apparatus and equipment having 2-1/2 inches NPS and larger connections.
V. Install flexible connectors at inlet and discharge connections to pumps (except inline pumps) and other vibration producing equipment.
W. Install metering stations at each inlet connection to pumps.
X. Anchor piping for proper direction of expansion and contraction.
Y. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."
Z. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

AA. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

BB. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

CC. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports. Piping supports must account and contraction, vibration, seismic restraint, and dead load of piping and its contents.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.
   5. Spring hangers to support horizontal runs for first three support points from all equipment and support points up to 50 linear feet from all rotating type equipment.
   6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
   7. Curb-mounted type pipe stands and supports for piping supported on roof.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes and in accordance with MSS-SP-69:
   1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
   7. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   8. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
   9. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes and in accordance with MSS-SP-69:
   1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
   2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
   3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. **NPS 2:** Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. **NPS 2-1/2:** Maximum span, 9 feet; minimum rod size, 1/2 inch.
7. **NPS 3:** Maximum span, 10 feet; minimum rod size, 1/2 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. **Soldered Joints:** Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. **Brazed Joints:** Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. **Threaded Joints:** Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. **Damaged Threads:** Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

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

H. **Flanged Joints:** Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. **Grooved Joints:** Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end pipe couplings. Use flexible, grooved-end pipe couplings where allowed.
   1. **Joints Requiring Torque Tightening:** Torque in strict accordance with manufacturer's written instructions. Test each bolt torque value and hand-write the value in indelible ink in a contrasting color on each fitting and coupling body.
   2. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. A factory-trained field representative shall provide onsite training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved piping products. Representative shall be a direct employee of the grooved system manufacturer. (A
distributor representative is not qualified for this site service.) Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products as deemed so by the system representative.


3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain. Install piping to expansion tank from side of main.

D. Install bypass chemical feeders in each hydronic system, in upright position with top of funnel not more than 48 inches above the floor. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

1. Install water meter in makeup water supply.
2. Install test coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on drawings.
3. Install a gate or full port ball isolation valves on inlet, outlet and drain below feeder inlet.
4. Install a swing check on inlet after the isolation valve.
5. Install 20, 10 and 5 micron filters for cleaning and passivation.
6. Install 5 micron filters after cleaning and passivation. Turn one set of new 5 micron filters over to Owner for future installation.

E. Install expansion tanks on the floor or suspended from structure. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections and at locations requiring gages and thermometers according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling.
B. Perform a certified laboratory analysis of the following:

1. Supply water to determine quality of water available at project site.
2. Water systems after cleaning and flushing to determine complete removal of cleaning chemicals prior to treatment.
3. Water systems after treatment to determine compliance with required water quality.
4. Water systems after treatment to determine compliance with required legionella levels.
5. Retests if any tests are failed.

C. Cleaning and Passivation Procedures for Hydronic Pipe Systems:

1. Drain the entire system completely from as many points as possible. Install a water meter on the system makeup and refill the system. Record the volume of the system. Provide chemical manufacturer with that volume for use in calculating the appropriate concentration of cleaner and inhibitor.
2. Introduce into the system via the filter/feeder or transfer pump alkaline new pipe cleaner.
3. The alkaline new pipe cleaner should be thoroughly circulated for 8 to 24 hours with all temporary circulator pumps running and all valves open. The minimum circulation velocity shall be 2 ft./sec. in all pipes. Provide temporary pumping capacity as required to meet velocity requirements. There should be no isolated areas or "dead legs." Provide cross connects in the system to eliminate dead legs. It is essential to have good thorough circulation for the cleaning process. A sample of the system water with cleaner should be retained for the chemical manufacturer. That sample will be tested by the chemical manufacturer to determine if the proper concentration of cleaner is present.
4. After the cleaning process is complete, the system should be thoroughly drained and flushed. The system should be refilled and a sample of the system water retained for the chemical manufacturer to test.
5. If the test indicates that the cleaner is still present, the system will require another complete drain and fill. A sample will be provided to the chemical manufacturer for testing again. This process will continue until the chemical manufacturer has determined that the cleaner is completely flushed from the system.
6. Time, materials, testing and retesting shall be included.
7. Once the chemical manufacturer has determined that the system is thoroughly flushed, a corrosion inhibitor shall be introduced into the system via the filter/feeder or pump. The chemical manufacturer will specify the necessary amount to be used.
8. Circulate with all circulator pumps on and all valves open. A sample of the treated system water should be provided to the chemical manufacturer to determine the correct concentration of inhibitor. Once a proper concentration of inhibitor is present, circulation is to continue for three weeks for proper filming and passivation to occur.
9. Begin using the filter "bags" in the filter/feeder to remove any remaining suspended solids. The filters are to be changed weekly for three weeks. Filter sizes will also change from larger to smaller (20 micron, 10 micron and 5 micron) each week depending on the solids level.
10. A final sample of system water should be provided to the chemical manufacturer. The chemical manufacturer shall complete a laboratory analysis of the cleaned and treated water.

D. Closed hydronic systems, including hot water heating and chilled water shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.3.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. "M" Alkalinity: Maintain a value within 100 to 500 ppm.
4. Boron: Maintain a value within 100 to 200 ppm.
5. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
6. Soluble Copper: Maintain a maximum value of 0.20 ppm.
7. TDS: Maintain a maximum value of 10 ppm.
10. Specific Conductance: Maintain a maximum value of 2,500.
11. Silica: Maintain a maximum value of 120 ppm.
12. Molybdenum: Maintain a value within 12 to 100 ppm.
13. Nitrite: Maintain a value within 600 to 1,000 ppm.
14. Microbiological Limits:
   a. Total Aerobic Plate Count: Maintain a maximum value of 1,000 organisms/ml.
   b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
   c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
   d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
   e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

E. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.9 CHEMICAL DISPOSAL

A. Removal of Chemicals from Site: Chemicals will be disposed of off-site by a licensed hazardous chemical waste company.
   1. Provide written and signed certification of proper disposal.

B. Alternative Disposal: If all approvals and acceptances are obtained, chemicals may be disposed of through the building sanitary system.
   1. Written and Signed Approvals/Acceptances:
      a. Owner.
      b. Water/Sewer Authority.
   2. Monitoring: Effluent shall be continually monitored during all disposal events for all restrictive allowable variables (e.g., pH level) outline in the specific approvals and acceptances gained.

3.10 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   3. Chemically clean and Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.
   4. Prior to system flush, remove automatic flow-control cartridges and secure to valve for re-installation after system flush but before balancing.
   5. Isolate equipment from piping. Install valves, caps or blinds in flanged joints at final equipment connection points to isolate equipment. If a valve is used to isolate
equipment, its closure shall be capable of sealing against test pressure without damage to valve.

6. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system up to equipment final connection points to hydrostatic test pressure of 1.5 times the system's working pressure, minimum 100 psig but shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping." Expansion joints which cannot sustain the reactions due to test pressure shall be provided with temporary restraint or shall be isolated from testing.
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Once the system is leak free, run the leak test for six hours.
7. Prepare written report of testing.

C. Test and inspect field welds are follows:

1. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field inspections and tests, and to prepare test reports.
2. Provide the testing agency and the Engineer safe access to the site throughout the duration of the piping installation. Notify the testing agency and the Engineer a minimum of 48 hours prior to start of welding.
   a. Visual Inspection: Visual inspection on 100 percent of all field pipe welds. The percentage of welds inspected may be modified by the Engineer of Record, depending on initial results. Witness of the actual welding by the testing agency to occur on a minimum of 15 percent of all field welds.
3. Correct deficiencies in or remove and replace welds that test reports and inspections indicate do not comply with the Contract Documents at no additional cost to the Owner.
4. Additional testing and inspection, at the Contractor’s expense, will be performed by the Owner’s testing agency to determine compliance of corrected work with specified requirements.

D. At six-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show the automatic chemical feed systems are maintain water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 “Performance Requirements” article.
E. Comply with ASTM D 3370 and with the following standards:


F. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Stencils.
D. Pipe Markers.

1.2 RELATED SECTIONS

A. Division 9 - Finishes for Painting.

1.3 REFERENCES


1.4 SUBMITTALS

A. Submit under provisions of Division 1.
B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
D. Product Data: Provide manufacturers catalog literature for each product required.
E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.
B. Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers: Best, EMED Co. or approved equal.
B. Equipment nameplates shall match current CCSU Campus Mechanical Identification/Color Coding Standards.
C. Description: Laminated three-layer plastic with engraved white letters on black background. For equipment, text indicating equipment name shall be 1" in height and all remaining text shall be 1/4" in height.
2.2 TAGS
   A. Manufacturers: Seton Name Plate Co., EMED Co. or approved equal.
   B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) square.
   C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) square with smooth edges.
   D. Chart: Typewritten letter size list in anodized aluminum frame.

2.3 STENCILS
   A. Manufacturers: Seton Name Plate Co., EMED Co. or approved equal.
   B. Stencils: With clean cut symbols and letters of following size:
      1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
      2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
      3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
      4. 8 to 10 inch (200-250 mm) Outside Diameter of Insulation or Pipe: 24 inch (600 mm) long color field, 2-1/2 inch (65 mm) high letters.
      5. Over 10 inch (250 mm) Outside Diameter of Insulation or Pipe: 32 inch (800 mm) long color field, 3-1/2 inch (90 mm) high letters.
      6. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.
   C. Stencil Paint: As specified in Division 9, semi-gloss enamel, colors conforming to ASME A13.1.

2.4 PIPE MARKERS
   A. Manufacturers: Setmark Type SNA or STR as manufactured by Seton Name Plate Co., EMED Co. or approved equal.
   B. Color: Shall match current CCSU Campus Mechanical Identification/Color Coding Standards.
   C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
   D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings; minimum information indicating flow direction arrow and identification of fluid being conveyed.
   E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

PART 3 - EXECUTION
3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 9 for stencil painting.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant brass or nylon chain.

C. Apply stencil painting in accordance with Division 9.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.

G. Identify all equipment with nameplates in accordance with current CCSU Campus Mechanical Identification/Color Coding Standards. Small devices may be identified with tags.

H. Identify control panels and major control components outside panels with nameplates.

I. Identify thermostats with nameplates.

J. Identify valves in main and branch piping with tags.

K. Tag all control components, instruments and relays. Key to control schematic.

L. Identify all piping, concealed or exposed, with pipe markers or stencilled painting. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) 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.

M. Identify ductwork with stencilled painting. Identify system type (supply, exhaust, etc.) and direction of flow. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.
B. Jackets and accessories.

1.2 RELATED SECTIONS

A. Division 9 - Finishes for painting.
B. Section 151400 - Supports and Anchors.
C. Section 151900 - Mechanical Identification.
D. Division 16 - Electrical.

1.3 REFERENCES

F. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
H. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
J. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
M. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
N. ASTM E84 - Surface Burning Characteristics of Building Materials.
Q. UL 723 - Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.
B. Product Data: Provide product description, list of materials and thickness for each service, and locations.
C. Samples: Submit two samples of any representative size illustrating each insulation type.
D. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255, and UL 723.

1.6 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Division 1.
B. Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
C. Store insulation in original wrapping and protect from weather and construction traffic.
D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastic, and insulation cements.
B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 GLASS FIBER
A. Manufacturers:
1. Manville Micro-Lok.
2. Other acceptable manufacturers offering equivalent products:
   a) Owens Corning.
   b) Certainteed Manson.
   c) Knauf.

B. Insulation: ASTM C547; rigid molded, noncombustible.
1. 'K' value (SI 'k' value): ASTM C335, 0.25 at 75 degrees F (0.036 at 24 degrees C).
4. Maximum Moisture Adsorption: 0.2 percent by volume.

C. Vapor Barrier Jacket:
1. White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: ASTM E96; 0.02 perm inch.

D. Installation and Jacketing:
1. Secure seams with pressure sensitive tape closure and butt joints with minimum 3 inch (76 mm) wide tape of same material as vapor barrier jacket.
2. PVC jacket shall be installed on following:
   a) Insulated piping located within mechanical rooms that is installed less than 10 feet (3 m) above finished floor.
   b) All piping systems located within eight feet of finished floor in occupied spaces, locker and shower rooms, and rest rooms.
   c) All insulated fittings and valves.
3. For finish see Division 9.

2.2 GLASS FIBER, RIGID

A. Manufacturers:
1. Manville 800 Series.
2. Other acceptable manufacturers offering equivalent products:
   a) Owens Corning.
   b) Certainteed.

B. Insulation: ASTM C612; rigid, noncombustible.
1. 'K' value (SI 'k' value): ASTM C518, 0.22 at 75 degrees F (0.032 at 24 degrees C).
3. Maximum moisture adsorption: 1.0 percent by volume.
4. Density: 6.0 lb/cu ft (96 kg/cu m).
5. Thickness: 4 inch (25 mm).

C. Vapor Barrier Jacket
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film for equipment interior to building.
2. Moisture vapor permeability: ASTM E96; .02 perm inch.
3. Secure with pressure sensitive tape.
4. For finish see Division 9.
D. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.3 FLEXIBLE ELASTOMERIC CELLULAR

A. Manufacturers: Armstrong Armaflex AP or approved equal.

B. Insulation: ASTM C534; flexible, cellular elastomeric, tubular.
   1. 'K' value (SI 'k' value): ASTM C177 or C518; 0.27 at 75 degrees F (0.04 at 24 degrees C).
   5. Moisture Vapor Permeability: ASTM E96; 0.20 perm inches.

C. Installation
   1. Slip insulation over piping or slit and snap over piping.
   2. Apply Armstrong 520 adhesive to all seams and butt joints.
   3. Fittings and Valves: Field fabricate per manufacturer's instructions.
   4. Finish with WB Armaflex finish.

2.4 JACKETS

A. Polyvinyl Chloride (PVC) Plastic
   1. Manufacturer: Manville Zeston 2000 or approved equal.
   2. Jacket: ASTM D1784, one piece molded type fitting covers and sheet material, off white color.
      a) Minimum Service Temperature: 0 degrees F (-18 degrees C).
      b) Maximum Service Temperature: 150 degrees F (66 degrees C).
      c) Thickness: 10 mil (.26 mm).
   3. Installation:
      a) Fittings and Valves: Factory precut inserts.
      b) Apply vapor retardant mastic to all seams and joints.
      c) Secure all seams and joints with Zeston PVC Z-Tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer’s instructions.

B. On exposed piping, locate insulation and cover seams in least visible locations.

C. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
D. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections and expansion joints.

E. Inserts and Shields:
1. Application: Piping 2 inches (50 mm) diameter or larger.
2. Shields: Refer to Section 15140.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: ASTM C640 cork, hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

F. Finish insulation at supports, protrusions, and interruptions.

3.3 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork insulation.
B. Duct liner.
C. Insulation jackets.

1.2 RELATED SECTIONS

A. Division 9 - Painting.
B. Section 151900 - Mechanical Identification.
C. Section 158900 - Ductwork.
D. Section 159100 - Ductwork Accessories.

1.3 REFERENCES

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
C. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
D. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
E. ASTM E84 - Surface Burning Characteristics of Building Materials.
H. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
I. UL 723 - Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.
B. Product Data: Provide product description, list of materials and thickness for each service, and locations.
C. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.
1.5 QUALITY ASSURANCE
   
   A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 and UL 723.

1.6 QUALIFICATIONS
   
   A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING
   
   A. Deliver, store, protect and handle products to site under provisions of Division 1.
   
   B. Deliver materials to site in original factory packaging, labeled with manufacturer's density and thickness.
   
   C. Store insulation in original wrapping and protect from weather and construction traffic.
   
   D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.8 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

2.1 GLASS FIBER, FLEXIBLE
   
   A. Manufacturers:
      1. Manville Microlite.
      2. Other acceptable manufacturers offering equivalent products:
         a) Owens Corning.
         b) Certainteed.
   
   B. Insulation: ASTM C553; flexible, noncombustible blanket.
      1. 'K' value (SI 'k' value): ASTM C518, 0.26 at 75 degrees F (0.038 at 24 degrees C).
      3. Maximum moisture adsorption: 0.20 percent by volume.
      4. Density: Type 100; 1.0 lb/cu ft (16 kg/cu m).
      5. Thickness: 1.5 inches (38 mm).
   
   C. Vapor Barrier Jacket
      1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
      2. Moisture vapor permeability: ASTM E96; 0.02 perm inch.
      3. Secure with pressure sensitive tape.
D. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.2 GLASS FIBER, RIGID

A. Manufacturers:
   1. Manville 800 Series.
   2. Other acceptable manufacturers offering equivalent products:
      a) Owens Corning.
      b) Certainteed.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. 'K' value (SI 'K' value): ASTM C518, 0.22 at 75 degrees F (0.032 at 24 degrees C).
   3. Maximum moisture adsorption: 1.0 percent by volume.
   4. Density: 6.0 lb/cu ft (96 kg/cu m).
   5. Thickness: 1 inch (25 mm).

C. Vapor Barrier Jacket
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film for ductwork interior to building.
   2. Moisture vapor permeability: ASTM E96; .02 perm inch.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.3 GLASS FIBER DUCT LINER

A. Manufacturers:
   1. Owens Corning Aeroflex Type 200.
   2. Other acceptable manufacturers offering equivalent products:
      a) Manville.
      b) Certainteed.

B. Insulation: ASTM C1071; flexible, noncombustible blanket.
   1. 'K' value (SI 'K' value): ASTM C518, 0.26 at 75 degrees F (0.038 at 24 degrees C).
   3. Density: 2.0 lb/cu ft (32 kg/cu m).
   4. Maximum Velocity on Coated Air Side: 5,000 ft/min (20.3 m/sec).
   5. Thickness: 2 inch (25 mm).

C. Noise Reducing Coefficient: NRC shall not exceed 0.6.

D. Adhesive: Waterproof, fire retardant type.
E. Liner Fasteners: Galvanized steel mechanical fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that ductwork has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer’s instructions and as outlined within this specification.

B. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

C. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Flexible Glass Fiber Insulation Application:
   1. Secure insulation seams with staples, spaced at 6 inches (150 mm) on center.
   2. Seal seams with pressure sensitive tape.
   3. Install without sags on underside of ductwork. Use mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
   6. Seal all tears, punctures and other penetrations with pressure sensitive tape.

E. Rigid Glass Fiber Insulation Application:
   1. Secure insulation with weld pins or stick clips at 12 inches (350 mm) on center. Locate at maximum 3 inches (76 mm) from each edge and corner of board.
   2. Cover pins and clips with vapor sealing pressure sensitive patches or tape.
   3. Apply 5 inch (130 mm) wide vapor sealing pressure sensitive tape to all joints and seams.

F. Duct Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage and adhere adhesive at all exposed edges and transverse joints.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
   3. Seal and smooth joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.
3.4 DUCTWORK INSULATION SCHEDULE

A. Schedule of Ductwork In Concealed Spaces:

<table>
<thead>
<tr>
<th>DUCTWORK</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Air</td>
<td>Flexible Glass Fiber</td>
</tr>
<tr>
<td>Return Air</td>
<td>Flexible Glass Fiber</td>
</tr>
<tr>
<td>Outside Air</td>
<td>Flexible Glass Fiber</td>
</tr>
<tr>
<td>Plenums</td>
<td>Flexible Glass Fiber</td>
</tr>
</tbody>
</table>

B. Schedule of Ductwork In Exposed Unconditioned Spaces:

<table>
<thead>
<tr>
<th>DUCTWORK</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Air</td>
<td>Rigid Glass Fiber</td>
</tr>
<tr>
<td>Return Air</td>
<td>Rigid Glass Fiber</td>
</tr>
<tr>
<td>Outside Air</td>
<td>Rigid Glass Fiber</td>
</tr>
<tr>
<td>Plenums</td>
<td>Rigid Glass Fiber</td>
</tr>
</tbody>
</table>

C. Schedule of Miscellaneous Ductwork:

<table>
<thead>
<tr>
<th>DUCTWORK</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ductwork shown lined on Drawings</td>
<td>Glass Fiber Liner</td>
</tr>
<tr>
<td>Ductwork exposed to outdoors</td>
<td>Glass Fiber Liner</td>
</tr>
<tr>
<td>Exposed ductwork in conditioned spaces</td>
<td>Insulation not required</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications, apply to this Section.

B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.2 SUMMARY

A. Section Includes:

1. Hydronic heating panels.

1.3 CT HIGH PERFORMANCE BUILDING REQUIREMENTS

A. The mandatory and standard options and procedures for compliance, submittal requirements, and reporting forms are in the CT High Performance Building Requirements Summary in Division 01.

1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, specialties, and accessories for each product indicated.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work. Detail equipment assemblies and suspension and attachment.

2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Radiant Panel Finishes: 12 by 12 inches.
1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Suspended ceiling components.
   2. Structural members to which heaters and suspension systems will be attached.
   3. Size and location of initial access modules for acoustical tile.
   4. Items penetrating finished ceiling, including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
   5. Perimeter moldings.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric radiant heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 HYDRONIC HEATING PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   1. Aero Tech Mfg.
   2. AIRTEX Radiant Systems.
   3. Sterling

B. Description: Linear sheet-metal panel with serpentine water piping, suitable for lay-in installation flush with T-bar ceiling grid.

   1. Panels: Minimum 0.0396-inch-thick, aluminum sheet.
   2. Backing Insulation: Minimum 1-inch thick, mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB with factory-applied jacket.
   3. Exposed-Side Panel Finish: Baked-enamel finish in manufacturer's custom paint color as selected by Architect.
   5. Surface-Mounted Trim: Sheet metal with baked-enamel finish in manufacturer's custom paint color as selected by Architect.
   6. Accessories: Provide as required for a continuous appearance.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive radiant heating and cooling units for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for hydronic piping connections to verify actual locations before radiant heating and cooling unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install radiant heating and cooling units level and plumb.

B. Suspend radiant heaters from structure.

C. Coordinate layout and installation of radiant heaters and suspension-system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, communications system, security system, and partition assemblies.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 232113 "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.

B. Unless otherwise indicated, install shutoff valve and union or flange at each connection.

C. Install piping adjacent to unit to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and units.

B. Remove and replace malfunctioning units and retest as specified above.

C. After installing panels, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

D. Prepare test and inspection reports.
3.5  DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain radiant heaters and panels. See Division 01 for additional requirements.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.
B. Non-metal ductwork.
C. Duct cleaning.

1.2 RELATED SECTIONS

A. Section 078400 - Fire Stopping.
B. Division 9 - Finishes for Painting.
C. Section 151400 - Supports and Anchors: Sleeves.
D. Section 152900 - Duct Insulation.
E. Section 159100 - Ductwork Accessories.
F. Section 159400 - Air Inlets and Outlets.

1.3 REFERENCES

A. ASTM A36 - Structural Steel.
B. ASTM A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
E. ASTM A480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
F. ASTM A525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
G. ASTM A527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
H. ASTM A568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
I. ASTM A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

K. AWS D9.1 - Welding of Sheet Metal.

L. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

M. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

N. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.


P. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

Q. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 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.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Sheet Metal Shop Drawings: Provide drawings at minimum 1/4" = 1'-0" scale indicating duct fittings, gages, sizes, welds, and configuration prior to start of work.

C. Product Data: Provide data for manufactured ductwork and flexible ducts.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

E. Manufacturers installation instructions.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
1.8 QUALIFICATIONS

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

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

1.9 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

2.1 MATERIALS


B. Round Galvanized Steel Ducts and Fittings:
   1. Manufacturers:
      a) SEMCO Type SS (85).
      b) Other acceptable manufacturers offering equivalent products include:
         1. United McGill.
         2. Quickdraft.
   2. ASTM A527 galvanized steel sheet, spiral lock seam construction, with G60 zinc coating in conformance with ASTM A90.


D. Insulated Flexible Ducts:
   1. Manufacturers:
      a) Thermaflex Model M-KF.
      b) Other acceptable manufacturers offering equivalent products include:
         1. Technaflax.
         2. Tuttle and Bailey.
   2. UL 181, Class 1, CPE inner liner bonded to helically wound spring steel wire; fiberglass insulation; metalized polyester vapor barrier film; complying with NFPA 90A and NFPA 90B.
   3. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
   4. Maximum Velocity: 4000 fpm (20.3 m/sec).
   5. Thermal Conductance: 0.23 BTU/hr/s.f./deg F maximum.
   6. Insulation: 1 1/2” thick; 3/4 lb/density.
   7. Temperature Range: -20 degrees F to 250 degrees F (-28 degrees C to 121 degrees C).
E. Fasteners: Rivets, bolts, or sheet metal screws.

F. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

G. Hanger Rod: ASTM A36; steel; threaded both ends, threaded one end, or continuously threaded.

2.2 METAL DUCTWORK FABRICATION

A. Fabricate and support in accordance with standards scheduled at Part 3 - EXECUTION. Provide duct material, gages, reinforcing, and sealing for static pressures classifications listed in Part 3 - EXECUTION. Exposed duct in occupied spaces shall be minimum 16 ga. galvanized steel or equivalent aluminum construction.

B. 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 double bladed air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.3 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for static pressures classifications listed in Part 3 - EXECUTION.

PART 3 - EXECUTION

3.1 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. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Provide openings in ductwork where required to accommodate control devices. 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.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use double nuts and lock washers on threaded rod supports.

G. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct usable space or block access for servicing building and its equipment.

H. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.

I. Coordinate layout with suspended ceiling and lighting layouts and similar finish work.

J. Connect diffusers to low pressure ducts with 8 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

K. Connect return and exhaust grilles directly to ductwork. Flexible duct shall not be allowed.

L. Connect flexible ducts to metal ducts with draw bands plus adhesive.

M. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 CLEANING

A. Clean work under provisions of Division 1.

B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

C. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 SCHEDULES

A. Ductwork Material Schedule:

<table>
<thead>
<tr>
<th>Air System</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply air, Return air,</td>
<td>Galvanized Steel</td>
</tr>
<tr>
<td>General and Toilet exhaust</td>
<td></td>
</tr>
</tbody>
</table>

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B. Construction Standards Schedule:

<table>
<thead>
<tr>
<th>Air System</th>
<th>Construction Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply air, Return air,</td>
<td>SMACNA - HVAC Duct</td>
</tr>
<tr>
<td>Outside air, Exhaust air,</td>
<td>Construction Standards</td>
</tr>
<tr>
<td>Metal and Flexible.</td>
<td></td>
</tr>
</tbody>
</table>

Outside Air Intake: Galvanized Steel

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Backdraft dampers.
B. Duct access doors.
C. Combination fire and smoke dampers.
D. Counterbalanced dampers.
E. Duct test holes.
F. Fire dampers.
G. Volume control dampers.
H. Flexible duct connections.

1.2 RELATED SECTIONS

A. Section 152900 - Ductwork Insulation.
B. Section 158900 - Ductwork.

1.3 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.
F. UL 33 - Heat Responsive Links for Fire-Protection Service.
G. UL 555 - Fire Dampers and Ceiling Dampers.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.
B. Shop Drawings: Indicate dimensions, required clearances and construction details for dampers.
C. Product Data:
   1. For counterbalanced and backdraft dampers indicate pressure drop and minimum static pressure required to open.
   2. For combination fire and smoke dampers indicate fusible link rating, UL listing and electrical characteristics.
   3. For fire dampers indicate fusible link rating and UL listing.

D. Manufacturer's Installation Instructions.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Record actual locations of dampers, access doors and test holes.

1.6 QUALIFICATIONS

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

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1.

B. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 COUNTERBALANCED DAMPERS.

A. Manufacturers:
   1. Ruskin Model CBD4.
   2. Other acceptable manufacturers offering equivalent products include:
      a) Air Balance
      b) Greenheck

B. Counterbalance Weights: Adjustable from .01” to .05” WG.

C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Extruded aluminum frame minimum .07” thick with extruded aluminum blades of maximum 6 inch (150 mm) width, with extruded vinyl edge seals, linked together in rattle-free manner with 90 degree stop.

2.2 BACKDRAFT DAMPERS

A. Manufacturers:
2. Other acceptable manufacturers offering equivalent products include:
   a) Air Balance
   b) Greenheck

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Extruded aluminum frame minimum .125" thick with extruded aluminum blades minimum .07" thick with extruded vinyl edge seals. Blades shall be maximum 6 inch (150 mm) wide, linked together in rattle-free manner with 90 degree stop.

2.3 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ruskin.
   2. Air Balance.

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. For insulated ductwork, install minimum one inch (25 mm) thick insulation with sheet metal cover.
   1. Less Than 12 Inches (300 mm) Square: Secure with sash locks.
   2. Up to 18 Inches (450 mm) Square: Provide two hinges or continuous hinge and two sash locks.
   3. Up to 24 x 48 Inches (600 x 1200 mm): Three hinges or continuous hinge 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.

2.4 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Ruskin Model FSD60.
   2. Other acceptable manufacturers offering equivalent products include:
      a) Air Balance.
      b) Greenheck.
      c) Prefco.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
C. Provide factory sleeve, minimum 20 gage, and collar for each damper.

D. Multiple Blade Dampers: Fabricate with minimum 16 gage (1.5 mm) galvanized steel frame and airfoil-shaped blades, stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.

E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Locate damper operator on exterior of duct and link to damper operating shaft.

F. Damper shall have 1 1/2 hour fire rating.

G. Fusible link: Set to melt at 165 degrees F (74 degrees C).

2.6 FIRE DAMPERS

A. Manufacturers:
   1. Ruskin models noted below.
   2. Other acceptable manufacturers offering equivalent products include:
      a) Air Balance.
      b) Greenheck.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, minimum 22 gage (0.76 mm) frame and 22 gage (0.76 mm) insulated blades. Provide with adjustable air flow balancing device and thermal insulation blanket for diffusers. Damper shall be Ruskin Model CFD.

D. Curtain Type Dampers: Galvanized steel minimum 22 gage (0.76 mm) frame and interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Damper shall be Ruskin Model IBD.

E. Multiple Blade Dampers: 16 gage (1.5 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock. Damper shall be Ruskin Model FD31.

F. Fusible Links: UL 33, separate at 165 degrees F (74 degrees C).

G. Fire rating of dampers shall be 1 1/2 hour unless noted otherwise on the drawings.

2.7 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Ruskin models listed below.
   2. Other acceptable manufacturers offering equivalent products include:
      a) Air Balance.
      b) Greenheck.
B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Single Blade Dampers: For duct sizes up to 6 x 30 inch (150 x 760 mm) with minimum 20 gage frame and blade and nylon bearings. Dampers shall be Ruskin Model MD25 and MDR525.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 48 inch (200 x 1200 mm). Provide with minimum 16 gage frame and blades and molded synthetic bearings. Dampers shall be Ruskin Model MD35.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.8 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.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
   2. Net Fabric Width: Approximately 3 inches (75 mm) wide.
   3. Metal: 3 inch (75 mm) wide, 24 gage (0.6 mm thick) galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions, NFPA 90A, and SMACNA publications and guidelines. Refer to Section 15890 for duct construction and pressure class.

B. Provide backdraft dampers on all exhaust fans where damper is not provided as an accessory to the fan and where shown on the drawings.

C. Provide duct access doors for inspection and cleaning before and after manual dampers, control dampers, fire dampers and where shown on the drawings. Minimum door size shall be 12 x 12 inches (250 x 300 mm) except where limited by duct size.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers and combination fire and smoke dampers at locations indicated, and where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install combination fire and smoke dampers in accordance with NFPA 92A.

G. Demonstrate re-setting of fire dampers to Owner's representative.

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H. Provide balancing dampers at points on supply, return, outside air and exhaust systems where branches are taken from larger ducts as required for air balancing and where shown on the drawings. Install minimum 2 duct widths from duct take-off.

I. Provide 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.

J. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment and supported by vibration isolators. Refer to Section 15246.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers.
B. Registers.
C. Grilles.

1.2 RELATED SECTIONS

A. Division 9 - Finishes for Painting.
B. Section 158900 - Ductwork.
C. Section 159100 - Ductwork Accessories.

1.3 REFERENCES

B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.
C. ARI 650 - Air 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.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.
B. 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. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
C. Samples: Submit two of each required air outlet and inlet type.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.
B. Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE
A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

1.7 QUALIFICATIONS

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

PART 2 - PRODUCTS

2.1 GENERAL

A. For all diffusers, grilles and registers, Noise Criteria (NC) shall not exceed 30 unless noted otherwise on drawings. NC rating shall be for diffuser/neck assembly.

B. For schedule of sizes, airflows, etc. refer to schedule on the drawings.

C. NOTE: All supply and return registers to be provided by the agency (CCSU) and installed by G.C.

2.2 SQUARE CEILING DIFFUSERS

A. Manufacturers:
   1. Titus Model TMSA.
   2. Other acceptable manufacturers offering equivalent products:
      a) Metal Aire.
      b) Carnes Co.

B. Type: Square, adjustable pattern, stamped, multi-core, multi-louvered diffuser to discharge air in 360 degree pattern with removable inner core and round neck.

C. Frame: Compatible with ceiling to be mounted in.

D. Fabrication: Steel with baked enamel off-white finish.

E. Accessories: Model AG-75 opposed blade damper for round neck with damper adjustable from diffuser face without removing inner core.

2.3 SUPPLY REGISTERS

A. Manufacturers:
   1. Titus Model 272RS.
   2. Other acceptable manufacturers offering equivalent products:
      a) Metal Aire.
      b) Carnes Co.

B. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) deep, 3/4 inch (19 mm) maximum spacing with friction pivots at both ends to set blades, vertical face, double deflection.

C. Frame: Compatible with ceiling to be mounted in.
D. Fabrication: 20 gage (0.90 mm) minimum steel frames and aluminum extruded airfoil type blades with factory off-white enamel finish.

E. Damper: Model AG-35-AA aluminum, integral, gang-operated opposed blade type with removable key operator, operable from face.

2.4 EXHAUST AND RETURN REGISTERS

A. Manufacturers:
   1. Titus Model 23RL.
   2. Other acceptable manufacturers offering equivalent products:
      a) Metal Aire.
      b) Carnes Co.

B. Type: Streamlined fixes blades parallel to the long dimension, 3/4 inch spacing (19 mm), 3/4 inch deep.

C. Frame: Compatible with ceiling to be mounted in. Fasteners shall be Type C concealed screw type.

D. Fabrication: 20 gauge (0.90 mm) steel frame with aluminum extruded airfoil type blades. Finish shall be factory off-white enamel.

E. Damper: Model AG-35 steel, integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.5 EXHAUST, TRANSFER AND RETURN GRILLES

A. Manufacturers:
   1. Titus Model 50F.
   2. Other acceptable manufacturers offering equivalent products:
      a) Metal Aire.
      b) Carnes Co.

B. Type: Fixed 1/2 x 1/2 x 1/2 inch (13 x 13 x 13 mm) aluminum core.

C. Frame: Compatible with ceiling to be mounted in.

D. Fabrication: Aluminum with factory off-white enamel finish.

E. Damper: Model AG-35-AA aluminum, integral, gang-operated, opposed blade type with removable key operator, operable from face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to each air inlet or outlet, despite whether dampers are specified as part of the air inlet or outlet assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 9 - Finishes for Painting.

END OF SECTION
PART 1  GENERAL

1.1  RELATED DOCUMENTS

   A. Drawings and general provisions of Contract, including General and Supplementary
      Conditions and Division 1 Specification Sections, apply to this and the other sections of
      Division 16.

1.2  SUMMARY

   A. This Section includes general administrative, procedural, and other requirements for electrical
      installations. The following requirements are included in this Section to expand the
      requirements specified in Divisions 1 through 16:

      1. Submittals.
      2. Quality control.
      3. Definitions and abbreviations.
      4. Scheduling.
      5. Coordination drawings.
      6. Record documents.
      7. Maintenance manuals.
      8. Delivery, storage, and handling.
     10. Rough-ins.
     11. Electrical installations.
     12. Permits and instructions.
     13. Field quality control.
     14. Protection.
     15. Additional work.
     16. Electrical schedules.
     17. Cutting and patching.

1.3  SUBMITTALS

   A. General: Follow the procedures specified in Division 1.

   B. Increase, by the quantity listed below, the number of electrical related shop drawings, product
      data, and samples submitted, to allow for required distribution plus two copies of each
      submittal required, which will be retained by the Electrical Consulting Engineer.

      1. Shop Drawings - Initial Submittal: 1 black-line prints.
      2. Shop Drawings - Final Submittal: 1 black-line prints.
      3. Product Data: 1 additional copy of each item.
      4. Samples: 1 additional as set.

   C. Additional copies may be required by individual sections of these Specifications.

1.4  QUALITY CONTROL
A. Functional and Operational Test Procedure:

1. Test procedure to completely test all systems as to their functional and sequential operation.
2. Submit two (2) draft copies for review before conducting test.
3. Certify that the test procedure was used and testing completed, and that all systems are operational and functioning properly.
4. Submit certified Test Procedure for review prior to the date of final inspection.
5. Systems to be covered by test procedure:
   a. Power distribution
   b. Lighting systems including general lighting
   c. Fire Alarm systems
   d. Equipment shut-down requirements
   e. Emergency power/inverter systems
   f. Grounding systems

B. Other Tests and Certifications for:

1. Grounding System: As specified under Section 16452.

1.5 DEFINITIONS AND ABBREVIATIONS

A. Electrical Definitions: As defined by NEC, Article 100.

B. The term "indicated" shall mean "as shown on contract documents (specifications, drawings, and related attachments)".

C. The term "provide" shall mean "to furnish, install and connect completely".

D. The term "size" shall mean one or more of the following: "length, current and voltage rating, number of poles, NEMA size, and other similar electrical characteristics".

E. The term "space" on panelboard and switchboard schedules shall mean "provide space to install the number of poles and size of the protective device indicated with all the necessary buss and fittings to install the device at some future date".

1.6 SCHEDULING

A. Coordinate electrical work with other divisions of this project.

B. Coordinate electrical work with Project Coordinator.

C. Written requests for approval for planned shutdowns or interruption of Owner's operation or equipment shall be made 72 hours prior to the start of the requested periods.

D. Written notification for on site training of Owner's personnel shall be made 1 week prior to the start of the requested training period.
1.7 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:
   a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
   b. Fire-rated wall and floor penetrations.
   c. Equipment connections and support details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, raceway systems components, and other ceiling-mounted devices.

1.8 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.

2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.9 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine
and normal operating instructions; regulation, control, stopping, shutdown, and
emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting;
disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades,
compliance labels, and other information needed for identification.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Unless otherwise indicated, all electrical equipment has been based on Square D products.

B. As specified under other RELATED SECTIONS. Comparable manufacturers may be utilized,
and include the following:

1. Siemens
2. Square D (Design Based)
3. GTE Sylvania
4. General Electric

C. As specified on Drawings.

2.2 MATERIAL

A. General:

1. Unless otherwise indicated, all raceways for service, feeders, branch and control
wiring are RSC or IMC. See Section 16110.
2. Unless otherwise indicated, wiring to equipment and motors may be installed in liquid
tight flexible conduit, or in interior locations in flexible metal conduit, with a maximum
length of 5 feet.
3. Unless otherwise indicated, all conductors to be copper THHN/THWN.
4. Unless otherwise indicated, all outlet and switch boxes to be cast iron with threaded
hubs.
5. In interior protected locations, where recessed in ceiling and walls, outlet and switch
boxes may be stamped steel.
6. Unless otherwise indicated, provide ivory, heavy duty grade, 20 ampere, receptacles
and switches. Plates shall be 302 stainless steel, satin finish. Plates for surface
mounted interior boxes may be stamped steel. Plates exposed to weather or water to be
metal, weatherproof type.
B. As specified under RELATED SECTIONS.
C. As specified on Drawings.

2.3 EQUIPMENT

A. General:

1. Unless otherwise indicated, externally operated safety switches are unfused, solid neutral, heavy duty, and selected to meet the load requirements.

B. As specified under RELATED SECTIONS.
C. As specified on Drawings.

2.4 FABRICATION

A. General:

1. Unless otherwise indicated, all enclosures are NEMA Type 1. NEMA Type 3R shall be used for wet/damp locations.

B. As specified under RELATED SECTIONS.
C. As specified on Drawings.

PART 3 EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

C. Contractor is to provide connections, both power and control as noted.

3.2 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components. Electrical plans and details do not show all interferences and conditions, visible and/or hidden, that may exist. Before selecting material and equipment, and proceeding with work, inspect areas where material and equipment are to be installed to insure suitability, and check needed space for placements, clearances and
interconnections. Before cutting or drilling into building elements inspect and layout work to avoid damaging structural elements or building utilities.

2. Electrical plans, details, and diagrams show the general location and arrangement of electrical systems. They are diagrammatic and do not show all conduit bodies, connectors, bends, fittings, hangers, and additional pull and junction boxes which the Contractor must provide to complete the electrical system.

3. Verify all dimensions by field measurements.

4. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.

5. Coordinate the installation of required supporting devices and sleeves.

6. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Verify dimensional constraints of building door openings and passageways, and the maximum floor loadings, for the movement of selected material and equipment. Order equipment and material, broken down as may be required, to meet these constraints.

7. Measurement from above finished floor (AFF) shall be taken from the finished floor surface to the top of wall receptacles and switch boxes, to the centerline of wall lighting outlet boxes, to the centerline of top most switch handle, or to the lowest surface of ceiling lighting fixtures and other ceiling mounted equipment.
   a. Unless otherwise indicated, wall switch boxes shall be 42 inches AFF.
   b. Unless otherwise indicated, receptacle boxes shall be 18 inches AFF. Receptacle mounted above counter and at furniture locations shall be coordinated with architectural elements. Coordinate with Project Coordinator.
   c. Surface raceway heights shall be coordinated with Architectural requirements.

8. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible. Switch and receptacle heights shall meet handicap accessible code requirements.

9. Coordinate connection of electrical systems with incoming utilities and services. Comply with requirements of governing regulations, power, telephone, and data service companies, and controlling agencies. Provide required connection for each service. Provide power connection to equipment. Coordinate with other Divisions.

10. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Project Coordinator.

11. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

12. Conduit Sizing:
   a. Unless otherwise indicated, conduit size for indicated conductor shall be based on Chapter 9 of NEC.
   b. Conduit: 3/4 inch minimum size.

13. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Measure
and locate placement of equipment and materials in relation to building structure and surfaces, and between equipment to be installed and wired. Maintain required minimum access spacing for equipment and enclosures.

14. Install access panel or doors where units are concealed behind finished surfaces.
   Access panels and doors are specified elsewhere.

15. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 PERMITS AND INSPECTIONS

A. Obtain and pay for all required permits and arrange for all required inspections in accordance with state and local governing authorities.

B. Final Electrical Inspection Certificate from inspection agency or governing authority.

3.4 FIELD QUALITY CONTROL

A. Perform field tests as specified under other electrical sections.

B. Arrange for local Inspection Authorities to inspect work performed prior to burial, closing-in behind wall and above ceiling, or encased in concrete. Also arrange for final inspection of work and obtain Final Inspection Certificate before final inspection of work by Owner or his representative.

3.5 PROTECTION

A. Protect personnel from coming in contact with live parts.

B. During remodeling or alteration work, maintain fire ratings of walls, floors and ceilings when work is left unattended.

C. Protect from damage and theft equipment and materials provided or supplied by others in accordance with manufacturer's recommendation and warranties, and with electrical standards and practices.

3.6 ADDITIONAL WORK

A. Provide temporary electric service power outlets and lighting during construction.

B. Provide/maintain fire alarm system and interconnections to existing building fire alarm system.

C. Demolish existing electrical systems as required and in accordance with specifications.

D. Provide connections for power and controls to mechanical equipment being supplied under other divisions.
E. Provide power connections to miscellaneous equipment, ancillary systems, etc. Including but not limited to camera surveillance, security, door entry systems and related devices.

F. Provide emergency and egress lighting units.

3.7 ELECTRICAL SCHEDULES

A. As specified in related sections or shown on drawings.

3.8 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1. In addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
   
   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of the Contract Documents.
   d. Remove samples of installed Work as specified for testing.
   e. Install equipment and materials in existing structures.
   f. Upon written instructions from the Project Coordinator uncover and restore Work to provide for Project Coordinator observation of concealed Work.

2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.

3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

7. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 16010
PART 1 - GENERAL

1.1 RELATED DOCUMENTS:
   A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:
   A. Demolish designated and required elements of existing electrical system.
   B. Removal materials from site.
   C. Rework of existing electrical system for interface to new systems and equipment.
   D. This scope of work noted is in addition to the requirements of Division 2.

1.3 EXISTING CONDITIONS:
   A. Conduct electrical demolition to avoid existing system damage scheduled to remain. Interface with adjoining building elements.
   B. The scope of electrical demolition shall include but not limited to the following:
      - Power System
      - Emergency and Egress Lighting
      - Fire alarm system
   C. Conduct operations with minimum interference to existing systems serving other parts of the building.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.1 PREPARATION:
   A. Protect existing systems and components which are not to be demolished.
   B. Protect existing items which are not indicated to the altered.
   C. Provide and locate dumpster where directed by Owner.
   D. Coordinate work with Divisions 2, 15 and 16.
   E. Construct enclosed chutes from work areas to dumpsters. Use chutes to convey all debris.

3.2 EXECUTION
A. Demolish in an orderly and careful manner.

B. Except where noted otherwise, immediately remove demolished materials from site.

C. Cease operations and notify Project Coordinator immediately if adjacent systems appear to be endangered. Do not resume operations until corrective measures have been taken.

D. Remove designated electrical systems and equipment as noted above and in accordance with the Contract Documents, and Electrical Drawings.

E. Where penetrations through walls are to be closed and patched, both sides of wall shall be closed and patched

F. Removed demolished materials from site as work progresses. Leave site in clean condition.

G. Remove dumpster and clean and repair site to original condition.

END OF SECTION 160600
PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of other specified Division 16 Sections apply to this section.

1.2 SUMMARY

A. This Section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.

1.3 SUBMITTALS

A. Product Data for electrical wires, cables and connectors.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following code:

B. NFPA 70 "National Electrical Code."

   1. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.

C. UL Compliance: Provide components which are listed and labeled by UL under the following standards.

   1. UL Std. 83 Thermoplastic-Insulated Wires and Cables.
   2. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   3. UL Std. 1569 Metal Clad Cable.

D. NEMA/ICEA Compliance: Provide components which comply with the following standards:

   1. WC-5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

E. IEEE Compliance: Provide components which comply with the following standard.

   1. Std. 82 Test procedures for Impulse Voltage Tests on Insulated Conductors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
1. Wire and Cable:
   a. American Insulated Wire Corp.
   b. Brintec Corp.
   c. Carol Cable Co. Inc.
   d. Senator Wire and Cable Co.
   e. Southwire Company.

2. Connectors for Wires and Cable Conductors:
   a. AMP
   b. 3M Company
   c. O-Z/Gedney Co.
   d. Square D Company.

2.2 WIRES AND CABLES

A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.

B. Conductors: Provide stranded conductors for power and lighting circuits no. 10 AWG and smaller. Provide stranded conductors for sizes no. 8 AWG and larger.

C. Conductor Material: Copper for all wires and cables.

D. Conductor sizes indicated are based on copper.

E. Insulation: Provide THHN/THWN insulation for all conductors size 500MCM and larger, and no. 8 AWG and smaller. For all other sizes provide, THHN/THWN or XHHW insulation as appropriate for the locations where installed.

F. Color Coding for phase identification in accordance with Table 1 in Part 3 below.

G. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.

H. Cables: Provide the following type(s) of cables in NEC approved locations and applications where indicated. Provide cable UL listed for particular application:

   1. Metal-Clad Cable: Type MC - limited to lighting fixtures and outlets concealed in gypsum wall partitions.

   2. Metal clad above ceilings to be limited to maximum five (5) feet whips.

2.3 CONNECTORS FOR CONDUCTORS

A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with
temperature ratings equal to or greater than those of the wires upon which used.

PART 3 EXECUTION

3.1 WIRING METHOD

A. Use the following wiring methods as indicated:

1. Wire: install all wire in raceway.
2. Metal Clad Cable, Type MC: where wiring concealed in gypsum wall partitions, ceilings, for connections from raceway outlet boxes to lighting fixtures, unless otherwise noted.

3.2 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wires, and connectors in compliance with NEC.

B. Coordinate cable installation with other Work.

C. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

D. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

E. Conceal all cable in finished spaces.

F. Keep conductor splices to minimum.

G. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.

H. Use splice and tap connectors which are compatible with conductor material.

I. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than no 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.
B. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.

C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

D. TABLE 1: Color Coding for Phase Identification:

1. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

<table>
<thead>
<tr>
<th>208Y/120Volts</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>A</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
</tr>
<tr>
<td>Blue</td>
<td>C</td>
</tr>
<tr>
<td>White</td>
<td>Neutral</td>
</tr>
<tr>
<td>Green</td>
<td>Ground</td>
</tr>
</tbody>
</table>

END OF SECTION 16120
PART 1  GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements specified in other Division 16 Sections apply to this section.

1.2 SUMMARY

A. This section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:

1. Outlet and device boxes.
2. Pull and junction boxes.
3. Cabinets.
4. Hinged door enclosures.

B. Conduit-body-type electrical enclosures and wiring fittings are specified in Division 16 Section "Raceways."

1.3 DEFINITIONS

A. Cabinets: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.

B. Device Box: An outlet box designed to house a receptacle device or a wiring box designed to house a switch.

C. Enclosure: A box, case, cabinet, or housing for electrical wiring or components.

D. Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.

E. Wiring Box: An enclosure designed to provide access to wiring systems or for the mounting of indicating devices or of switches for controlling electrical circuits.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Product data for cabinets and enclosures with classification higher than NEMA 1.
2. Shop drawings for boxes, enclosures and cabinets that are to be shop fabricated, (nonstock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.
1.5 QUALITY ASSURANCE

A. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.

B. Nationally Recognized Testing Laboratory Listing and Labeling (NRTL): Items provided under this section shall be listed and labeled by a NRTL. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

C. National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."

D. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

   1. Cabinets:
      a. Electric Panelboard, Inc.
      b. Erickson Electrical Equipment Co.
      e. Spring City Electrical Mfg. Co.
      f. Square D Co.

2.2 CABINETS, BOXES, AND FITTINGS, GENERAL

A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations. This applies to kitchen areas.

2.3 MATERIALS AND FINISHES

A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.

B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

D. Cast Metal for Boxes, Enclosures, and Covers: Copper-free aluminum except as otherwise specified.
E. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.

F. Painted Interior Finish: Where indicated, white baked enamel.

G. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connecters.

2.4 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.

B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

C. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

2.5 PULL OR JUNCTION BOXES

A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

C. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.

D. Stainless-Steel Boxes: Fabricate of stainless steel conforming to Type 302 of ASTM A 167, "Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip." Where necessary to provide a rigid assembly, construct with internal structural stainless steel bracing. Cover shall be gasketed.

E. Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.

2.6 CABINETS

A. Comply with UL 50, "Electrical Cabinets and Boxes."

B. Construction: Sheet steel, NEMA 4 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame.
and frame. Provide concealed fasteners, not over 24-inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24-inches apart and not over 6-inches from top and bottom of door. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets make front same height and width as box.

C. Doors: Double doors for cabinets wider than 24-inches.

D. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power, and lighting cabinets located within wire closets and mechanical-electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.

2.7 STEEL ENCLOSURES WITH HINGED DOORS

A. Comply with UL 50, "Cabinets and Enclosures" and NEMA ICS 6,

B. "Enclosures for Industrial Controls and Systems."

C. Construction: Sheet steel, 16 gage, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting.

D. Doors: Hinged directly to cabinet and removable, with approximately 3/4-inch flange around all edges, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24-inches. Provide multiple doors where required.

E. Mounting Panel: Provide painted removable internal mounting panel for component installation.

F. Enclosure: NEMA 4 except as indicated. Where door gasketing is required, provide neoprene gasket attached with oil-resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.

B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

C. Support and fasten items securely in accordance with Division 16 Section "Supporting Devices."

D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
E. Remove sharp edges where they may come in contact with wiring or personnel.

3.2 APPLICATIONS

A. Cabinets: Flush mounted, NEMA enclosure Type 1 except as otherwise indicated.

B. Hinged Door Enclosures: NEMA Type 1 enclosure except as indicated.

C. Hinged Door Enclosures Outdoors: Install drip hood, factory tailored to individual units.

D. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:

   1. Interior Dry Locations: NEMA Type 1, sheet steel or as permitted by local code.
   2. Locations Exposed to Weather, Dampness, or Wet Locations: NEMA Type 3R enclosures.

E. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

3.3 INSTALLATION OF OUTLET BOXES

A. Outlets at Windows and Doors: Locate close to window trim.

B. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.

C. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.

D. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:

   1. Exterior locations.
   2. Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).
   3. Where exposed to moisture laden atmosphere.
   4. Where indicated.

E. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

F. Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles either vertically or horizontally but consistently either way. Three or more
gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.

G. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4-inches square by 1-1/2-inches deep, minimum.

H. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.

I. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

3.4 INSTALLATION OF PULL OR JUNCTION BOXES

A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8-inches square by 4-inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed the following:

<table>
<thead>
<tr>
<th>Size of Largest Conductors in Box</th>
<th>Maximum no. of Conductors in Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4/0 AWG</td>
<td>30</td>
</tr>
<tr>
<td>250 MCM</td>
<td>20</td>
</tr>
<tr>
<td>500 MCM</td>
<td>15</td>
</tr>
<tr>
<td>Over 500 MCM</td>
<td>10</td>
</tr>
</tbody>
</table>

1. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30-inches inside boxes.

2. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

3. Size: Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

3.5 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

A. Mount with fronts straight and plumb.

B. Install with tops 78-inches above floor.

C. Set cabinets in finished spaces flush with walls.

3.6 GROUNDING
A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

3.7 CLEANING AND FINISH REPAIR

A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.

B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the tray manufacturer.

C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION 161350
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles
2. Ground Fault Circuit Interrupter Receptacles
3. Snap Switches
4. Wall Plates

1.2 SUBMITTALS

A. Product data for each type of product specified.

B. Samples of those products indicated for sample submission in Engineer's comments on product data submittal. Include color and finish samples of device plates and other items per Engineer's request.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following codes.

B. NFPA 70 "National Electrical Code".

1. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.

1.4 SEQUENCE AND SCHEDULING

A. Schedule installation of finish plates after the surface upon which they are installed has received final finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Bryant Electric Co.
2. Crouse-Hinds Co.
4. Hubbell Inc.
5. Leviton
6. Pass and Seymour Inc.

2.2 WIRING DEVICES:
A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide ivory color devices and wall plates. Verify color selections with Owner/Owner’s Representative.

B. Receptacles: As scheduled in Table 1 in Part 3 below. Comply with UL 498 and NEMA WD 1.

C. Ground-Fault Interrupter (GFI) Receptacles: As indicated in Table 1 in Part 3 below; provide “feed-thru” type ground-fault circuit interrupter, with integral heavy-duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 2-3/4 inch deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 94.3.

D. Snap Switches: quiet type AC switches as indicated in Table 2 in Part 3 below. Comply with UL 20 and NEMA WD1.

2.3 WIRING DEVICE ACCESSORIES

A. Wall plates: single and combination, of types, sizes, and with ganging and cutouts as required. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plates with engraved legend where required. Provide plates possessing the following additional construction features:

1. Material and Finish: 0.04 inch thick, type 302 satin finished.
2. Material and Finish: steel plate, galvanized, limited to mechanical rooms only.

PART 3 EXECUTION

3.1 INSTALLATION OF WIRING DEVICES AND ACCESSORIES

A. Install wiring devices and accessories, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.

C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.

D. Install wiring devices after wiring work is completed.

E. Install wall plates after painting work is completed.

F. Install telephone/power service connections in accordance with final furnishings arrangement plan, plumb, true, and secure.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment
manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

3.2 PROTECTION

A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.3 FIELD QUALITY CONTROL

A. Testing: Prior to energizing circuits, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.

B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

C. TABLE 1

RECEPTACLES

<table>
<thead>
<tr>
<th>DESIGNATION</th>
<th>CURRENT RATING AMPS</th>
<th>VOLTAGE RATING</th>
<th>NEMA SINGLE/DUPLEX</th>
<th>CONFIGURATION</th>
<th>UL GRADE</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>-</td>
<td>20</td>
<td>125</td>
<td>DUPLEX</td>
<td>5-20R</td>
<td>HEAVY DUTY</td>
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<tr>
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<td>20</td>
<td>125</td>
<td>DUPLEX</td>
<td>5-20R</td>
<td>HEAVY DUTY</td>
<td>INTEGRAL GFCI</td>
</tr>
<tr>
<td>WP GFCI</td>
<td>20</td>
<td>125</td>
<td>DUPLEX</td>
<td>5-20R</td>
<td>HEAVY DUTY</td>
<td>INTEGRAL GFCI</td>
</tr>
</tbody>
</table>

NOTES

(1) Letter designations are used where symbols alone do not clearly designate on plans locations where specific receptacle types are used.

D. TABLE 2

SNAP SWITCHES

<table>
<thead>
<tr>
<th>DESIGNATION</th>
<th>TYPICAL APPLICATION RATING (AC) POLES UL GRADE</th>
<th>VOLTAGE RATING</th>
</tr>
</thead>
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<td>(1)</td>
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</table>

COUNSELING RENOVATIONS
CCSU PROJECT No.: 05-101
JANUARY 29, 2021
<table>
<thead>
<tr>
<th></th>
<th>CONTROL LIGHTS</th>
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<th></th>
<th>HEAVY DUTY</th>
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<td>S</td>
<td>20A</td>
<td>120/277</td>
<td>1</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>S3</td>
<td>20A</td>
<td>120/277 3-way</td>
<td>1</td>
<td>HEAVY DUTY</td>
<td>-</td>
</tr>
<tr>
<td>S</td>
<td>1HP</td>
<td>120/277</td>
<td>1</td>
<td>HEAVY DUTY</td>
<td>(2)</td>
</tr>
<tr>
<td>STOL</td>
<td>DISCONN. MOTOR</td>
<td>2HP</td>
<td>208/480</td>
<td>HEAVY DUTY</td>
<td>(2)</td>
</tr>
</tbody>
</table>

NOTES

(1) For snap switches, designation is the same as the symbol used on plans for the device. Type of switch is determined from plan context including type of device or circuit being controlled.

(2) With overload element in switch.

END OF SECTION 161430
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications, apply to this Section.

B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.2 SUMMARY

A. Section Includes:

1. Indoor occupancy and vacancy sensors.
2. Digital occupancy/vacancy sensors.
3. Digital daylighting sensors.
4. Switchbox-mounted occupancy sensors.
5. Emergency shunt relays.

1.3 (NOT USED)

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:
   a. Occupancy sensors.
   b. Vacancy sensors.
   c. Daylight sensors.
   d. Emergency shunt relays.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.
1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which equipment will be attached.
3. Items penetrating finished ceiling, including the following:
   a. Luminaires.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
   f. Control modules.
   g. Occupancy/Vacancy sensors.
   h. Daylight sensors.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Faulty operation of lighting control software.
   b. Faulty operation of lighting control devices.

2. Warranty Period: Eight (8) years from date of Substantial Completion of the Work.

PART 2 - PRODUCTS

2.1 (NOT USED)
2.2 INDOOR DIGITAL OCCUPANCY AND VACANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Acuity Brands Lighting Inc. “nLight” or comparable product by one of the following:

1. “Digital Lighting Management (DLM)” by Wattstopper
2. “NX” by Hubbell Control Solutions
3. “Greenlight” by Crestron

B. Digital Wall or Ceiling Occupancy/Vacancy Sensors: General requirements for sensors:

1. Wall or ceiling mounted, indoor digital passive infrared (PIR), ultrasonic or dual technology (passive infrared and ultrasonic) occupancy and vacancy sensors with separate auxiliary low voltage relay and extra sets of contacts closures in wall-mounted or ceiling mounted occupancy sensor that need to be connected to BMS system for activation of HVAC system.
2. Hardwired secondary connection to BMS and lighting control system.
3. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.

6. Bypass Switch: Override the "on" function in case of sensor failure.

7. Operation:
   a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1-30 minutes.
   b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1-30 minutes.

8. Digital calibration and pushbutton programming for the following variables:
   a. Sensitivity: 0-100% in 10% increments.
   b. Time Delay: 1-30 minutes in 1 minute increments.
   c. Test Mode: Under one minute delay.
   d. Detection Technology: PIR, ultrasonic or dual technology activation and/or re-activation.
   e. Walk-through test mode.
   f. All sensor parameters are to be able to be configurable locally and remotely from the lighting control network software.
   g. One or two input point(s) for connection to local network.
   h. Device Status LEDs including:
      1) PIR detection.
      2) Ultrasonic detection.
      3) Configuration mode.
      4) Load binding.
      5) Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
      6) Manual override of controlled loads.

9. Multiple occupancy sensors may be installed in a room by simply connecting them to the local network. No configuration or reprogramming will be required when for failed devices.

10. Wall or ceiling sensor devices to be provided in a color selected by the architect with matching color face plates.

2.3 DIGITAL DAYLIGHT SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Acuity Brands Lighting Inc. "nLight" or comparable product by one of the following:

1. "Digital Lighting Management (DLM)" by Wattstopper
2. "NX" by Hubbell Control Solutions
3. "Greenlight" by Crestron
B. Greenlight Crestron

C. General Requirements for sensors:
   1. Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed through 0-10V.
   2. Lighting control set point is based on two lighting conditions:
      a. When no daylight is present (target level).
      b. When significant daylight is present.
   3. Daylight sensors shall be interchangeable without the need for rewiring.

D. Digital calibration and pushbutton programming for the following variables:
   4. An internal photodiode that measures only within the visible spectrum, and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Sensor light level range shall be from 0-200 footcandles (fc).
   5. Programmable wall switch override (where shown) to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.
   6. Colored configuration LED that blinks to indicate data transmission.
   7. Colored status LED indicates test mode, override mode and load binding.
   8. An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.
   9. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
   10. Automatically establishes setpoints following self-calibration.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Acuity Brands Lighting Inc. or comparable product by one of the following:
   1. Watt Stopper.
   2. Hubbell Building Automation, Inc.
   3. Philips Lighting Controls.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
   2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
   4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V, 1200-VA ballast or LED load at 277 V, and 800-W incandescent.
   5. Include ground wire.
C. Wall-Switch Sensor (Use for Appropriate Proper Coverage):

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
2. Sensing Technology: PIR passive infrared.
3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 2 to 200 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
11. Faceplate: Color matched to switch.

2.5 EMERGENCY SHUNT RELAY

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Lighting Control and Design.
2. Watt Stopper.
4. LVS, Inc.

B. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: 120 or 277 V.
2. Contact Rating: 20-ampere.
3. Mounting: Mount on a 4" x 4" x 2-1/8" 2-gang outlet box, located above nearest accessible ceiling.
4. Barrier: Steel to isolate normal and emergency circuits.
5. Rated Number of Operations: 40,000 at 20 amperes.

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

D. Install unshielded, twisted-pair cable for control and signal transmission conductors.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment and devices, smoke detectors, fire-suppression systems, partition assemblies, and architectural features.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 APPLICATION OF OCCUPANCY / VACANCY SENSORS

A. Provide wall mounted passive infrared wall switch occupancy (vacancy) sensor with single override switch within janitor closet, small closets, single stall small toilet, small storage room etc. and wherever indicated on electrical plans. Wall mounted passive infrared wall switch occupancy (vacancy) sensor shall be manufactured by Acuity Brands Lighting Inc. "Sensor Switch" WSX-SA series.

3.4 APPLICATION OF DIGITAL OCCUPANCY/VACANCY SENSORS

A. Install ceiling mounted digital dual technology type occupancy sensors within classroom, labs, collaborative space, lab tech, group study rooms, faculty rooms, science lab, IT-Walk-in room, Barnard room, IT's office, Banner room, Academic adviser office, Community room, computer lab, multi-people office, seminar rooms, admin. room, conference room, private office, work room, meeting room, with drop ceiling 12 FT AFF or less: Provide Acuity Brands Lighting Inc. "nLight" nCM PDT 10 series.

B. Install pendant ceiling mounted dual technology type occupancy sensors within storage rooms, computer repair room not exceeding 1,000 sq. ft. with no ceilings: Acuity Brands Lighting Inc. "nLight" nCM PDT 10 series. Contractor to provide stem as required. Occupancy sensor shall be mounted at same height as lighting fixtures within room. Coordinate exact mounting height with architect

C. Install corner wall -mounted digital dual-technology type occupancy sensors where ceiling mounted occupancy sensor application is not feasible: Provide Acuity Brands Lighting Inc. "nLight" #nWV PDT16 series.
3.5 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.6 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch.

C. Wiring within Enclosures: Comply with NECA 1. Bundle, lace and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.7 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.
3.9 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner’s operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner’s operations.

3.10 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. As a minimum and in addition to the requirements of other sections, provide two 4-hour days of owner training sessions in addition to multiple start-up visits to properly support the contractor.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes circuit and motor disconnects.

1.2 SUBMITTALS

A. Product data for each type of product specified.

B. Maintenance data for circuit and motor disconnects, for inclusion in Operation and Maintenance Manual specified in Division 1 and Division 16 Section "Basic Electrical Requirements."

1.3 QUALITY ASSURANCE

A. Electrical Component Standards: Provide components complying with NFPA 70 "National Electrical Code" and which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Appleton
2. Crouse-Hinds Co.
3. Cutler-Hammer Inc.
5. Siemens

2.2 CIRCUIT AND MOTOR DISCONNECT SWITCHES

A. General: Provide circuit and motor disconnect switches in types, sizes, duties, features ratings, and enclosures required by NEC for load served. Provide NEMA 1 enclosure in interior locations except in wet/damp locations provide NEMA 3R. Provide NEMA 3R enclosures with raintight hubs in exterior locations. For motor and motor starter disconnects, provide units with horsepower ratings and starters suitable to the loads.

B. Fusible Switches: heavy duty switches, with fuses of classes and current ratings required by NEC for load served. Where current limiting fuses are required, provide switches with non-interchangeable feature suitable only for current limiting type fuses.
C. Non-fusible Disconnects: heavy duty switches of classes and current ratings as required by NEC for load served.

D. Double-Throw Switches: heavy duty switches of classes and current ratings as required by NEC for load served

PART 3 - EXECUTION

3.1 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECTS

A. General: Provide circuit and motor disconnect switches where required by code. Comply with switch manufacturers' printed installation instructions.

3.2 FIELD QUALITY CONTROL

A. Testing: Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION 161700
PART 1  GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements specified in other Division 16 Sections apply to this section.

1.2 SUMMARY

A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

1. Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.

C. Shop drawings indicating details of fabricated products and materials.

D. Engineered Design consisting of details and engineering analysis for supports for the following items:

1. Fastener supporting systems.

1.4 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

B. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2  PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Slotted Metal Angle and U-Channel Systems:
a. Allied Tube & Conduit  
b. American Electric  
c. B-Line Systems, Inc.  
d. Cinch Clamp Co., Inc.  
e. GS Metals Corp.  
f. Haydon Corp.  
g. Kin-Line, Inc.  
h. Unistrut Diversified Products

2. Conduit Sealing Bushings:

a. Bridgeport Fittings, Inc.  
b. Cooper Industries, Inc.  
d. GS Metals Corp.  
f. Madison Equipment Co.  
g. L.E. Mason Co.  
h. O-Z/Gedney  
i. Producto Electric Corp.  
j. Raco, Inc.  
k. Red Seal Electric Corp.  
l. Spring City Electrical Mgf. Co.  
m. Thomas & Betts Corp.

2.2 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.3 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:

1. Expansion Anchors: Carbon steel wedge or sleeve type.  
2. Toggle Bolts: All steel springhead type.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and
insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems: 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

2.4 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
   a. 3-inch and smaller: 20-gage.
   b. 4-inch to 6-inch: 16-gage.
   c. over 6-inch: 14-gage.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:

1. Conform to manufacturer's recommendations for selection and installation of supports.
2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.
3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners
may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

6. Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.

7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. Vertical Conductor Supports: Install simultaneously with installation of conductors.

E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

F. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

G. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with requirements specified elsewhere.

H. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

I. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

J. TESTS: Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:

1. Expansion anchors.
2. Toggle bolts.

K. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the structural Engineer's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

L. Conduit seals at walk-in cooler& freezer location: Install seals for conduit penetrations into cooler or freezer equipment where conduit enters the respective conditional areas, and at slab locations.

3.2 Table I: Spacing for Raceway Supports

**HORIZONTAL RUNS**

<table>
<thead>
<tr>
<th>Raceway Size (Inches)</th>
<th>No. of Conductors in Run</th>
<th>Location</th>
<th>RSC, IMC, EMT (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2,3/4</td>
<td>1 or 2</td>
<td>Flat ceiling or wall.</td>
<td>5</td>
</tr>
<tr>
<td>1/2,3/4</td>
<td>1 or 2</td>
<td>Where it is difficult to provide supports except at intervals fixed by the building construction.</td>
<td>7</td>
</tr>
<tr>
<td>1/2,3/4</td>
<td>3 or more</td>
<td>Any location.</td>
<td>7</td>
</tr>
<tr>
<td>1/2-1</td>
<td>3 or more</td>
<td>Any location.</td>
<td>7</td>
</tr>
<tr>
<td>1 &amp; larger</td>
<td>1 or 2</td>
<td>Flat ceiling or wall.</td>
<td>6</td>
</tr>
<tr>
<td>1 &amp; larger</td>
<td>1 or 2</td>
<td>Where it is difficult to provide supports except at intervals fixed by the building construction.</td>
<td>10</td>
</tr>
<tr>
<td>1 &amp; larger</td>
<td>3 or more</td>
<td>Any location.</td>
<td>10</td>
</tr>
<tr>
<td>An</td>
<td>...</td>
<td>Concealed.</td>
<td>10</td>
</tr>
</tbody>
</table>

**VERTICAL RUNS**

<table>
<thead>
<tr>
<th>Raceway Size (Inches)</th>
<th>No. of Conductors in Run</th>
<th>Location</th>
<th>RSC, IMC, EMT (1,2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2,3/4</td>
<td>...</td>
<td>Exposed.</td>
<td>7</td>
</tr>
<tr>
<td>Diameter</td>
<td>Location</td>
<td>Code</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>--------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>1.1-1/4</td>
<td>Exposed</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>1-1/2 and larger</td>
<td>Exposed</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Up to 2</td>
<td>Shaftway</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>2-1/2</td>
<td>Shaftway</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>3 &amp; larger</td>
<td>Shaftway</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Any</td>
<td>Concealed</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

1. Maximum spacing of supports (feet).
2. Maximum spacing for IMC above apply to straight runs only.

**Abbreviations:**

- IMC  Intermediate metallic conduit.
- RSC  Rigid steel conduit.
- EMT  Electrical Metallic Tubing

**END OF SECTION 161900**
PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Related Documents: General provisions of the Contract, including General and Supplementary Conditions apply to this Section.

B. The Contract Documents are complementary. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the intent of this Section.

1.2 SUMMARY

A. Section includes the following types of LED luminaires:

1. Materials.
2. Finishes.
3. Luminaire support.

1.3 CT HIGH PERFORMANCE BUILDING REQUIREMENTS

A. The mandatory and standard options and procedures for compliance, submittal requirements, and reporting forms are in the CT High Performance Building Requirements Summary in Division 01.

1.4 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
   a. Manufacturers’ Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
   b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
7. Plans: Plans containing computer-generated point-by-point layouts in all spaces that interior luminaires submitted or substitutions are located.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
   1. Each sample shall include the following:
      a. Lamps and ballasts, installed.
      b. Cords and plugs.
      c. Pendant support system.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Luminaires.
   2. Suspended ceiling components.
   3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
   4. Structural members to which equipment and or luminaires will be attached.
   5. Initial access modules for acoustical tile, including size and locations.
   6. Items penetrating finished ceiling, including the following:
      a. Other luminaires.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Ceiling-mounted projectors.
7. Moldings.
8. Architectural features.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

G. Sample warranty.

1.7 SUBSTITUTIONS

A. Substitutions are unacceptable unless the following procedures and requirements are met in order to submit alternate luminaires or manufacturers other than those specified:
   1. If the bidder wishes to substitute luminaires from alternate manufacturers, attention is called to Section 2.10, LUMINAIRE DESCRIPTION of PART 2 - PRODUCTS. Specified luminaires cannot be changed without prior approval by the Owner and design team.
   2. Bidders wishing to obtain approval on brands other than those specified by name and catalog number in LUMINAIRE SCHEDULE section of this specification shall submit their requests no later than five (5) business days after the bid opening. Approval will be in the form of an addendum to the specifications issued to all prospective bidders indicating that the additional brand or brands are approved as equal to those specified as far as the requirements of the project are concerned.
   3. If the bidder wishes to substitute luminaires from alternate manufacturers, attention is called to Section 2.1, GENERAL MATERIAL REQUIREMENTS of PART 2 - PRODUCTS. In addition, note that the dimensions of visible parts of many luminaires (for example, the aperture diameters of recessed luminaires) are binding to the bidder and cannot be changed without prior approval by the Owner and design team.
   4. Request for approval shall be accompanied by working luminaire samples (with an appropriate lamp, complete photometric, mechanical and electrical data, list of materials and finishes and unit cost to the Owner) of both the specified brand and the proposed substitutes, as required, to make complete comparison and evaluation. These samples shall be in addition to those required by Luminaire Specification. The above data shall be delivered separately to the Project Coordinator. The luminaire samples shall be furnished and installed, at the bidder's expense, at a location selected by the Project Coordinator. In addition, the bidder shall furnish the Project Coordinator with the name and location of at least one completed project where each proposed substitute has been in operation for a period of at least six (6) months, as well as the names and addresses of the Owner.
   5. If the bidders do not elect to obtain prior approval during the time so specified, the Owner and design team have no obligation to review or consider any such article after the contract award.
1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. LED Boards: One for every 20 of each type. Furnish at least one board for each luminaire type.
   2. LED Drivers: One for every 20 of each type. Furnish at least one driver for each luminaire type.
   3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
   4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.10 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
B. Provide luminaires from a single manufacturer for each luminaire type.
C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.12 COORDINATION

A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies. Coordinate type of luminaire with ceiling type and insulation. Notify the Project Coordinator of conflicts prior to ordering fixtures via Coordination Drawings described in this Section.

1.13 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
B. Warranty Period: Five years from the date of Substantial Completion of the Work.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements below.

1. Luminaires:
   a. If multiple manufacturers are listed in Luminaires Schedule, the first named manufacturer listed in the Luminaires Schedule is the basis of design, if the Electrical Contractor chooses to provide one of the listed acceptable equivalent manufacturers, the light fixture submittal in addition to proposed light fixtures shall include lighting calculations for interior areas to demonstrate equivalent fixture performance. Light fixture samples shall be provided at the request of the Project Coordinator
   b. If one manufacturer is listed in Luminaires Schedule followed by the words "or equal," contractor may submit on any manufacturer with similar characteristics to those listed under description.

2. LED Boards:
   a. Cree.
   b. Nichia.
   c. Lumileds.
   d. Samsung.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
   1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.3 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Standards:
   1. ENERGY STAR certified.
   2. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
   3. UL Listing: Listed for damp location.
   4. Recessed luminaires shall comply with NEMA LE 4.

C. CRI of minimum 80. CCT of as shown on Luminaires Schedule.

D. Rated lamp life of 50,000 hours to L70.

E. Lamps dimmable from 100 percent to 10 percent of maximum light output, unless indicated otherwise.
F. Internal driver.

G. Nominal Operating Voltage: As shown on Luminaire Schedule.
   1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

H. Mounting Provisions for Ceiling Trim: Mounting provisions and ceiling trim are not indicated on the specific luminaire type specification. Coordinate mounting provisions and ceiling trim in the field, prior to ordering of luminaires to match all ceiling types and installation configurations. Provide all necessary mounting hardware, hangers, rails, yokes, steams, chains, cables, etc.

2.4 DRIVERS - GENERAL REQUIREMENTS

A. Description: Include the following features, unless otherwise indicated.
   1. Rebate Program Compliance: All electronic drivers must be on the local utility company's list of approved ballasts.
   2. Voltage: Field verify all voltage requirements prior to releasing lighting package and provide driver voltages as required by circuiting on plans.
   3. Disconnecting Means: Code-approved disconnecting means within each luminaire.

2.5 DRIVERS FOR LED BOARDS

A. Description: Electronic driver designed for applicable fixture(s) and load indicated by LED boards. Driver shall be designed for full light output with full range dimming.
   1. Input Voltage Range: 120 to 277, +/-10%.
   2. Input Frequency: 50 to 60 Hz.
   3. Power Factor: >90% at full load.
   4. THD: <20% at full load.
   5. Case temperature rated for -40 deg. C through +80 deg. C.
   7. Primary fused.
   8. Dimming Range: 100 to as indication on the drawings percent of normal.
   9. Compatibility: Certified manufacturer for use with specific dimming control system and lamp type indicated.
   10. Control: Coordinate wiring from driver to control device to ensure that the driver, controller, and connecting wiring are compatible.

2.6 MATERIALS

A. Metal Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter, shape, size, wattage, and coating.
   c. CCT and CRI for all luminaires.

2.7 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.8 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.


D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 TEMPORARY LIGHTING

A. If approved by Project Coordinator, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Provide support for luminaire without causing deflection of ceiling or wall.
   4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:
   1. Attached per manufacturer recommendations.
   2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end. Utilize integral joiner system to align adjacent luminaire sections in the field.
   4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
   5. Pendant Stem-Mounted Fixtures: Connect luminaire body to building structure with aircraft cable run through the fixture stem.

G. Ceiling-Grid-Mounted Luminaires:
   1. Secure to any required outlet box.
   2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
   3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
   4. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from luminaire corners.
   5. Support Clips: Fasten to luminaires and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
6. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

I. Remote Mounting of Drivers: Distance between the driver and fixture shall not exceed that recommended by driver manufacturer. Verify, with driver manufacturers, maximum distance between driver and luminaire. Locate drivers within accessible ceiling.

J. Luminaire Locations: Refer to architectural reflected ceiling plans, sections, elevations, and details for exact luminaire locations, mounting heights, and mounting arrangements.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260943 "Digital Network Lighting Controls," and Section 260936 "Digital Standalone Lighting Controls."

3.7 ADJUSTING

A. Luminaire Aiming: For adjustable luminaires, aim all luminaires per Project Coordinator's direction.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Project Coordinator.

END OF SECTION
PART 1- GENERAL

1.1 GENERAL REQUIREMENTS

The general provisions of the contract, including General Conditions, Supplementary General Conditions, Division 1 Specification sections apply to the work of this Section.

Section 15000 - General Conditions, and division – 1 Specification sections apply to the work of this Section.

Section 16000 – General Provisions for Electrical work apply to work specified in this section.

1.2 SCOPE OF WORK

A. Provide labor, equipment, materials, services and transportation necessary for complete and operational multiplexed, addressable life safety fire alarm systems as shown on Contract Drawings and specified herein, including but not limited to the following:

1. All necessary modules
2. Addressable detection, initiation, control and monitor devices
3. Signaling devices – Speaker/strobe units. Strobe units
4. Addressable relay modules
5. Programming and other necessary modifications to new building fire alarm panel being installed under separate contract.
6. System programming and testing
7. Area of refuge intercom system
8. Warrantee

B. Substitutions

1. Bids shall be based on the proprietary Edwards EST Signature Series equipment to match the existing system. No other systems will be acceptable in the Contractor’s bid.
2. With bid, furnish data sheets, diagrams and specifications of complete system.
3. Fire Alarm Contractor supplying the EST3 system must be an EST Strategic partner.

C. Warrantee and service all devices, wiring, equipment and installation for one year from time of acceptance of that portion of the system by the Owner. Programming shall be updated as necessary over the entire construction period. Warrantee and service all main hardware, including fire alarm control panel, for one year beyond final acceptance of the entire building fire alarm system.

1.3 RELATED WORK SPECIFIED ELSEWHERE

The work covered by this section of the specifications shall be coordinated with the other sections related to work.
1.4 SPECIAL REQUIREMENTS

A. The system shall be covered under a complete parts and labor warranty for a period of one year from the date of final acceptance. Warranty service shall include all emergency service for equipment or component failures and two preventative maintenance visits scheduled at six month intervals.

B. The Contractor shall note this section specifies the proprietary Edwards EST Addressable System as provided by an EST approved vendor. Due to the fact that work specified in this section modifies and extends an existing campus wide system and that these modifications will impact the system, all system programming and system connections shall be done the Agency approved fire alarm contractor.

C. All keys used for access to fire alarm equipment shall match Owner’s existing EST system keys.

D. Davidson Hall Fire Alarm System shall be programmed into the color graphics display monitor located at the Campus Police Station.

E. At the completion of the project, The approved Vendor shall supply to C.C.S.U. as-built drawings, AutoCad drawings and software to C.C.S.U.

F. The approved Vendor shall provide 4 hours of training to the facility on the maintenance, diagnostic, operation and troubleshooting of this fire alarm system.

1.5 SUBMITTALS

A. Submit for review shop drawings on following:
   1. Fire alarm control panel modules
   2. Heat and smoke detectors
   3. Speaker/strobe units
   4. Strobe units
   5. Fire alarm pull stations
   6. Battery units – with sizing calculations
   7. Wire and cable
   8. Manufacturer’s or vendor’s UL-UUJS certification, certificate number and UL listing as per UL issued certification.
   9. Area of refuge intercom system.
   10. A notarized letter from the Contractor indicating compliance with code and compatibility with central campus system.

B. Submit samples as requested.

C. Provide manufacturer’s roughing-in diagrams and written product specification and instruction for installation, operation and maintenance, suitable for inclusion in maintenance manuals.
D. Include copies of manufacturer’s published product warranties. Include standard or typical riser and wiring diagrams.

E. Provide shop drawings showing equipment and device locations and connecting wiring for the entire system in riser format. Include point to point wiring in riser diagrams and battery calculations.

F. Riser diagram shall be a Computer Aided Drafting produced drawing that is compatible with and readable by the Owners and Engineers CAD systems. (AutoCad)

1.6 RECORD DRAWINGS

A. Prior to final inspection and instruction period, deliver following items in duplicate to Architect.

1. Certificate by manufacturer of fire alarm system, stating that system has been properly installed, adjusted and tested.

2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts.

3. CAD discs with “As Built” riser diagrams which indicate each piece of equipment and interconnecting wiring.

4. Complete diagrams of internal wiring for each piece of equipment, including “as built” revisions. Diagrams shall identify wiring operation and maintenance.

1.7 QUALITY ASSURANCE

A. Catalog numbers are those for an Edwards EST System and represent the type, quality and operating characteristics of the equipment required. All equipment shall be supplied and serviced by a factory authorized dealer and shall be from one manufacturer with a minimum of 8 years experience in supply and servicing of fire alarms systems and maintain a direct factory sales and service local branch office, within a reasonable distance from the site, employing factory trained service technicians, Branch office shall have 24-hour service availability.

261 Pepe’s FARM Road.
Milford, CT
(203) 878-1321 (Al Sullivan)

NOTE: CONTRACTOR TO OBTAIN SERVICES OF AND COORDINATE WITH FIRE ALARM SUPPLIER AND PROVIDE ALL NECESSARY MODIFICATION AND REPROGRAMMING OF THE EXISTING FIRE ALARM CONTROL PANEL AND COLOR GRAPHICS AT THE CAMPUS POLICE DEPARTMENT TO INDICATE THAT THE FIRE ALARM SYSTEM HAS BEEN ACTIVATED.

B. This installation shall be made in accordance with the drawings, specification and the following:

1. NFPA 70 National Electrical Code
5. International Building Code
6. Local codes and Authorities Having Jurisdiction.
7. All fire alarm components shall be UL listed for their application.

C. Wiring requirements for shielding certain conductors from others or routing in separate raceways shall be as recommended by the manufacturer. Contractor shall request all special installation requirements from the manufacturer and include in his bid price.

D. The system including all components shall be listed by Underwriters Laboratories, Inc. for use a fire protective signaling system.

E. The system and components shall be supplied by one manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least three (3) years and who shall be able to refer to similar installations rendering satisfactory service. All references to model numbers and other pertinent information herein is intended to establish minimum standards of performance, quality and construction.

F. All material and equipment shall be new and unused.

G. All individual components and composite systems shall be designed for continuous operation without undue heating or change in rated values, and shall be properly fused.

1.8 SYSTEM DESCRIPTION

A. Work shall include all labor, materials, and equipment necessary for installation of complete power-limited, microprocessor based, multiplex, addressable device type life safety systems with battery standby for fire control and evacuation, to be connected to the existing building fire alarm control panel as described herein. Locations of controls, alarm initiation devices, and alarm signal devices shall be as show on the drawings. System shall be wired, zoned, addressed, electrically supervised, connected, tested, and left in fully operation condition.

B. Expand campus central system control panel color graphics, data loops to Campus Police Station as required to monitor the proposed additional devices. All necessary modifications shall be accomplished without central campus system “shut-down” of any existing functions.

C. Local fire alarm control panel shall monitor status of detection and alarm conditions for all new Signature type devices. Each power supply shall have sufficient capacity to operate all equipment to be connected under this contract with additional minimum spare capacity of 25 percent.

D. All controls panels shall be provided with 24VDC battery back-up of sufficient capacity to operate and supervise all connected equipment for minimum 60 hours with primary (AC) power disconnected, after which time batteries shall have sufficient capacity to operate all connected equipment in alarm mode.
PART 2 PRODUCTS

2.1 EQUIPMENT MANUFACTURERS STANDARD OF ACCEPTANCE

A. EST Signature Series Intelligent Analog Devices.

2.2 EQUIPMENT AND MATERIAL GENERAL REQUIREMENTS

A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be provided by a single manufacturer or if provided by different manufacturers, recognized as compatible by both manufacturers.

2.3 ADDITIONS AND RETROFIT

A. The system shall be capable of detecting the electrical location of each new intelligent Signature type device. It shall be possible to display the intelligent device map on the laptop PC. It shall be possible for authorized service personnel using Signature Series SIGA-PRO Signature Program/Service Tool or laptop PC to change the personality/function of a Signature Series Device to meet changes in building layout or environment.

B. System changes shall be verified by the manufacturer’s representative and a verification certificate presented upon completion.

2.4 CONTROL PANEL REQUIREMENTS

A. This Life Safety System Specification must be conformed to in its entirety to ensure that the installed and programmed Life Safety System will accommodate all of the future requirements and operations required by the building owner. Any specified item or operational feature not specifically addressed prior to bid date will be required to be met without exception.

B. Any deviation from the equipment, operations, methods, design or other criteria specified herein must be submitted in detail to the Specifying Architect or Engineer a minimum of 10 working days prior to the scheduled submission of bids. Each deviation from the operation detailed in these specifications must be documented in detail, including Page Number and Section Number that lists the system function for which the substitution is being proposed.

2.5 EQUIPMENT AND MATERIAL GENERAL REQUIREMENTS

A. All equipment furnished for this project shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be the best suited for the intended use and shall be provided by a single manufacturer. If any of the equipment provided under this Specification is provided by different manufacturers, then that equipment shall be recognized as compatible by both manufacturers, and “Listed” as such by Underwriters’ Laboratories.
B. System installation and operations shall be verified by the manufacturer’s representative and a verification certificate presented upon completion. The manufacturer’s representative shall be responsible for an on-site demonstration of the operation of the system and initial staff training as required by the Architect and/or Consulting Engineer.

C. The system shall be capable of detecting the electrical location of each Signature intelligent device including new and existing devices. It shall be possible to display the intelligent device map on the laptop PC.

If a device map cannot be generated by the Control Panel, the contractor must include a minimum of (3) days to verify location of all wire runs while in the presence of the Architect/Engineer or Building Owners Representative to verify all conduit and wire runs.

In addition, “As-Built” riser and wiring diagrams reflecting all T-Taps, each programmed device characteristic including detector type, base type, serial number, sensitivity setting and wire configurations will be provided to the Architect/Engineer, based on the information gathered during the verification process described above.

D. It shall be possible for authorized service personnel using a Program/Service Tool or laptop PC to change the personality/function of a Signature Series Device to meet changes in building layout or environment. System changes shall be verified by the manufacturer’s representative and a verification certificate presented upon completion.

2.6 MANUFACTURERS

A. Equipment and materials shall be provided by Authorized Engineered Systems Distributor Name to ensure proper Specification Adherence, final connection, test, turnover, warranty compliance, and service.

B. Service availability: The supplier shall have sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 8 hours of service calls, 24 hours a day, 7 days a week to service completed systems.

C. The Engineered Systems Distributor of the Fire Alarm / Life Safety Equipment specified herein shall provide a copy of their certificate of successful completion of an authorized Training Course given by the Manufacturer of the Fire Alarm / Life Safety Equipment.

2.7 EQUIPMENT

A. The Life Safety System shall include all required hardware and system programming to provide a complete and operational system.

2.8 LIFE SAFETY SYSTEM OPERATIONS INTERFACE:

A. SDC Card
   1. The Signature Device Card (SDC) shall be the interface between the Fire Alarm Control Panel and the Signature Series Detectors and Modules.
   2. The communications format between the SDC and the Signature Series Devices shall be 100% digital. Communications to devices must incorporate BROADCAST POLLING and DIRECT ADDRESS SEARCH to ensure the fastest reporting of off-normal conditions to the system human interface layer.
3. It shall be possible to wire the SDC as Class A (Style 6 or Style 7) or Class B (Style 4) without twisted or shielded wire. It must be possible to wire branch circuits (T-Taps) from Class B Circuits.

4. The associated controller (3-SSDC), through the SDC, shall provide the ability to set the sensitivity and alarm verification of each of the individual intelligent detectors on the circuit. It shall be possible to automatically set the sensitivity of individual intelligent detectors during day and night periods.

5. It shall be possible for the SDC to address all intelligent devices connected to it without having to set switches at the individual devices.

6. It shall be possible to obtain a mapping report of all devices connected to the circuit for confirmation of “as-built” wiring. The map shall show physical wiring of T-Taps, device types, and the panel addresses of devices connected to the circuit. The SDC shall be capable of reporting unexpected additional device addresses and changes to the wiring in the data circuit. A specific trouble shall be reported for any off-normal non-alarm condition.

7. The SDC shall be able to report the following information on a per intelligent device basis:
   a. Device Serial Number
   b. Device Address
   c. Device Type

8. Any of 32 possible trouble codes to specifically diagnose faults.

9. Should a Signature Driver Controller CPU fail to communicate, the Signature circuit shall go into the stand alone mode. The circuit shall be capable of producing a loop alarm if an alarm type device becomes active during stand alone mode.

B. Hard Wired NAC Circuits

1. Provide where indicated on the plans supervised hard wired Notification Appliance Circuits (NAC) for the control of 24Vdc EST Integrity Series Signaling Appliances. The NAC shall be Class B (Style 4), and shall control up to 3.5 amps of power to the circuit.

2. Provide where indicated on the plans supervised hard wired Notification Appliance Circuits (NAC) for the control of 70.7Vrms EST Integrity Series Audio Signaling Appliances. The NAC shall be Class B (Style 4), and shall control up to 35 Watts of power to the circuit.

3. Provide where indicated on the plans supervised hard wired Notification Appliance Circuits (NAC) for the control of 25Vrms EST Integrity Series Audio Signaling Appliances. The NAC shall be Class B (Style 4), and shall control up to 50 Watts of power to the circuit.

4. Panel NACs shall be power limited to 3.5A at 24Vdc and 4.1A at 20.4Vdc to support higher current demand by visible appliances at lower battery voltages.


6. Hard Wired Initiating Device Circuits
7. Provide where indicated on the plans supervised hard wired initiating device circuits. It shall be possible to configure IDCs for alarm, supervisory, or monitor operation.

2.9 COMPONENTS

A. Remote Booster Power Supplies - General

The power supply shall provide a central processor with a watchdog circuit. It shall provide 2 initiating circuits, 2 notification appliance circuits rated at 24 Vdc at 2.5A, form 'C' alarm and trouble contacts, and auxiliary power at 24Vdc at 500 mA. The power supply shall be a high efficiency switch mode type providing 4 A total to the NACs, 500 mA of auxiliary power at 24Vdc, and an automatic battery charger capable of supporting up to 10 AH of sealed lead acid batteries. Site programming shall enable or disable the local trouble buzzer, allow the following of existing signal rates or select internally generated evacuation signal rates at continuous, 20 SPM, 120 SPM, temporal 3-3-3, or California continuous or march time independent of the existing signal rate. Indicators shall be power on, system trouble, ground fault, battery trouble, and notification appliance circuit trouble. It shall be possible to activate the BPS via dry contact or by connection to an existing NAC circuit. It shall be possible to convert the BPS circuits ICs and NACs to Class 'A' operation. The base panel shall provide a communication channel and operating power for expansion modules.

1. Remote Booster Power Supply, BPS
   a. The remote booster power supply shall be Edwards Systems Technology (EST) type BPS Series incorporating all control electronics, relays, and necessary modules and components in a semi-flush mounted cabinet. The panel shall be supervised, site programmable, modular design with expansion modules to serve connection to existing NAC circuits. All initiating, notification, and low voltage power source circuits shall be power limited.

   b. The booster power supply shall be provided with battery back-up. The batteries sealed, lead-acid type and provide (60) hours of normal standby operation and five (5) minutes of normal alarm operation at the end of the standby period. The batteries shall be supervised for placement and low voltage. It shall be possible to mount the batteries remote from the panel.

   c. <The Relay/City Module shall have a yellow LED and an enable/disable switch. It shall be configurable with the BPS to serve as an auxiliary relay.>

C. Intelligent Detectors

1. The System Intelligent Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires
shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.

2. Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total analog loop response time for detectors changing state shall be 0.5 seconds.

3. Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the analog loop controller. A red LED shall flash to display alarm status. Both LEDs on steady shall indicate alarm-standalone mode status. Both LEDs shall be visible through a full 360 degree viewing angle.

4. The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.

5. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings.

6. Each detector microprocessor shall contain an environmental compensation algorithm which identifies and sets ambient “Environmental Thresholds” approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24 hour long term and 4 hour short term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the “learned” base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

7. The intelligent analog device and the analog loop controller shall provide increased reliability and inherent survivability through intelligent analog standalone operation. The device shall automatically change to standalone conventional device operation in the event of a loop controller polling communications failure. In the analog standalone detector mode, the analog detector shall continue to operate using sensitivity and environmental compensation information stored in its microprocessor at the time of communications failure. The analog loop controller shall monitor the loop and activate a loop alarm if any detector reaches its alarm sensitivity threshold.

8. Each Signature Series device shall be capable of automatic electronic addressing and/or custom addressing without the use of DIP or rotary switches. Devices
using DIP or rotary switches for addressing, either in the base or on the detector shall not be acceptable.

9. The intelligent analog detectors shall be suitable for mounting on any Signature Series detector mounting base.

10. Fixed Temperature Heat Detector, EST 284B-PL
   a. Provide fixed temperature heat detectors EST 284B-PL with SIGA-CT1 single input monitor modules. The heat detector shall have a temperature heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The heat detector shall have a nominal alarm point rating of 194°F. The heat detector shall be rated for ceiling installation at a minimum of 25 ft centers and be suitable for ceiling mount applications. Zoning as indicated on contract drawings.

11. Fixed Temperature/Rate of Rise Heat Detector, SIGA/HRS
   a. Provide intelligent combination fixed temperature/rate-of-rise heat detectors < SIGA/HRS>. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

12. Photoelectric Smoke Detector, SIGA-PS
   a. Provide intelligent photoelectric smoke detectors < SIGA-PS>. The analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using...
a laptop <or the SIGA-PRO Signature Program/Service Tool>. The photo detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39m/sec) without requiring specific air duct detector housings or supply tubes.

b. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:
   1. Temperature: 3232°F to 120°F (0°C to 49°C)
   2. Humidity: 0-93% RH, non-condensing
   3. Elevation: no limit

13. Standard Detector Mounting Bases, SIGA-SB / SIGA-SB4
   a. Provide standard detector mounting bases <SIGA-SB> <SIGA-SB4> suitable for mounting on <North American 1-gang, 3½” or 4” octagon box and 4” square box> <European BESA or 1-gang>. The base shall, contain no electronics, support all Signature Series detector types and have the following minimum requirements:
      1. Removal of the respective detector shall not affect communications with other detectors.
      2. Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.
      3. The base shall be capable of supporting one (1) Signature Series <SIGA-LED> Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

14. Relay Detector Mounting Bases, SIGA-RB / SIGA-RB4
   a. Provide relay detector mounting bases <SIGA-RB> <SIGA-RB4> suitable for mounting on <North American 1-gang, 3½” or 4” octagon box and 4” square box> <European BESA or 1-gang>. The relay base shall support all Signature Series detector types and have the following minimum requirements:
      1. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
      2. The position of the contact shall be supervised.
      3. The relay operation shall be exercised by the detector processor upon power up.
      4. The relay shall automatically de-energize when a detector is removed.
5. The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.

6. Form “C” Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for “pilot duty”.

7. Removal of the respective detector shall not affect communications with other detectors.

8. Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

15. Duct Detector Housing, SIGA-DH
   a. Provide smoke detector duct housing assemblies <SIGA-DH> to facilitate mounting an intelligent analog Photoelectric Detector <SIGA-PS>, along with a standard, relay or isolator detector mounting base. Provide for variations in duct air velocity between 300 and 4000 feet per minute (300 to 1000 feet per minute for ion-photo-heat detector). Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube which extends into the duct air stream up to ten feet. Provide drilling templates and gaskets to facilitate locating and mounting the housing. Provide five one gang knockouts for mounting optional Signature Series modules. Finish the housing in baked red enamel.

D. Intelligent Modules

1. It shall be possible to address each Intelligent Signature Series module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
   a. Temperature: 32°F to 120°F (0°C to 49°C)
   b. Humidity: 0-93% RH, non-condensing

2. Single Input Module, SIGA-CTI
a. Provide intelligent single input modules <SIGA-CT1>. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers. The single input module shall support the following circuit types:

1. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
2. Normally-Open Alarm Delayed Latching (Waterflow Switches)
3. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
4. Normally-Open Active Latching (Supervisory, Tamper Switches)

3. Dual Input Module, SIGA-CT2

a. Provide intelligent dual input modules <SIGA-CT2>. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers. The dual input module shall support the following circuit types:

1. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
2. Normally-Open Alarm Delayed Latching (Waterflow Switches)
3. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
4. Normally-Open Active Latching (Supervisory, Tamper Switches)

4. Monitor Module, SIGA-MM1

a. Provide intelligent monitor modules <SIGA-MM1>. The Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit. The monitor module shall be suitable for mounting on North American 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers.

5. Waterflow/Tamper Module, SIGA-WTM

a. Provide intelligent waterflow/tamper modules <SIGA-WTM>. The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class B input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. Channel B
shall support a Normally-Open Active Latching Tamper Switch. The
waterflow/tamper module shall be suitable for mounting on North
American 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4”
square boxes with 1-gang covers.

6. Single Input Signal Module, SIGA-CC1
   a. Provide intelligent single input signal modules <SIGA-CC1>. The
      Single Input (Single Riser Select) Signal Module shall provide one (1)
      supervised Class B output circuit capable of a minimum of 2
      personalities, each with a distinct operation. When selected as a
      telephone power selector, the module shall be capable of generating its
      own “ring tone”. The module shall be suitable for mounting on North
      American 2 ½” (64mm) deep 2-gang boxes and 1 ½” (38mm) deep 4”
square boxes with 2-gang covers, or European 100mm square boxes.
The single input signal module shall support the following operations:
   1. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A,
      25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
   2. Telephone Power Selector with Ring Tone (Fire Fighter’s
      Telephone)

7. Dual Input Signal Module, SIGA-CC2
   a. Provide intelligent dual input signal modules <SIGA-CC2>. The Dual
      Input (Dual Riser Select) Signal Module shall provide a means to
      selectively connect one of two (2) signaling circuit power risers to one
      (1) supervised output circuit. The module shall be suitable for mounting
      on North American 2 ½” (64mm) deep 2-gang boxes and 1 ½” (38mm)
deep 4” square boxes with 2-gang covers, or European 100mm square
      boxes. The dual input signal module shall support the following
      operation:
   1. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A,
      25 Vrms @ 50w or 70 Vrms @ 35w of Audio)

8. Control Relay Module, SIGA-CR
   a. Provide intelligent control relay modules <SIGA-CR>. The Control
      Relay Module shall provide one form “C” dry relay contact rated at 2
      amps @ 24 Vdc to control external appliances or equipment shutdown.
The control relay shall be rated for pilot duty and releasing systems. The
      position of the relay contact shall be confirmed by the system firmware.
The control relay module shall be suitable for mounting on North
      American 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4”
square boxes with 1-gang covers.

9. Universal Class A/B Module, SIGA-UM
   a. Provide intelligent class A/B modules <SIGA-UM>. The Universal
      Class A/B Module shall be capable of a minimum of fifteen (15) distinct
      operations. The module shall be suitable for mounting on North
American 2 ½” (64mm) deep 2-gang boxes and 1 ½” (38mm) deep 4” square boxes with 2-gang covers, or European 100mm square boxes. The universal class A/B module shall support the following circuit types:

1. Two (2) supervised Class B Normally-Open Alarm Latching.
2. Two (2) supervised Class B Normally-Open Alarm Delayed Latching.
3. Two (2) supervised Class B Normally-Open Active Non-Latching.
4. Two (2) supervised Class B Normally-Open Active Latching.
5. One (1) form “C” dry relay contact rated at 2 amps @ 24 Vdc.
6. One (1) supervised Class A Normally-Open Alarm Latching.
7. One (1) supervised Class A Normally-Open Alarm Delayed Latching.
8. One (1) supervised Class A Normally-Open Active Non-Latching.
9. One (1) supervised Class A Normally-Open Active Latching.
10. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
12. One (1) supervised Class A 2-wire Smoke Alarm Verified
13. One (1) supervised Class B 2-wire Smoke Alarm Verified
14. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.
15. One (1) supervised Class B Signal Circuit, 24Vdc @ 2A.

10. Isolator Module, SIGA-IM
   a. Provide intelligent fault isolators modules <SIGA-IM>. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on North American 2 ½” (64mm) deep 2-gang boxes and 1 ½” (38mm) deep 4” square boxes with 2-gang covers, or European 100mm square boxes.

E. Intelligent Manual Pull Stations
   1. It shall be possible to address each Signature Series fire alarm pull station without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The manual stations shall have a minimum of 2 diagnostic LEDs mounted on their integral, factory assembled single or two stage input module. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and
ground faults. The fire alarm pull station shall be suitable for operation in the following environment:

a. Temperature: 32°F to 120°F (0°C to 49°C)

b. Humidity: 0-93% RH, non-condensing


a. Provide intelligent single action, single stage fire alarm stations <SIGA-270>. The fire alarm station shall be of lexan construction with an internal toggle switch. Provide a key locked test feature. Finish the station in red with white “PULL IN CASE OF FIRE” lettering. The manual station shall be suitable for mounting on North American 2½” (64mm) deep 1-gang boxes and 1½” (38mm) deep 4” square boxes with 1-gang covers.

F. Heat Detectors

1. Combination Fixed Temperature/Rate-of-Rise Heat Detectors, 281B, 282B

a. Provide low profile heat detectors rated for a maximum smooth ceiling rating of 2500 sq. ft. The detector shall be finished pure white and have a positive identification for the operation of the fixed temperature element. The detectors shall be rated at 15°F (9°C) per minute rate-of-rise and 135°F (57°C) fixed temperature. 15°F (9°C) per minute rate-of-rise and 194°F (90°C) fixed temperature.

2. Fixed Temperature Heat Detectors, EST 284B-PL

a. Provide low profile heat detectors rated for a maximum smooth ceiling rating of 625 sq. ft. The detector shall have a positive identification for the operation of the fixed temperature element. The detectors shall be rated at 194°F fixed temperature.

G. Notification Appliances

1. All appliances shall be UL Listed for Fire Protective Service.

2. All strobe appliances or combination appliances with strobes shall be capable of providing the “Equivalent Facilitation” which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971, and ULC S526 Listed.

3. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers’ instructions.

4. Any appliances which do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers which clearly states that their equipment (as submitted) are 100% compatible with each other for the purposes intended.
H. Self-Synchronized Strobes
   1. GENESIS 1-Gang Strobes, GIR-VMSeries
      a. Provide strobes manufactured by EST, Cat No. GIR-VM. In – Out screw terminals shall be provided for wiring. The strobes shall have a red plastic face plate. They shall provide 15 cd, 30 cd, 75 cd, and 110 cd synchronized flash outputs. Strobes shall mount in a North American 1-gang box.

I. Speaker/strobes
   1. Provide electronic horn/strobes manufactured by EST, Cat. No. G4-S2VM In – Out screw terminals shall be provided for wiring. The SPEAKER/STROBE shall have a plastic housing. Speaker strobe shall be selectable for ¼, ½, 1 and 2 watt operation. Pattern sound output level of 90 dBA average shall be provided.
      2. The strobe shall provide 15 cd, 75 cd, 30 cd, 110 cd synchronized flash outputs. The strobe shall have lens markings oriented for wall/ceiling mounting. Horn/strobe shall mount to a North American 4” electrical box (2-18” deep) using the 2 screws provided with box or to a 20-gang (2-3/4” deep) electric box.

J. Ancillary Devices - general
   1. Ancillary devices submitted for use must have written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

K. Remote relays
   1. Multi-Voltage Control Relays, MR-100 Series
      a. Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 24 Vdc, 24 VAC, 115 VAC, or 230 VAC. A red LED shall indicate the relay is energized. A metal enclosure shall be provided.

L. Sounder Bases
   1. Sounder base is a mounted base, which requires separate power connection. Sounder turns on when devices (detector) is in alarm and sound a local alarm. When the detector alarms, it commands the sounder to activate. Sound output has a minimum 85 dBa measured in UL reverberant room. Upon alarm of respective sounder base, a local signal shall transmit at the panel monitoring location.

M. Vandalism/Damage Stoppers
   1. Pull Station Vandalism/Damage Stopper
      a. Pull station protective guard shall be STI-1230 Stopper II without horn.
N. REMOTE CALL STATIONS

1. The remote call station shall contain an amber “call-placed” indicator and a red acknowledge indicator, a 3.5” 45ohm speaker and a cancel button on an extruded aluminum panel.

2. Screw terminals for the remote call station shall be provided for wiring connections.

3. Remote call stations shall be mounted a maximum of 48” above finished floor.

4. The remote call station shall be compatible with CCSU’s fire alarm system.

5. The operation instructions (as indicated below) shall be sealed in plastic and mounted adjacent to each remote call station.

FOR EMERGENCY ONLY

Area of Rescue Assistance
Operating Instructions

1. Push the Call Button for help.

2. Observe the Amber call-placed light and remain in this designated area.

3. Observe the Red acknowledge light and listen for instructions.

4. Answer voice communication (hands-free)

O. POWER SUPPLY / CONTROL UNIT

1. The master station power supply / control unit shall be compatible with CCSU’s fire alarm system.

2. The power supply/control unit shall be compatible with CCSU’s fire alarm system and be assembled with the above-described components.
3. Indicator lamps shall have removable lenses for lamp replacement and to protect lamp identification markings.

4. Construction shall be of extruded aluminum with a metal flush mount housing and trim frame.

PART 3 - EXECUTION

3.1 GENERAL
A. The entire system shall be installed in a workmanlike manner in accordance with approved manufacturers manuals and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the NEC, approved by local authorities having jurisdiction for the purpose, and shall be installed in dedicated conduit throughout.

B. All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.

C. End of Line Resistors shall be furnished as required for mounting as directed by the manufacturer.

D. All wiring shall be installed according to NEC standards per the drawings submitted by the authorized Engineered Systems Distributor, unless otherwise noted.

3.2 FIELD QUALITY CONTROL
A. The system shall be installed and fully tested under the supervision of trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

PART 4 - MANUFACTURERS

4.1 Bids shall be based on the proprietary Edwards EST equipment to match and integrate into the existing system. No other systems or manufacturer will be acceptable in the contractor's bid.

PART 5 - MAINTENANCE

5.1 The Contractor shall provide for two preventive maintenance visits per year, emergency service response for equipment or component failures. Testing shall be performed in accordance with NFPA 72H. The maintenance contract shall begin at the end of the warranty period.

5.2 The Contractor shall note this section specifies the proprietary Edwards EST Addressable System as provided by an EST approved vendor. Due to the fact that the work specified in this section modifies and extends an existing campus wide system and that these modifications will impact that system, all system programming and system connections shall be done by the Agency approved fire alarm contractor.
PART 6 - TESTING

6.1 TESTING

A. The entire Fire Alarm System shall be tested by an approved UUIS Service company which shall issue a U.L. Certificate for the correctness of the installation, maintenance of required system documentation, periodic system testing and system repair and maintenance for specified system.

B. Provide Service Company legal, valid copy of Certificate with submittals.

C. Prior to final acceptance of the system manufacturer of system with Contractor shall, in the presence of contractor, owner's Representative, Architect's/Engineer's Representative, Construction Specialist, Department of Public Works and the State Fire Marshal, test the system as required by N.F.P.A., Article 72H.

D. Final approval of the completed system and the testing shall be by the authority having jurisdiction.

E. The Vendor shall leave the Fire Alarm System installed under this Project, complete and operable in every respect. Any and all monies allowed but not expended, shall be refunded to the State, in their entirety.

F. Scope: The scope of the work required to satisfy the intent of the work stated above includes, but shall not be limited to the following:

1. The assignment of addresses to all devices, data loop, signal devices and other functions, using the Contractors approve Bill of Materials to obtain the approval of the Engineer and the Agency.

2. Provide, subsequent to the approvals of the drawings and the installation of equipment, all required programming of local building and police station loop panels.
   a. Color Graphics: Submit all programs, floor plans, DXF/dwg., files, etc. for the approval of the Engineer and the Agency's Architect. Subsequent to approval, install approved program(s) in the Color Graphic Touch Screen at Campus police station. Test all devices through the TV color graphics in accordance with the test specified above.

3. Provide technical, Job Site assistance during the construction process and for all final connections.

4. Provide the initial testing of each device at the local panel and the head end panel, located at the Police Station, for function, program correctness and loop integrity. Coordinate the above with the Electrical Contractor.

5. Provide all final connections to the Campus Police Central Panel.

6. Provide all final testing of the system in the presence of the Electrical Contractor, the Agency's Architect and the Fire Marshall.

7. Provide NFPA 72 certificate signed by the Vendor. provide UL certification for the system prior to its incorporation into the Project, (4403-621).
8. Provide a one year system warranty, in accordance with the requirements specified herein and two maintenance visits. The equipment warranty shall be provided by TPC.

9. Assist the Contractor in his preparation of as built system drawings.

10. Provide all miscellaneous devices, appurtenances and other similar items incidental to, or required for, a complete and operable installation.

11. Coordinate the work of all the trades required to fulfill the intent of this Allowance stated above.

END OF SECTION 167210
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section will also be bound by the Related Documents identified in Division 01 Section “Summary”.

1.2 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, each and every Contractor, Subcontractor and/or supplier providing goods or services referenced in or related to this Division will also be bound by the Documents identified in General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Examine all Project Specifications and Drawings for requirements that affect this SECTION whether or not such work is specifically mentioned in this SECTION.

C. Drawings and Specifications, general design considerations, and installation guidelines are provided in this document. Quantities of technology outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification will take precedence. The successful vendor will meet or exceed all requirements for the cable system described in this document.

D. Provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although if work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation.

1.3 QUALIFICATIONS

A. Comply with below qualification requirements.

B. The Installer (Firm and Employees) will be experienced in the operations they are engaged to perform. Demonstrate at least five years of continuous recent experience on similar projects. The Installer will hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed.

C. Provide names of contacts from the last five similar projects including the General Contractor, Owner's Representative, Architect and Engineer. Indicate project locations, scope and current phone numbers that the contacts can be reached at.

D. Qualified Structured Cabling System Installation firms will have demonstrable design and installation training with certifications of competence. Certified training will be industry recognized and at least equal to:

2. Registered Communications Distribution Designer (RCDD).
3. Certified Installer for Solution provided.

E. Provide a full time on site foreman who personally has been certified as described above. Submit all documentation under this Section.
F. Provide an on-call Project Manager to supervise the project.

G. Each Foreman and Installer working on this project will be trained to the qualified level as specified by the Manufacturer(s) for installation and maintenance of equipment being provided on this project. The training will consist of at least a minimum of proper installation techniques of their specific equipment in order to have a complete operating system meeting or exceeding the requirements as specified herein. Each Foreman and Installer working on this project will have documentation from the Manufacturer indicating that they have been adequately trained prior to the start of the project. Only Foreman and Installers who have been properly trained and documented by the Manufacturer whose equipment is being provided on this project will be allowed to install same.

H. Separate Qualifications Requirements:
   1. Installers will be specifically qualified for each system being installed under this section. Provide documentation for each installer including:
      a. State of Connecticut License
      b. Registered Telecommunications Installer Apprentice Certificate

I. Maintain at the site an updated copy of the Manufacturer Trained Installers list including a copy of their training documentation from the Manufacturer. This documentation will be made available to the Architect upon request.

1.4 SECTION INCLUDES

A. The work under this Section includes providing of all material, labor, equipment and supplies and the performance of all operations to provide a complete working and fully functional telecom/data required by the Drawings and details and as specified herein. Where the Drawings, Specifications, Codes, Regulations, Laws, or the requirements of the local Authority conflict, provide the higher quality and higher quantity indicated or required and follow the strictest requirement. In general, the work includes, but is not limited to, the following:

B. Furnish and install a complete data, voice cabling system infrastructure.

C. Furnish and install all required relay brackets, cabinets and/or racks as required and as indicated.

D. Furnish, install, and terminate all UTP Systems including:
   1. Horizontal Cabling.
   2. Cable Management.
   3. Work Area Outlets.
   4. Modular Jacks.
   5. Patch Panels.
   7. Cross Connect Blocks.
   8. Cross Connect Cabling.

E. Furnish any and all material required to form a fully functional cabling system.
F. Furnish, install and make fully functional overhead projectors and local sound systems in locations indicated on drawings.

G. Cable segments and links will be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).

H. Furnish test results of all cabling to the owner on disk and paper format, listed by each Equipment/Telecommunication Room, then by workstation ID.

I. Provide owner training and documentation. (Testing documentation and As-built drawings)

J. Pathways and Supports – (Coordination per Division 26 specifications) if applicable.

K. Pathways and Supports – (Provide Specific Pathways and Supports that are Not Being Provided per Division 26 specifications, i.e., J-hooks, etc.).

L. Structured Cable Pathway (Within Technology Spaces and Integral to Structured Cabling System Equipment Racks and Layouts/Support) if applicable see drawings.

M. Power Requirements - (Coordination per Division 26 specifications).

N. UL 497 primary and UL 497A secondary line lightning and surge protection at entrance to the building from the exterior.

O. Protection of new and existing work.

P. Record Drawings and Documentation.

Q. Staging.

R. Telecommunications Equipment Grounding/Bonding to Telecommunications Grounding Backbone System.

S. Telephone System Cabling.

T. Seismic Supports, Supplementary Steel and Channels.

U. Operation and Maintenance Instructions and Manuals for this Section's work.

V. Nameplates, Labels and Tags.

W. Testing and certification.

X. Sealing of Penetrations and Openings.

Y. Phasing of work and maintenance of service to existing and temporarily relocated items, owner equipment, etc. as required meeting the project schedule, including premium time.

Z. Coordination with Manufacturers, other trades, General Contractor and Owner. Include costs associated with adjustments and changes resulting from coordination.
AA. Costs associated with core drilling and cutting and patching using appropriate and trained tradesmen approved by the General Contractor and the Architect.

BB. The Contractor will be responsible for testing and verification that the entire building structure is free from EMI/RFI interference factors prior to installation of unshielded twisted pair station cabling. Tests will be given to Owner's Representatives prior to start of cable purchasing.

CC. Coordinate to ensure the General Contractor indicates on the project schedule:

1. Installer, Architect and Owner coordination meetings: 3 months (90 days) prior to scheduled Substantial Completion date or as soon as Submittals are submitted and reviewed for projects with schedules shorter than 5 months (150 days).
2. Systems Testing: 30-45 days prior to project completion and prior to Substantial Completion, Acceptance Demonstrations and Training.
3. Acceptance Demonstrations: 15 days prior to project Substantial Completion and prior to Owner acceptance of project.
4. Systems Training (if Applicable): 15 days prior to final Substantial Completion and prior to the Owner's acceptance of project.

1.5 REGULATORY REFERENCES

A. All work and materials will conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.

B. All materials will be UL Listed and will be marked as such. If UL has no published standards for a particular item, then other national independent testing standards will apply and such items will bear those labels. Where UL has an applicable system listing and label, the entire system will be so labeled.

C. All materials will be ETL Verified (not just tested) to be Category 6 component and channel compliant.

D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The Contractor will comply and reference the latest editions of the following standards including any related addendum or TSB’s not listed below:

1. ANSI/TIA/EIA - 568-B.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces
6. ANSI/TIA/EIA – 570-A, Residential Telecommunications Cabling Standard
7. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings

E. If any of the above documents are in conflict, then the more stringent requirement will apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The Contractor must be aware of local codes that may impact this project.

1.6 INTERPRETATION OF DRAWINGS

A. All work indicated on the Drawings is intended to be approximately correct to scale, but figures dimensions and detailed Drawings are to be followed in every case. The Drawings are diagrammatic. Size of raceways, cable pathways and methods of running them are indicated, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered.

B. Schematic diagrams shown on the Drawings indicate the required functions. Standard diagrams of the Manufacturer may be used for the functions indicated without exact adherence to the Schematic Drawings shown. Work required for such deviations will be provided.

C. Where Drawings or Specifications conflict or are unclear, advice the Architect/Engineer, in writing, before Award of Contract. Otherwise, interpretations of Contract Documents by the Architect/Engineer will be final, and no additional compensation will be permitted due to discrepancies or inconsistencies, resolved according to the Architect/Engineer's interpretation.

D. Items referred to in singular number in Contract Drawings will be provided in quantities necessary to complete work.

E. The right is reserved to make reasonable changes in locations of work prior to rough-in at no additional cost.

F. Drawings do not limit responsibility of determining full extent of work required by Contract Documents. Refer to all Drawings and Specifications that indicate types of construction in which work will be installed and work of other trades with which work of this Section must be coordinated.

G. Where Drawings or Specifications do not coincide with Manufacturer’s recommendations, or with applicable Codes and Standards, alert the Architect in writing before installation. Otherwise, make changes in installed work as the Architect requires without additional cost.

H. In situations or where potential conflicts exist or where the Installer believes guidance is required, submit a sketch identifying proposed solution and the Architect will review, note if necessary, and return this sketch appropriately marked for use by the Installer.
1.7 COOPERATION AND COORDINATION WITH OTHER TRADES

A. The work will be so performed that the progress of the entire building construction, including all other trades, will not be delayed and not interfered with. Materials and apparatus will be installed as fast as conditions of the building will permit and must be installed promptly when and as directed.

B. Keep fully informed as to the shape, size and position of all openings required for all apparatus and give information in advance to build openings into the work. Furnish and set in place all sleeves, pockets, supports and incidentals.

C. Coordinate exact locations and roughing in dimensions of all work before installation and make all final connections as required. Any changes required to avoid interferences or to provide adequate clearances for Code and maintenance requirements will be made at no additional costs.

D. Structural elements of the project will not be relocated, altered or changed to accommodate the work without written authorization from the Architect.

E. Work that is installed before coordination with other trades or that causes interference with the work of other trades will be changed to correct condition at no additional cost.

F. Obtain a complete set of Project Drawings and Specifications for coordination and to determine the full scope of work.

G. Attend project coordination meetings to coordinate work of this Section, pathways, work of other trades phasing and other project requirements.

1.8 SUBMITTAL REQUIREMENTS

A. Submit complete shop drawings, data and samples in accordance with SECTION 01300 - SUBMITTALS

B. Under the provisions of this request for proposal, prior to the start of work the Structured Cabling System Contractor will:
   1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
   2. Submit proof from Manufacturer of Contractor's good standing in Manufacturer's program.
   3. Submit appropriate cut sheets and samples for all products, hardware and cabling.

C. Work will not proceed without the Owner's approval of the submitted items.

D. The Structured Cabling Systems Contractor will receive approval from the Owners on all substitutions of material. No substituted materials will be installed except by written approval from the Owner.

1.9 RECORD DRAWINGS

A. Purchase and maintain at the job site a complete and separate black line set of prints of the approved Working Drawings which accurately indicate daily progress by coloring materials and
apparatus as installed. Schedules will be modified to reflect data consistent with that of the installed equipment. Clearly show all changes to the work as a result of addenda, change orders, clarifications, instructions issued by the Architect or conditions encountered in the field. Accurately indicate the location, size, type and elevation of new work and their relationship to existing work. Provide dimensions from permanent site improvements or column centerlines.

B. The marked up and colored in prints will be used as a guide for determining the progress of the work installed. They will be inspected weekly and will be corrected immediately if found inaccurate or incomplete. Requisitions for payment will not be approved until the Drawings are accurate and up-to-date.

C. At the completion of the work submit one set of the marked up prints for review and acceptance. After acceptance, these marked up prints will be used in the preparation of the CADD Record Drawings "as-built". Record Drawings will consist of all Contract Drawings of this Section.

D. Structured Cabling System Record Documents:
   1. Provide "as-built" structured cabling system records with at least the minimum information including "required linkages", "other linkages" and "user codes" required by TIA/EIA 606 for the following:
      a. Pathway Records
      b. Termination Hardware Records
      c. Space Records
      d. Termination Position Records
      e. Cable Records
      f. Grounding Records

E. Make all modifications on the CADD Drawing files indicated on the marked up set of Record Drawings. Remove all superseded data to show the completed installation.

F. Deliver the completed Record Documents properly titled and dated to the Architect. These Record Documents will become the property of the Owner.

1.10 PROTECTION OF WORK AND PROPERTY

A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.

B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen will be replaced with equal material or equipment at the option of the Architect and Owner.

C. Materials and equipment stored for this project will be protected and maintained according to the Manufacturer’s recommendations and requirements and according to the applicable requirements of NFPA 70B.

D. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good any damage caused.
E. Use caution to avoid damage to existing work, and to prevent harm to personnel working in all areas.

F. Observe all safety precautions and requirements for the construction.

G. The General Contractor and the Installer are responsible for initiating, maintaining, and supervising all safety precautions and requirements during construction.

H. Coordinate installations with all other trades in order to not damage equipment or cables during construction. Any work that is damaged during construction will not be repaired. Replace damaged work completely, with no splices in cabling, at no additional cost to the Project.

1.11 USE OF THE SITE

A. Use of the site will be at the owner's discretion in matters that the owner deems it necessary to place restrictions. The Owner I.T. Department reserves the right to place restrictions in areas that affect operational facilities and service.

1.12 MATERIAL AND EQUIPMENT STANDARDS

A. Where materials or equipment are specified by patent proprietary name or name of the Manufacturer, such specification is used for the purpose of establishing a standard for that particular item. If more than one Manufacturer is listed the Contract Documents are based on the first Manufacturer listed, and all other Manufacturers are considered a substitution.

B. If three or more Manufacturers are indicated without the term "or equal", or "or approved equal", then the material and equipment will be supplied by one of those indicated and that material and equipment will conform in all respects to the Drawings and Specifications.

C. No equipment or material will be used, furnished or installed unless previously reviewed and accepted by the Architect.

D. Substitutions may be offered for review provided the material, equipment or process offered for consideration is equal in every respect to that indicated or specified. The request for each substitution must be accompanied by a letter from an Authorized Representative of the Manufacturer and the Installer indicating that the substitution meets or exceeds all specified requirements. Provide complete specifications, drawings or samples to properly appraise the materials, equipment or process. Acceptance of substitutions will be based on performance, appearance, use, maintenance requirements, durability, aesthetics, physical arrangement, size and quality.

E. If a substitution of materials or equipment, in whole or in part, is made, the installer under this section will bear the cost of any changes, engineering or construction, necessitated as a result of said substitution.

F. Materials will be new, unused, of recent manufacture, not previously installed, full weight, standard, and the best quality of its kind and acceptable to the Architect.

G. Provide NRTL listed or labeled products whenever there are NRTL standards, listings or labeling available for that product category.
H. The Specifications or notes and description following a catalog number is basically to identify
the item, but may also call for accessories, options or modifications which are not indicated in
the catalog number.

I. Reviewed submittals on substitute equipment will only allow the Installer to proceed with
installation. The substitution will not be considered equal until such time as the Architect and
Owner's Representative have completely accepted the installation. All costs for removal,
relocation, or replacement of said Substitution will be at the risk of the Installer.

J. Provide products of one Manufacturer for each classification of equipment.

1.13 WARRANTY

A. Manufacturers will provide replacement warranties for material and equipment furnished under
this Section. Such warranties will be in addition to and not in lieu of all liabilities which the
Manufacturer and the Installer may have by law or by provisions of the Contract Documents.

B. All materials, equipment and work furnished or installed under this Section will be warranted
against all defects in materials and workmanship for a period of 18 months commencing with
the date of Substantial Completion. Any failure due to defective material, equipment,
installation or workmanship which may develop will be corrected at no expense to the Owner
including all materials, labor, travel, expenses, system diagnostics and damage to areas,
materials and other systems resulting from such failures.

C. Upon receipt of notice from the Owner of failure of any part of the systems during the warranty
period, the affected parts will be replaced. Any equipment requiring excessive service
consisting of more than two unscheduled service calls, will be considered defective and will be
replaced.

D. Where warranties, maintenance contracts, or training are required beyond a period of one year,
provide written proof from the Manufacturer for the time period indicated as acceptable to the
Architect and provide a performance bond payable to the Owner covering the required work for
the time period. Written proof and bonds will be submitted prior to payment for Substantial
Completion.

E. Include copies of all warranties, maintenance contracts, training contracts and performance
bonds in the Operation and Maintenance Manuals.

F. Provide certified factory trained technical service personnel for service and maintenance of the
system.

G. Provide a copy of this warranty section in the Operations and Maintenance Manuals. Each
copy will be dated, signed and certified by an authorized Representative of the Installer
providing work under this Section stating that these requirements are understood and will be
complied with without exception.

H. Provide extended warranty as indicated in this specification.

1.14 EXTENDED WARRANTY/GUARANTEE – UTP AND FIBER OPTIC CABLELING SYSTEMS

A. Provide a 20 year Manufacturer’s warranty/guarantee. This warranty/guarantee will include all
labor and material and will be provided by a factory certified installer for the products being
installed under this Section.
B. Provide Manufacturer’s assurance that all warranty conditions are met and that the installation qualifies for all applicable 20 year warranty programs.

1.15 CONTINUITY OF SERVICE AND SCHEDULING OF WORK

A. Continuity of all services will be maintained in all areas that will be occupied or temporarily relocated during the construction period. If an interruption of service becomes necessary, such will be scheduled in advance, made only upon consent of the Owner and at a time outside normal working hours as the Owner will designate. The Contractor will schedule the shutdown with seven days in advance. Arrange work to minimize shutdown time.

B. Should services be inadvertently interrupted, immediately notify the Owner. Be prepared to immediately furnish labor, materials and the equipment necessary for prompt restoration of interrupted service.

C. Refer to the overall scheduling of the work of the project. Schedule work, process Submittals and order materials and equipment to neither conform to this schedule and install work to not delay nor interfere with the progress of the project.

D. Inform General Contractor and Architect immediately of any delays or potential delays. Furnish Manufacturer’s letter to verify order date, equipment delays, expected shipment date, order number, and potential remedies to speed up delivery. Any costs to speed up delivery will be implemented at no cost to the project if the equipment or material was not ordered as soon as possible after Contract award or within the time frames indicated with the Submittals.

E. Include premium time required to comply with the project scheduling and phasing.

F. Be aware of, and plan for, project scheduling and phasing. Provide for complete continuous operation of all systems. Coordinate scheduling and phasing with the Architect, Owner, other Trades, and the General Contractor.

G. Demolition of existing systems being updated will take place only after the new or replacement system is completely installed, operational, tested and certified. This work may be required on a "per-phase” basis.

1.16 CERTIFICATES OF APPROVAL

A. Upon completion of all work, and as a condition to receiving payment at Substantial Completion, furnish to the Architect the following original signed certificates and include copies of these certificates as part of the Operation and Maintenance manuals:

1. Certification from the Manufacturers authorized representative stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be installed in accordance with the Manufacturer’s requirements, all requirements for Manufacturer’s warranties are complied with, and equipment is in satisfactory operating condition. This certification will be provided for each piece of major equipment and cabling and for all complete systems. Provide certificate for additional items requested by the Architect.

2. Certificates of inspection, letters or notices from the appropriate governmental authorized inspectional authorities stating that all portions of the work (indicate trade and responsibility) have been inspected and are installed in conformance with the applicable codes, laws, ordinances and referenced standards. If non-conformance notices are received, include the re-inspection certificate, letter of explanation, etc. as required to
indicate complete conformance. Provide written evidence of all exceptions or variances
given by any Inspector.

3. Certificate from the installing firm responsible for the work (indicate trade and
responsibility) signed by an authorized Officer of the firm and the Foreman or Project
Manager in charge, indicating trade license numbers and stating that to the best of the
signer’s knowledge and belief that the project (indicate project name and address) has
been installed in compliance with the Contract Drawings, Specifications and Addenda,
and all applicable codes, laws, ordinances and referenced standards. Where sub-
contractors perform a portion of the work of this section include certificates from them.

B. Final affidavit for the occupancy permit will not be signed until the above certificates have been
submitted and accepted.

1.17 SUBSTANTIAL COMPLETION

A. When Work under this Section, or a designated portion of Work, is substantially complete,
submit written notice through the General Contractor with a list of items remaining to be
completed or corrected.

B. Should Architect observe and find Work is not substantially complete, promptly notify the
General Contractor, in writing, listing observed deficiencies.

C. Remedy all deficiencies and submit a second written notice of Substantial Completion.

D. Substantial Completion will not be considered unless work remaining is less than one percent
of the Contract Value of this Section and all systems are operational and tested to verify
compliance with Contract Documents. Only minor items will remain to be completed.

E. Record Drawings, Operation and Maintenance Manuals, Acceptance Demonstrations, Owner
personnel training, spare parts or extra materials required, test reports, warranties,
performance bond for extended warranties and maintenance contracts and training, and
certifications of installation inspections will be submitted and accepted prior to Substantial
Completion.

F. When Architect finds Work is substantially complete a Certificate of Substantial Completion in
accordance with provisions of the Contract Documents will be prepared.

1.18 FINAL COMPLETION

A. When Work under this Section is complete, submit through the General Contractor written
certification that:

1. Contract Documents (which include addenda, clarifications, RFI’s, change orders and
instructions from the Architect) have been reviewed.
2. Work has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents and deficiencies
listed with Certificate of Substantial Completion have been corrected.
4. Equipment and systems have been tested, adjusted and balanced and are fully
operational.
5. Work is complete and ready for Architect’s final review.

B. Should Architect observe and find Work incomplete, the review will be promptly suspended and
the General Contractor notified in writing.
C. Complete work, remedy deficiencies and send a second certification of Final Completion.

D. Architect will, upon receipt of a second certification of completion, make a second review and will notify the General Contractor listing observed deficiencies.

E. When Architect finds Work is complete, he will consider close out submittals.

F. Final payment of up to 10 percent of Contract Value (in addition to any retainage being withheld) will be withheld until all punch list items, close out submittals, certifications, training performance bonds, and Acceptance Demonstrations are provided and accepted.

1.19 DEMOLITION

A. As per National Electric Code. NFPA 90A requires the removal of abandoned cable. Any cables that are not active or terminated at both ends are not permitted to remain in within the building infrastructure.

B. The Telecommunication Contractor for this project and under this division will be responsible for removing and disposal of all existing unused communication cabling and devices. Coordinate with the CM and owner for storage of some devices that will be reutilize in this project.

1.20 REMOVAL WORK

A. Particular care will be taken to avoid creating hazards on the site or causing disruption of service in the adjoining buildings.

B. All existing cabling will be removed and discarded as per the NFPA 70 - National Electrical Code® which requires the removal of abandoned cable.

C. All existing equipment and material indicated to be removed will be done in a neat and workmanlike manner. All existing equipment indicated to be turned over to the Owner will be presented to the Owner in good condition at a location designated by the Owner. All other existing equipment and material that is removed will be removed from the premises.

D. Remove all abandoned wiring, raceways and equipment not built into building construction. Where ceilings or walls are removed, all abandoned wiring, raceways, supports and equipment will be removed and the ends of live services capped. Abandoned elements built into walls or located above existing ceilings that are not being removed will remain. All raceway ends will be capped and be marked abandoned.

E. Equipment and materials that are removed from the premises will be legally disposed of. Particular attention will be taken regarding the disposal of any and all hazardous materials. Provide written manifests and certifications of legal disposal or recycling of all hazardous or regulated material to the Owner. Include copies with closeout submittals.

1.21 SEISMIC REQUIREMENTS

A. Equipment and work will meet the restraint requirements for a Seismic Zone - 2 location including installation and connections of material and equipment to the building structure.
1.22 HAZARDOUS MATERIALS PROCEDURES

A. Should any suspected hazardous materials or hazardous related products or materials be encountered during the performance of the work, stop affected work immediately and so inform the Owner of the presence of hazardous materials.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Electrical Code referred to in these specifications is the National Electrical Code as currently adopted by the State of Connecticut. All work will be provided in strict compliance with the Electrical Code and all regulations that may apply.

B. Where standards exist, for a particular category, products used on this project will be listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL), and be approved or listed for the intended service and application.

C. These specifications do not undertake to repeat the requirements of codes, regulations or NRTL listing or labeling instructions. The Specifications or Drawings may require items or work beyond the requirements of applicable codes or regulations. The stricter, higher quality, greater quantity or higher cost will be provided. It is incumbent on the Installer, material and equipment suppliers to meet these specifications, applicable codes, regulations, and NRTL listing agency restrictions.

D. Manufacturers:

1. The word "Manufacturer" will include the Manufacturer, the Manufacturer's Representative, the Distributor, the Fabricator, and the Supplier of the particular classification of equipment, system, product, and material.
2. Each and every Manufacturer will refer to all Sections of the Specifications (Parts One - General, Two - Products and Three - Execution) and Drawings for requirements.
3. Each Manufacturer will be thoroughly familiar with all specified products relating to the Work and submit written objection prior to bid if he objects to the proposed use of any product.
4. During construction, each Manufacturer will visit the site periodically to observe the installation of supplied product. The Manufacturer will advise the Installer and the General Contractor immediately if supplied product is not being installed as recommended by the Manufacturer.
5. Upon completion of the Work, each Manufacturer will certify in writing that supplied product was installed according to the Manufacturer's recommendation and the installation is approved by the Manufacturer. Refer to Certifications.
6. Each Manufacturer, when accepting orders for material and equipment, agrees that submittal schedules and production schedules will be adjusted as required to accommodate material and equipment supplied for this project. Material and equipment will be manufactured and delivered to the site sufficiently ahead of schedule so as not to delay the completion of the Work.
7. The Contract Documents are based on the Manufacturer specified. If more than one Manufacturer is listed, the Contract Documents are based on the first Manufacturer named to establish functions, quality, space, and operating features, and all other Manufacturers are considered a substitution.

E. All work, equipment, and systems will be manufactured, provided, repaired, installed, and tested in accordance with the latest edition and all current amendments of the applicable
publications and standards of the organizations listed below as of the date of the Contract Documents. When the Specification requirements exceed the requirements of these publications and standards the Specifications will govern:

1. State Building Code (SBC)
2. Building Department Inspectional Services
3. American Society for Testing and Materials (ASTM)
4. Underwriter’s Laboratories, Inc. (UL)
5. Insulated Cable Engineers Association (ICEA)
6. National Electrical Manufacturers Association (NEMA)
7. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
8. American National Standards Institute, Inc. (ANSI)
9. National Fire Protection Association (NFPA)
10. Local Electric Code
11. Department of Public Safety (DPS)
13. Department of Labor USA. Safety and Health Regulations for Construction (OSHA)
14. Energy Codes
15. National Electrical Contractors Association (NECA)
17. Federal Communications Commission (FCC)
18. Utilities Serving Project.
19. Fire Department.
22. Any and all Federal, State and Local Standards, Codes and Authorities having Jurisdiction.
23. Building Industry Consulting Service International (BICSI)
24. In addition, all phases of the Telecommunications System installation will adhere to applicable Local Area Network (LAN) Specifications. The entire system and all components will be NRTL certified to appropriate ANSI/TIA/EIA performance rating category, and the following Industry standards:

   a. ANSI/TIA/EIA-568-B.1 and addenda "Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements"
   b. ANSI/TIA/EIA-568-B.2 and addenda "Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair"
   d. ANSI/TIA/EIA-568-B and addenda "Commercial Building Standard for Telecommunications Pathways and Spaces"
   e. ANSI/TIA/EIA-606-A and addenda "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"
   f. ANSI-J-STD-607-A and addenda "Commercial Building Grounding and Bonding Requirements for Telecommunications"
   g. ANSI/TIA/EIA-526-7
      "Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant"
   h. ANSI/TIA/EIA-526-14A
      "Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant"
   i. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments "Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling"
   j. ISO/IEC 11801:2002 Ed2.0 and amendments "Information technology - Generic cabling for customer premises"
k. CENELEC EN 50173:2000 and amendments "Information Technology - Generic cabling systems"

F. The Installer will have available at the job site at all times one copy of the latest edition of the National Electrical Code and ANSI/TIA/EIA Standards applicable to the work for use by the Installer and others.

G. The above requirements will not in any way limit responsibility or requirements to comply with all other codes, standards and laws.

H. Material, equipment, enclosures, and systems will be designed for use as required to suit the conditions, exterior or interior operation, dust tight, water tight, explosion-proof, or other special types.

I. Equipment will have as a minimum a factory coat of non-lead Manufacturer's standard finish paint unless otherwise indicated.

2.2 CABLE SUPPORTS

A. Refer to Section 2.1 - GENERAL for additional Manufacturer's requirements.

B. Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturer's:

1. D-Rings: Hubbell
3. Hook and Loop Fasteners: Hubbell,
4. Beam Clamps: Burndy, Minerallac, Kindorff, Steel City, OZ/Gedney
5. Split Mesh Strain
6. Reliefs (Kellums): Hubbell

C. D-Rings and J-Hooks will be sized to correctly support the number of cables which pass through them. Under no circumstances will cable quantity exceed 30 in any given support. Fill capacity will be as required by code for conduit. That is to say that every D-Ring or J-Hook will have a maximum of 40 percent fill capacity. Install additional supports as required.

D. Hook and loop fasteners will be designed for their specific application. For example, if a hook and loop fastener is used to support cables to a rack, it will have a grommeted opening for use with a 12-24 rack mounting screw.

E. Cable-ties are specifically prohibited.

F. Beam clamps will be steel with threaded bolt type closure. Spring steel or "quick-clip" type clamps are specifically prohibited.

G. Split mesh strain reliefs will be properly sized for each cable that they support. Only one cable will be installed in each split mesh strain relief.

2.3 BONDING AND GROUNDING JUMPER CABLE

A. Refer to Section 2.1 - GENERAL for additional Manufacturer's requirements.
B. Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturers:

1. Belden (No. 8669) or equivalent.

C. Jumper cable will be hollow braided, 60 amp capacity, copper.

D. Provide equal conductor as described in "B" above for aluminum equipment.

E. Jumpers will have compression or exothermic type terminals on both ends of cables. Terminals will be compatible with jumper cable material and equipment material in order to not have any degenerative reaction.

2.4 UNSHIELDED TWISTED PAIR (UTP) STATION CABLING SYSTEMS

A. Refer to Section 2.1 - GENERAL for additional Manufacturer’s requirements.

B. Provide products meeting or exceeding the requirements of the Drawings and Specifications from the following Manufacturer:

1. Hubbell NextSpeed Category 6 enhanced cable

C. Each work area outlet will consist of the following:

1. Single gang or double gang faceplate thermoplastic (nylon) with number of voice, data, video and sound jacks as indicated in the Specifications and Drawings.
2. The color of all faceplates will be "Hubbell White" unless otherwise indicated. Faceplates will have squared corners and will be same dimension as the electrical outlet plate being used on this project. Oversized face plates are specifically prohibited.
3. Furniture mounted work area outlet will be single gang with number of voice and data jacks indicated on Drawings or in Specifications, semi-flush mounted on furniture utilizing manufacturer provided box or opening in raceway. Adhesive mounting is not allowed. Furniture work area outlets will be coordinated with furniture manufacturer and will be specifically designed for powered furniture. Surface mounted outlets that are designed for general use applications are specifically prohibited.
4. Each faceplate will be able to support the jack modules, as required. All openings remaining after required numbers of jack modules have been installed in faceplates will be blanked off with manufacturer provided blank modules.
5. Manufacturer and Installer Company logo, signage or any advertisement will not be permitted on face of work area outlets.
6. Wall mounted telephone outlets will have modular jack integral to the faceplate and will have hardware to support the telephone device. Cover plate will be stainless steel. Provide wall mounted telephone outlets approved by the manufacturer of the work area outlets being provided on this project.
7. Work area outlets will have integral identification label holders with clear plastic cover panel. Adhesive label holders are specifically prohibited.
8. Work area outlets will have cable strain relief for each cable terminated. Cables will not rely on the conductor termination for support.
9. Work area outlets will have rear accessible modules and use Philips head cover plate screws.
10. Refer to Work Area Outlet Details for placement of jack
11. Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturers.
a. Wire and Cable: HUBBELL CABLE, OR HUBBELL CABLE PARTNERS  
b. Modular Jacks: HUBBELL  
c. Patch Panels: HUBBELL  
d. Cable Management: HUBBELL  
e. Cross Connect Blocks: HUBBELL  
f. Cross Connect Block Panels: HUBBELL  
g. Patch Cables: HUBBELL  

12. Cross Connect Cabling: Of same Wire and Cable Manufacturer.  
13. NOTE: Each of the products listed herein will be provided to ensure manufacturer warranty.

D. UTP Cabling system Pin/Pair Termination Assignment

1. The UTP cabling systems will have TIA/EIA T568B pin/pair termination assignment. All eight conductors provided will be properly and consistently terminated at both ends throughout the entire systems. Splitting pairs of conductors between multiple jacks or other devices is specifically prohibited.

E. Horizontal Cable

1. Twisted-Pair Cabling: All qualified cables will exceed the most severe requirements provided in the Industry Requirements by the worst case margins listed by the manufacturer:
   a. Hubbell NextSpeed® category 6 enhanced cable.  
   b. Cable sheath will be the following colors:
      1) Data – 1 Blue  
      2) Data – 2 Green  
      3) Data – 3 Purple  
      4) Voice – 1 Gray  

2. Modular Jacks (Work Area Outlets)
   a. All category 6 modular outlets will:  
   b. Be independently verified for category 6 compliance  
   c. Be available in black, white, red, gray, yellow, blue, orange, ivory, bright white, light ivory and alpine white  
   d. Have available a gravity feed (45 degree angled) design to help control patch cord bend radius as well as flush mount design  
   e. Utilizes TRI-BALANCE™ technology with optimized pair balance design and linear crosstalk response to address applications up to 250 MHz  
   f. Have 310 style insulation displacement connectors with quadrant pair isolation and a Pyramid™ wire entry system  
   g. Allow termination with a single conductor impact tool  
   h. Have available termination aid (included with each box of 20) for stabilization of module to facilitate lacing and impact during termination  
   i. Modules should feature category markings on front and rear of outlet  
   j. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity
k. Have rear protective strain relief caps with side or rear entry, which can be installed onto cable before or after termination
l. Support industry standards for T568B wiring options on each individual outlet
m. Allow installation from the front or rear of the faceplate, and allow for the jack to pass through the faceplate without re-termination
n. Be side-stackable for high-density solutions
o. Have a color matching protective, hinged or flexible door to protect the outlet from dust and other airborne contaminants
p. Provide color-coded, slide-in icons available for circuit identification
q. Allow for a minimum of 200 terminations without signal degradation below standards compliance limits
r. Be constructed of high impact, flame-retardant thermoplastic
s. Must be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards

3. Modular jacks color will be:
   a. Voice – 1 Gray (Category 6)
   b. Data – 1 Blue (Category 6)
   c. Data – 2 Green (Category 6)
   d. Data – 3 Purple (Category 6)

4. Each work area outlet and modular jack will have jack opening dust cover. Modular jacks that do not have integral dust covers will have dust covers installed on each modular jack.
5. Each 8-position modular jack will be color coded and have color-coded icons.
6. Horizontal cables will have single point IDC Type connection integral to the jacks only.
7. Jack modules will be flame retardant thermoplastic with integral cable strain relief.

F. Cable Management

1. Each equipment rack and equipment cabinet will have cable management panels with horizontal and vertical brackets.
   a. Cable management will be EIA nineteen-inch (518mm) rack mounted 1.75-inch (44mm) high panel with horizontal and vertical patch cable distribution rings, or approved equivalent and will be provided above and below each patch panel in the equipment rack.
   b. Patch panel manufacturer will furnish equipment rack cable management.
   c. Cable management for high density, IDC Type cross-connect block panels will be distribution rings integral to the panel or approved equivalent. Cable management will be provided above and below each cross connect block in the equipment rack.

G. Patch Cables and Line Cords

1. All category 6 compliant, modular equipment cords will:
2. Be factory assembled and 100% transmission tested with laboratory grade network analyzers for proper performance up to 250 MHz
3. Be backwards compatible with lower performing categories
4. Be equipped with identical modular 8-position plugs on both ends, wired straight through with standards compliant wiring
5. Utilize patented metallic isolator shields pairs inside plug for optimum NEXT performance and a 360 degree crimp for providing excellent plug-to-cable strain relief without causing pair deformation

6. Obtain the required performance without use of printed circuit board components

7. Incorporate internal stranded cordage isolator within a round, flame-retardant jacket to provide extended flex life and maintain ideal pair geometry

8. Use bend relief compliant boots (with optional color-coded icons) to ensure proper category 6 performance and feature a latch guard to protect against snagging

9. Use modular plugs which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, have 50 micro-inches minimum of gold plating over nickel contacts and are resistant to corrosion from humidity, extreme temperatures, and airborne contaminants

10. Be available in standard lengths of 3, 5, 7, 10, 15 and 20 ft. with custom lengths available upon request

11. Offer multiple cable colors (with color matching boots) in standard colors of black, white, red, gray, yellow, blue and green for proper circuit identification

12. Be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards

13. Meet the Hubbell NextSpeed category 6 enhanced performance specifications.

H. Cross Connect Blocks – Voice Cabling Systems

1. Category 6:
   a. Cross-connect blocks will be ANSI/TIA/EIA Category 6 (UL Category 6) color-coded, high density, IDC type terminations, 100, 200, or 300 pair, cross connect blocks. Type 66 IDC cross connect blocks or similar are not allowed. Cross-connect blocks will have integral standoff support.
   b. Modular connectors that allow pre-connectorized cables to be connected to the cross connect blocks are specifically prohibited. Cables will have single point IDC type connection to the cross-connect blocks only.
   c. Each (4 pair) connection will have color-coded identification label. Continuous label strips for multiple in-line terminations are acceptable.
   d. Provide with horizontal and vertical cable management.
   e. Provide separate, dedicated cross-connect blocks for voice cabling systems.

2. Cross-connect cabling will be NRTL certified that it meets or exceeds the TIA/EIA UL category rating of the system installed.

I. Cross Connect Blocks – Facilities Systems Cabling

1. Category 6:
   a. Cross-connect blocks will be ANSI/TIA/EIA Category 6 (UL Category 6) color-coded, high density, IDC type terminations, 100 pair, cross connect blocks. Type 66 IDC cross connect blocks or similar are not allowed. Cross-connect blocks will have integral standoff support.
   b. Modular connectors that allow pre-connectorized cables to be connected to the cross connect blocks are specifically prohibited. Cables will have single point IDC type connection to the cross-connect blocks only.
   c. Each (4 pair) connection will have color-coded identification label. Continuous label strips for multiple in-line terminations are acceptable.
   d. Provide with horizontal and vertical cable management.
c. Provide separate, dedicated cross-connect blocks for facilities cabling systems.

2. Cross-connect cabling will be NRTL certified that it meets or exceeds the TIA/EIA UL category rating of the system installed.

3. The frequency response will be from 12 MHZ to 890 MHZ and the return loss at any port will be no less than 14 dB. Isolation between any two tap outlets will be no less than 30 dB from 5 MHZ to 400 MHZ and no less than 15 dB from 470 MHZ to 806 MHZ.

4. The tap will be housed in a rugged cast aluminum housing provided with flanges to permit mounting on any flat surface.

PART 3 - EXECUTION

A. Loose materials will not be stored on-site. A "gang box" is acceptable to be placed in a location agreeable to the Owner and the General Contractor. The Installer is responsible for all equipment and materials and for their delivery until the system is deemed complete and accepted by the Owner.

B. A trailer may be used for the storage of materials to be located on the Owner's property at a location designated by the Owner and the General Contractor. Such on-site storage will be kept locked by the Installer. Security for the trailer and its contents will be strictly the responsibility of the Installer.

C. Protect existing in spaces where work is being performed to protect it from damage and from the accumulation of dirt.

D. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section will be replaced, or at the Owner's option, repaired with similar materials, workmanship and quality.

E. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits in order to determine scope of work.

F. Maintain the existing building in operation at all times during the entire construction period. If it is necessary to have a system shutdown, a written request for approval will be submitted in advance stating the estimated shutdown time. Work will be planned to minimize shutdown. Shutdowns will be at the convenience of the Owner and, if necessary, on premium time.

G. Clean and touch up all equipment, materials and work sites at the completion of work in each area.

H. Certain portions of the work area may be occupied during construction. Determine which areas and schedule work accordingly and include necessary premium time.

I. Make sure necessary provisions to provide continuous service of all existing systems throughout all occupied areas.

J. Existing System Operation:

1. It is imperative that completely operable and operating computer systems be maintained in all areas of the building where such operation is provided.

2. Temporary and short interval interruptions of the ability of a single existing system zone in any area of the building to operate to complete installation of the building network according to the building construction phases may be tolerated with the express written
permission of the Owner. This permission will only be considered if a written request for such an interruption is made before the actual need therefore.

3.2 WORK AREA OUTLETS

A. All work area outlet locations will be as indicated on the Drawings. Uniquely label each work area outlet and jack within the outlet according to the numbering convention outlined in the section on labeling.

B. Work area outlets installed in casework will have their cables installed within the conduit provided or raceway provided.

C. Install jack and connector modules as indicated in the details on the Drawings.

D. Work area outlets will be seated properly and will be installed level on walls and parallel to building elements as required.

3.3 TERMINATIONS

A. All copper and fiber conductors (every cable) will be completely terminated at both ends.

3.4 SEALING OF PENETRATIONS AND OPENINGS

A. Smoke and Fire Stopping Seals:

1. All firestop systems will be installed in accordance with the Manufacturer's recommendations and will be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

2. Provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion will not be substantially increased.

3. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings will be fire stopped using approved methods and NRTL listed products to maintain the fire resistance rating.

4. Installation restrictions of the listing agencies will be strictly adhered to (e.g. 24 inch (610 mm) minimum horizontal separation between boxes on opposite sides of the wall, maximum square inch opening in wall).

5. Fire stopping in sleeves or in areas having small openings that may require the addition or modification of installed cables or raceways will be soft, pliable, non-hardening fire stop putty. Putty will be water resistant and intumescent.

6. Fire stopping in locations not likely to require frequent modification will be NRTL listed putty or caulk to meet the required fire resistance rating.

7. Box penetrations into a fire rated wall or shaft will have a fire-stopping pad installed on the back of the box.

8. Fire stopping of cable trays through walls will be with NRTL listed bags to meet the required fire resistive rating and that will not allow products of combustion to pass through the protected opening. The NRTL listed bags will be installed inside and on both sides of the opening as required to meet the required resistive fire rating of the wall.

9. Fire stopping materials will be NRTL listed to UL 1479 (ASTM E814). Installation methods will conform to a UL fire stopping system. Submit specifications and installation drawings for the type of material to be used. Fire stopping materials will be as manufactured by 3M, International Protective Coatings Corp., Specified Technologies, Inc., Carborundum Company, RayChem, Nelson Fire Stop or approved equal.
3.5 INSTALLATION

A. All cabling will be installed in conduit where indicated on plans, or will be installed open using other methods, approved by Engineer, such as J-Hooks.

1. Install wiring, per Manufacturers recommendations.

B. All conduits and raceways will have plenum rated pull strings remaining after cable is pulled.

C. Impedance and Level Matching:

1. Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

D. Layout of structured cabling systems equipment cabinet and racks

1. The equipment cabinet and racks will contain the following equipment:
   a. Fiber optic patch panel
   b. Fiber optic cable management
   c. Surge protected power strip
   d. Patch panels - Horizontal distribution
   e. Horizontal distribution cable management
   f. Patch cords

2. The fiber patch panel will be placed at the top of the active rack and cabinet.
3. Provide 1 RU wire management above and below the fiber patch panel.
4. The remaining space within the cabinet is for the installation of network electronics - provided by the Owner.
5. Grounding bars will be installed as per Division 26 specifications at location shown on drawings.

3.6 LABELING

A. Labeling procedure will meet EIA/TIA 568A, 606-A (Class 2 Administration) and BICSI Standards.

B. The labeling scheme will be provided as follows at all locations within the cable infrastructure:

1. Labeling will follow the following standard:
   a. Location identification will start from the left, as you walk in the doorway, and continue around the room in a clockwise direction.
   b. Data drops will be labeled with the room number and sequential letters, starting with 'A' (e.g. the first three data drops in Room 201 would be labeled 201A, 201B and 201C). Skip the letter 'V'.
   c. Voice drops will be labeled with the room number and the letter 'V' (e.g. the telephone drop in Room 128 would be 128V).

C. Hand-written and embossed type labels are specifically prohibited. In addition, provide the following:
1. Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
2. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
   a. Inside receptacle box at the work area.
   b. Behind the communication room patch panel or punch block.
3. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications room location that is specific to the facilities terminated therein.
4. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606(A) standard color codes for termination blocks.
5. Mount termination blocks on color-coded backboards.
6. Labels will be machine-printed. Hand-lettered labels will not be acceptable.
D. Use industry standard EIA/TIA and BICSI color codes as specified herein and maintain consistent color-coding throughout the building.

3.7 FIRESTOPPING
A. Work, in general, includes furnishing and installing fire and smoke barrier penetration seals for openings in floor, walls, and other elements of construction.
B. Related Sections:
   1. Division 26 - Conduit.
C. Applicator Qualifications: Two years experience installing UL classified firestopping.
D. Performance of materials will have been tested to provide fire rating equal to that of the construction.
E. Shop Drawings:
   1. Submit shop drawings showing each condition requiring penetration seals indicating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.
   2. Submit a copy of UL illustration of each proposed system indicating Manufacturer approved modifications.
F. Manufacturer’s Data: Submit copies of Manufacturer’s specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
G. Applicator's Qualification Statement: List past projects indicating required experience.
H. Existing Project Conditions:
   1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

I. Environmental Requirements:

1. Furnish adequate ventilation if using solvent.
2. Furnish forced air ventilation during installation if required by Manufacturer.
3. Keep flammable materials away from sparks or flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

J. Warranties: Submit copies of written warranty, minimum of one year, agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted Manufacturer’s data as an inherent quality of the material for the exposure indicated. The guarantee period will be one year from date of substantial completion.

K. Acceptable Manufacturers: Subject to compliance with requirements, provide products of Nelson Fire Protection Products or Engineers approved equal as further defined in the Systems and Applications Schedule in Part 3 of this section.

L. Materials:

1. Provide materials classified by UL to provide Fire Barrier equal to time rating of construction being penetrated.
2. Provide asbestos free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E-814.

M. Preparation: Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

N. Installation:

1. Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory and in accordance with Manufacturer’s instructions.
2. Seal holes or voids made by penetration to ensure an effective smoke barrier.
3. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
4. Protect materials from damage on surfaces subject to traffic.

O. Field Quality Control:

1. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
2. Keep areas of work accessible until inspection by applicable code authorities.
3. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.
P. Adjusting and Cleaning:

1. Clean up spills of liquid components.
2. Neatly cut and trim materials as required.
3. Remove equipment, materials and debris, leaving area in undamaged clean condition.

Q. Systems and Application Schedule:

<table>
<thead>
<tr>
<th>CONSTRUCTION CONDITION</th>
<th>UL DESIGNATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Metal Pipe or Conduit Through Round Opening in brick, CMUs, and Concrete</td>
<td>49, 95, 138, 202</td>
</tr>
<tr>
<td>2 Non-metallic (Plastic) Pipe or Conduit Through Opening in Brick, CMUs, and Concrete</td>
<td>64</td>
</tr>
<tr>
<td>3 Metal Pipe or Conduit Through Gypsum Board Wall</td>
<td>137</td>
</tr>
<tr>
<td>4 Non-metallic (Plastic) Pipe or Conduit Through Gypsum Board Wall</td>
<td>148</td>
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<tr>
<td>5 Metal Pipe or Conduit Through Wood Construction</td>
<td>59, 169</td>
</tr>
<tr>
<td>6 Non-Metallic (Plastic) Pipe or Conduit Through Wood Construction</td>
<td>160, 167</td>
</tr>
</tbody>
</table>

3.8 CABLING SYSTEM TESTING

A. General:

1. Cabling systems will meet or exceed the electrical and transmission characteristics of the systems specified.
2. Cable segments and links will be tested and certified from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).
3. The Installer will test all cables installed under this Section.
4. The systems will not be considered certified until the tester has acknowledged that the performance of the physical layer of each system has been fully tested and is operational at the completion of the installation phase.
5. After the installation is complete, in addition to any other required testing as described herein, and at such times as the Owner/Engineer directs, the Contractor will be present while the Owner conducts an operating test for approval. The installation will be demonstrated to be in accordance with the requirements of this specification. Any defects revealed will be corrected promptly at the Contractor's expense and the tests performed again.
6. After review of the completed test results, the Owner/Engineer reserves the right to retest up to 100 of the installed cables, utilizing the Contractor's tester and the Contractor's labor.

B. Equipment Manufacturer’s Factory Test:

1. Each cable and equipment Manufacturer will factory test their respective products being installed on this project and provide test reports at time of delivery. Provide separate respective test reports indicating that they meet or exceed the latest applicable TIA/EIA Standards and technical bulletins.
2. All other products relative to this specification will be tested to its respective industry strictest standards.
3. Each Manufacturer will factory test their respective cable or equipment provided to this project at several lower frequency levels, including the minimum and maximum frequency...
level indicated herein. The test reports will indicate test results for at least five equal incremental frequency levels including the maximum required.

C. Field Testing Equipment: Submit during shop drawing review on the testing equipment to be utilized on this project. Provide a hard copy of all field testing.

1. Unshielded Twisted Pair Testing Equipment:
   a. Cable tester will be NRTL certified for EIA/TIA TSB95.
   b. The cable tester will have a wide variety of preprogrammed cable types as an integral part of its testing system and have the ability to test cables less than 6 feet (6ft.) from the test point.
   c. All balanced twisted-pair field testers will be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate will be provided for review prior to the start of testing.
   d. Testing will be accomplished using level III or higher field tester that is loaded with the most current version of test software by the manufacturer of the test equipment.
   e. Provide factory calibration report of field test equipment.

3.9 CATEGORY 6 CABLE TESTING

A. Cabling systems will meet or exceed the electrical and transmission characteristics of the systems specified.

B. Cable segments and links will be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).

C. The system will not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.

D. Provide test reports upon completion of each phase of the project.

E. After the installation is complete, in addition to any other required testing as described herein, and at such times as the Owner/Engineer directs, the Contractor will be present while the Owner conducts an operating test for approval. The installation will be demonstrated to be in accordance with the requirements of this specification. Any defects revealed will be corrected promptly at the Contractor's expense and the tests performed again.

F. After review of the completed test results, the Owner/Engineer reserves the right to retest up to 100 of the installed cables, utilizing the Contractor's tester and the Contractor's labor.

G. Equipment Manufacturer’s Factory Test

1. Each cable and equipment Manufacturer will factory test their respective products being installed on this project and provide test reports at time of delivery. Provide separate respective test reports indicating that they meet or exceed the latest applicable TIA/EIA Standards and technical bulletins.

2. All other products relative to this specification will be tested to its respective industry strictest standards.
3. Each Manufacturer will factory test their respective cable or equipment provided to this project at several lower frequency levels, including the minimum and maximum frequency level indicated herein. The test reports will indicate test results for at least five equal incremental frequency levels including the maximum required.

H. Field Testing Equipment: Submit during shop drawing review on the testing equipment to be utilized on this project. The installer will test all cables installed under this Section.

1. Unshielded Twisted Pair Testing Equipment:
   a. The cable tester will have a wide variety of preprogrammed cable types as an integral part of its testing system and have the ability to test cables less than 6 feet (6ft.) from the test point.
   b. Testing will be accomplished using level III or higher field tester that is loaded with the most current version of test software by the manufacturer of the test equipment.
   c. Provide factory calibration report of field test equipment.

I. Testing Procedures:
   1. Testing will conform to TIA/EIA-568-B.1 standard or current version of the Category 6 standard.
   2. Testing will be to the Permanent Link Test Parameters.
   3. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.
      a. If copper cables contain more than the following quantity of bad pairs, or if outer sheath damage is cause of bad pairs, remove and replace the entire cable at no cost to the Owner:

      | CABLE SIZE | MAXIMUM BAD PAIRS |
      |------------|-------------------|
      | <100       | 1                 |
      | 101 to 300 | 1 – 3             |
      | 301 to 600 | 3 – 6             |
      | >601       | 6                 |

   b. If horizontal cable contains bad conductors or shield, remove and replace cable.
   4. Test each UTP cable and passive components. Provide certification that entire installation of UTP cabling, equipment and jacks are NRTL certified meeting or exceeding a minimum of category performance specified on all four pairs of conductors.
   5. Tests will be based on each pair of conductors and not the aggregate multiple pair results.
   6. Test all installed cable segments end-to-end, from the telecommunications room horizontal patch panel/cross connect block panel to each work area outlet and from each telecommunications room backbone patch panel/cross-connect block panel to respective main cross connect, and from the work area outlet to the main cross-connect (through patch cables or cross- connect wiring) with a Signal Injector, Graphical Link Testing Meter and Time Domain Reflectometer (TDR) for compliance to latest TIA/EIA performance requirements, as well as NEXT, ELFEXT, structural return loss, alternating power sum, opens, shorts, continuity, cable length, and characteristic impedance.
7. Provide report indicating failures and what actions were taken to ensure a passing horizontal cable and its terminations. Any cable failing the certification test (Fail, Fail* or, Pass*) must have remedial work done to provide a full pass test result; Remediation may include re-termination or replacement of the cable, which fails. No cables passing within tolerance only (Conditional Pass*) will be accepted.

J. Test results:

1. The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.

2. Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

3. Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).

4. Test Results will include the following:

   a. Applicable room number of jack location (room number per Contract Documents)
   b. Applicable Telecommunications Room number
   c. Circuit I.D. number with corresponding jack identifier
   d. Wire Map – will include the following:

      1) Continuity to the remote end
      2) Shorts between any two or more conductors
      3) Crossed pairs
      4) Reversed pairs
      5) Split pairs
      6) Any other mis-wiring

e. Length
f. Insertion Loss
g. Near-end Crosstalk (NEXT) Loss
h. PS-NEXT (Power Sum Near End Cross Talk)
i. ELFEXT (Equal Level Far End Cross Talk)
j. PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)
k. Propagation Delay
l. Delay Skew
m. Return loss

5. The Owner and Engineer reserve the right to observe testing and/or randomly sample completed links for conformance to project specifications.

6.  

3.10 STRUCTURED CABLING SYSTEMS DOCUMENTATION

A. Label all equipment as herein specified.

B. Provide:

2. Hard copy documentation of test results for every cable segment and link in 3-ring binder. Documents will include measured values as well as whether or not the test passed.

3. "Record" drawings indicating location of all equipment including but not limited to work area outlets, patch panels, cross connect blocks, on each segment and cable routing. Indicate labeling for each piece of equipment.

4. Record drawings indicating actual cable routes and outlet identifiers. Provide respective copies mounted in each telecommunications room, and the main cross connect.

C. Provide "as-built" Drawings on AutoCAD Version 2004 or higher to the Owner. Obtain copy of original Drawings from the Architect.

D. Submit NRTL certification that the voice, data and video cabling systems meets the transmission requirements of TIA/EIA 568A and TSB72.

E. Submit NRTL certification that the fiber optic cabling system meets the transmission requirements of TIA/EIA 455, 492AAAA, 568A and TSB72.

F. Provide installer/tester certificate indicating compliance with transmission and reliability requirements for all components of the systems installed.

3.11 TRAINING

A. As a minimum training sessions will consist of the following:

1. General project information and review will be by the General Foreman or Superintendent of the Trade.

2. Specific system training will be by a Factory Trained Representative.

3. Provide a complete review of the project and systems including, but not limited to, the following:

   a. Review each Record Drawing (use of typicals is acceptable).
   b. Note equipment layouts, locations and control points.
   c. Review each system.
   d. Review system design operation and philosophy.
   e. Review alarms and necessary responses.
   f. Review standard troubleshooting techniques for each system.
   g. Review areas served by equipment.
   h. Identify color codes used.
   i. Review features and special functions.
   j. Review maintenance requirements.
   k. Review operation and maintenance manuals.
   l. Respond to questions (record questions and answers).

4. After training, walk the entire project, review each equipment room and typical locations. Explain equipment and proper operation.

B. During the instruction period the Owner and Maintenance Manual will be used and explained.

C. The Owner and Maintenance Manual material will be bound in 3-ring binders and indexed. On the edge of the binder provide a clear see-through plastic holder with a typed card indicating
the Project name, the Architect's name, the installer's name and the Volume number (e.g., Vol. No.1 of 2).

D. Provide name, address and telephone number of the Manufacturer’s representative and Service Company for all items supplied so that the source of replacement parts and service can be readily obtained.

1. Include copies of Manufacturer’s and installer's warranties and maintenance contracts and performance bonds properly executed and signed by an authorized representative.
2. Include copies of all test reports and certifications.

3.12 ACCEPTANCE DEMONSTRATIONS

A. Systems installed under this Section will be demonstrated to the Owner and Architect. Demonstrations are in addition to necessary testing and training sessions. Notify all parties at least 7 days prior to the scheduled demonstration. Schedule demonstrations in cooperation with and at times convenient to all parties and so as to not disturb ongoing activities.

B. Systems will be tested prior to the demonstrations and each system will be fully operational and tested prior to arranging the Acceptance Demonstration. Final payments will be withheld until a satisfactory demonstration is provided for all systems indicated or requested.

C. If the demonstration is not totally complete, performing all functions, features and connections or interfaces with other systems, or if there is a failure during the demonstration, additional demonstrations will be arranged. Provide and pay for all costs, labor and expenses incurred for all attendees for each additional demonstration required for acceptance and demonstration of complete system operation.

D. Demonstrations will be scheduled in ample time to complete all activities prior to final acceptance and Owner occupancy. Demonstrations will take place at least 30 days prior to the scheduled project completion date and 30 days prior to owner's use and occupancy.

E. As a minimum, provide demonstrations for systems indicated under "Work Included" under Part One of the Specifications. Provide demonstrations of additional systems as requested by the Owner, or Architect.

3.13 PROJECT OWNER COORDINATION

A. Prior to Substantial Completion of the project and in ample time to address and resolve any coordination issues, request and arrange meetings between the Owner, Owner's Vendors and Consultants, Architect and General Contractor to discuss the Scope of Work for each system being provided and the interface required for a fully functional and operational system upon project completion. Initial meetings will be scheduled three months prior to the scheduled Substantial Completion date or as soon as Submittals are submitted and reviewed for projects with shorter schedules.

B. At these meetings the required interface with the Owner will be reviewed, requests for information required to complete programming or for coordination will be presented and system operation and philosophy will be discussed.

C. Additional meetings will be held as requested by any party so that all issues are resolved and with the goal and intent being that all systems are fully operational and functional upon project.
Substantial Completion and that the responsibility for all components required is clearly established.

3.14 CLEANING UP

A. Upon completion of all work, and testing, thoroughly inspect all exposed portions of the installation and completely remove all exposed labels, markings, and foreign material.

B. The interior of all boxes and cabinets will be left clean; exposed surfaces will be cleaned and plated surfaces polished.

C. Repair damage to finish surfaces resulting from work under this Section.

D. Remove material and equipment from areas of work and storage areas.

E. All equipment will be clean from dirt, dust, and fingerprints prior to final acceptance.

F. Touch up all damaged pre-finished equipment using materials and methods recommended by the Manufacturer.

3.15 PROJECT CLOSEOUT

A. Provide close out submittals as required herein and in SECTION 01700 - PROJECT CLOSEOUT including the following close out submittals.

1. Operation and Maintenance Manuals
2. Record Drawings
3. Test Reports
4. Warranty certification form Manufacturer’s
5. Extra Materials
6. Provide factory calibration report of field test equipment

B. Obtain written receipts of acceptance close out submittals submitted. Receipts will specifically detail what is being delivered (description, quantity and specification section) and will be dated and signed by firm delivering materials and by the Owner’s Representative.

C. Provide patch cables as follows:

1. Provide one UTP patch cable for each horizontal cable terminated within the patch panel.
2. Coordinate patch cable lengths with the Owner prior to ordering.
3. Provide fifteen percent (15%) spare patch cables and line cords for each cable type and length of each type provided.
4. Provide ten percent (10%) spare dust covers provided to the Owner at the completion of the project.

D. Provide equipment cords as follows:

1. Provide one 10-foot (3 m) Category 6 equipment cord for each data connector installed in data Work Area Outlets.
2. Coordinate equipment cord lengths with the Owner prior to ordering.
3. Provide fifteen (15%) spare equipment cords.
E. Provide record drawings indicating actual cable routing and cable terminations including all required identifiers. Provide a half size laminated set of drawings mounted in the Main Communications Equipment Room.

F. All sketches, drawings, and charts herein are for the purpose of providing for specifications in a simplified format. Errors and omissions in such do not relieve the Contractor of the responsibility for providing a fully complete, secure and properly operating integrated instructional technology network system suitable for the intended use. Bidders must obtain a complete set of Project Drawings and Specifications to determine the full scope of work. In case of conflict, the Project Drawings and Specifications will prevail.

END OF SECTION 169900