CITY OF TAMPA

Bob Buckhorn, Mayor **CONTRACT ADMINISTRATION DEPARTMENT**

Michael W. Chucran, Director

ADDENDUM NO. 4

DATE: December 2, 2015

Contract 16-C-00007; Wayne C. Papy Center Renovations

Bidders on the above referenced project are hereby notified that the following addendum is made to the Contract Documents. BIDS TO BE SUBMITTED SHALL CONFORM TO THIS NOTICE.

Item 1: Delete the first line on page I-1b.

Item 2: Replace Proposal page P-3 with the attached Proposal page P-3R.

Item 3: Add the attached Mechanical specifications 230500 thru 233713.

Item 4: Add the attached Electrical specifications 260500 thru 265101.

Item 5: Add the attached Plumbing specifications 220500 thru 224000.

Item 6: Add the attached Mechanical, Electrical and Plumbing drawings.

Item 7: Sheet A2.2; Key Note 3 Clarification; remove “Additive Alternate #1” from end of Note. Add “Basis of design is Stagestep, Inc.” www.stagestep.com.

Item 8: Sheet A8.1; Door Schedule; Clarification; The following door numbers are changed as follows: Door No. 100 is changed to Door No. 105, Door No. 101 is changed to Door No. 106; Door No. 102 is changed to Door No. 108; Door No. 103 is changed to Door 109; Door No. 105 is to be deleted.

Item 9: Sheet A8.1; Window Types; Clarification; Windows Type A1 is ¼” tinted tempered glass in aluminum storefront.

Item 10: Sheet M1.1; Clarification; EG-1 shown in Existing Janitor Storage Room 115 is to be installed in Existing Storage Room 114.

All other provisions of the Contract Documents and Specifications not in conflict with this Addendum shall remain in full force and effect. Questions are to be e-mailed to Contract Administration@tampagov.net.

Jim Greiner

Jim Greiner, P.E., Contract Management Supervisor

Contract Item No.	Estimated Quantity	Description and Price in Words	Computed Total Price for Item in Figures
BASE BID	LS	The work includes the furnishing of all labor, equipment, and material for the renovation of existing gymnasium and dance buildings including existing restrooms, 3300 sf of new “Marley” type dance floor with sub flooring and vented cove base, as shown and indicated but not limited to Sheet A2.2, interior metal stud framing, drywall, painting, plumbing, electrical, any allowances that may be listed in Section 01020, and with all associated work required for a complete project in accordance with the Contract Documents. _____ _____ dollars and _____ cents (BASE BID) LS	$_____

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 MECHANICAL NOTES

A. General
1. Install all equipment, piping, ductwork, and components with sufficient access for maintenance, filter replacement, etc.
2. Install ductwork, piping, etc., as high as possible above the ceiling.
3. Provide an access panel at all locations where a valve, damper, or other device requiring service is installed behind inaccessible ceiling or wall.
4. Provide flexible connection at every duct connection to equipment.
5. Provide a duct mounted smoke detector in supply duct for all air handling units having supply air greater than 2,000 CFM.
6. Provide a fire damper at every duct penetration of a fire rated wall or ceiling, whether shown on drawings or not.
7. Where fire dampers, duct mounted smoke detectors, control dampers or duct coils are required, provide duct access doors to allow for inspection of device. Provide ceiling/wall access panels where installed behind inaccessible ceiling or wall. Panels in rated construction shall have UL label visible.

B. Ductwork
1. Round ducts and fittings shall be spiral seam construction, manufactured from G-60 galvanized steel according to ASTM A924-A653 and as specified. Rectangular ductwork shall be manufactured from G-60 galvanized sheet metal steel according to ASTM A653-A653M and as specified.
2. All duct construction, installation, and supports are to comply with latest edition of SMACNA's "HVAC Duct Construction Standards". All ductwork shall be 2" pressure class unless otherwise noted.
3. Prior to ordering and fabricating any equipment, the contractor is to examine the physical conditions at the project site to determine any necessary modifications and verify sufficient clearances are available for installing equipment, ductwork, piping, and appurtenances and pipe routing on documents is diagrammatic and may require field modifications to avoid interfaces with building structure and other conditions.
4. Duct sizes given are inside free area dimensions.
5. Install runout ducts with 45 degrees lateral take-offs, unless otherwise noted. Where the height of main duct is less than a runout duct diameter/height, provide a transition fitting of equivalent area to the runout duct.
6. Provide and install volume control dampers in take-off fitting/runout duct to each supply diffuser, return grille, exhaust grille, and in each duct branch serving two or more terminals, whether shown on drawings or not.
7. Flexible ducts shall not exceed 5 feet fully stretched length. Install flexible ducts without kinks, and with maximum 15% compression from fully stretched length.

8. Install VAV air terminals with 3 inlet diameters of straight, inlet size duct before the air terminal connection. If inlet duct run exceeds 5 feet, increase inlet size duct by 4 inches up to 3 inlet diameters of straight duct.

C. Air Distribution
   1. Diffusers, registers and grilles shall be provided as indicated in air distribution schedule and specified on drawings.
   2. Coordinate exact locations of air distribution equipment with the ceiling layout and lighting devices.
   3. Ceiling supply diffusers shall be 4-way throw unless note otherwise.
   4. The return air from individual spaces is through return air plenum above the ceiling.

D. Test & Measurement
   1. Test, adjust, and balance each system in accordance with ASHRAE Standard 11/SMACNA Tab Manual.
   2. Provide a test and balance report upon completion of project work and prior to final inspection.

1.2 GENERAL NOTES

A. General
   1. Provide shall be defined as “furnish and install”.
   2. The complete mechanical system which shall be provided by the contractor shall include all work, materials and apparatuses specified herein after and indicated on the drawings. All workmanship shall be of the highest quality and no substandard work will be accepted.
   3. Provide all work and mechanical system components required, as specified, and indicated on the drawings. The work shall include complete testing of all mechanical systems at the completion of the work and making any changes and adjustments necessary for the proper functioning of the systems.
   4. Make a thorough examination of the site and the contract documents prior to executing the contract. No claim for additional compensation will be recognized for difficulties encountered which an examination of site conditions and contract documents would have revealed.
   5. The plans are generally diagrammatic and indicate the design intent of work to be performed under this contract.
   6. Coordinate all work with other trades as required to avoid interferences between trades (i.e. beams, conduits, equipment, piping, etc). Provide the required clearances around all electrical panels, switchgear, etc. If conflicts exist, they shall be brought to the engineer of record prior to resolving conflict and prior to installation.

B. Work Performance
   1. Job site safety and worker safety is the responsibility of the contractor.
   2. Arrange, phase and perform all work during time periods scheduled with and acceptable to the Owner before proceeding. No additional compensation will be authorized for work necessitated by ill-timed, defective, or non-conforming work.
   3. The contractor shall ensure that all systems operate as designed and/or required and shall review their operation with the Owner upon completion of construction

and testing. Compile complete and updated as-built drawings/documents and issue one (1) set to the Owner.

C. Codes & Standards
   1. Perform work in compliance with the latest edition of all applicable, federal, state and local codes, regulations and standards, to include those listed below, adopted by the authority having jurisdiction. Where differences may occur the more stringent requirements shall govern. In case of conflict provide written notification and obtain a decision from the Architect or Engineer.
      a. NFPA 90A: Standard for the Instllation of Air Conditioning and Ventilating Systems.
      b. NFPA 101: Life Safety Code
      c. NFPA 241: Standard for Safeguarding Construction, Alteration and Demolition Operations
      d. FBC: Florida Building Code
      e. OSHA Part 1910: Occupational Safety and Health Standards
      f. OSHA Part 1926: Safety and Health Regulations for Construction

D. Warranty
   1. Contractor shall warranty all work for a period of one (1) year from date of substantial completion. Contractor shall rectify any defects due to faulty materials or workmanship and pay for any damage to other work resulting therefrom within said period. The Owner will give notice of defects with reasonable promptness.
   2. Provide complete warranty information for each item to include product or equipment; date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

E. Submittals
   1. Submit five (5) complete bound hardcopy sets or one (1) electronic copy. The engineer will return minimum one (1) copy of submittal no later than 21 calendar days from receipt.
   2. Approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval, will not be permitted at the job site.
   3. Submittal shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Architect/Engineer to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
   4. Submittal for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
   5. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.
   6. Submittals shall be marked to show specification reference including the section and paragraph numbers. Submit each section separately and include the following:
      a. Information that confirms compliance with contract requirements. Include the manufacturers name, model or catalog numbers, catalog information,

technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

b. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

7. Manuals: Submit in accordance with "1" above for review and comment.
   a. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish three (3) copies, bound in hardback binders, (manufacturer's standard binders) or an approved equal. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
   b. Inscribe the following identification on the cover: The words "Maintenance and Operation Manual, the name and location of the system, equipment, building, name of contractor, and contract number". Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
8. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Engineer to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
9. Product Data:
   a. Submit Product Data for review on all scheduled pieces of equipment, equipment requiring electrical connections or connections by other trades, and as required by the contract documents. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures and similar data. Manufacturer's abbreviations or codes are not acceptable.

1.3 CONTRACT DOCUMENTS

A. Examine all drawings and specifications carefully before submitting a bid. Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction. If discrepancies or conflicts occur between drawings, or between drawings and specifications, notify the Engineer in writing prior to bid date; however, the most stringent requirement shall govern.

B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, Contractor shall make use of all data in all of the contract documents and shall verify this information at the building site.

C. The drawings indicate required size and points of termination of pipes, conduits and ducts and suggest proper routes to conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the responsibility of the Contractor to make the installation in

such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.

D. Furnish, install and/or connect with appropriate services all items shown on any drawing without additional compensation.

E. Consider the terms "provide" and "install" as synonymous with "furnish and install".

1.4 CODE REQUIREMENTS

A. Perform work in accordance with the following codes and any applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
   1. ASHRAE:
      a. Standard 15 – Safety Standard for Refrigeration Systems
      b. Standard 55 – Thermal Environmental Conditions for Human Occupancy
      c. Standard 62 – Ventilation Standard for Acceptable Indoor air Quality
      d. Standard 90.1 – Energy Standard for Buildings Except Low Rise Residential Buildings
   2. Occupational Safety and Health Regulations (OSHA)
   3. National Fire Protection Association (NFPA):
      a. NFPA 1 – Uniform Fire Code
      b. NFPA 54 – National Fuel Gas Code
      c. NFPA 70 – National Electrical Code
      d. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilation Systems
      e. NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems
      f. NFPA 91 – Standard for the Installation of Blower and Exhaust Systems
      g. NFPA 101 – Life Safety Code
   4. Florida Building Code 2010 Edition:
      a. Accessibility Code
      b. Energy Conservation Code
      c. Fuel Gas Code
      d. Mechanical Code
      e. Plumbing Code
   5. Florida Administrative Code
   6. ADA Accessibility Guidelines for Buildings (ADAAG)

B. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.

C. The installer shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations.

1.5 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Specifications and standards are minimum requirements for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

B. Whenever a reference is made to a standard, installation and materials shall comply with the latest published edition of the standard at the time project is bid unless otherwise specified herein.

1.6 QUALITY ASSURANCE

A. The intent of the Division 23 specifications and the accompanying drawings is to provide a complete, operable, and satisfactory HVAC system as shown, specified, and required by applicable codes. Include all work specified in Division 23 and shown on the accompanying drawings.

B. The drawings that accompany the Division 23 specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Follow the drawings as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the building, subject to approval, and without additional cost to the contract.

C. Coordinate exact requirements governed by actual job conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

D. Systems shall be built and installed to deliver their full rated capacity at the efficiency for which they were designed.

E. The entire HVAC system shall operate at full capacity without objectionble noise or vibration.

F. Materials and Equipment:
   1. Furnish new and unused materials and equipment. Work shall be of good quality, free of faults and defects.
   2. All equipment shall fit in the space provided.
   3. Each piece of equipment provided shall meet all detailed requirements of the drawings and specifications and shall be suitable for the installation shown.
   4. Where two or more units of the same class of equipment are provided, use products of the same manufacturer; component parts of the entire system need not be products of the same manufacturer.
   5. Manufacturer's model names and numbers used in these drawings and specifications are subject to change per manufacturer's action. Contractor shall

therefore verify model names and numbers with manufacturer's representative before ordering any product or equipment.

G. Workmanship:
   1. Install all materials in a neat and workmanlike manner.
   2. Follow manufacturer's directions. If they are in conflict with the contract documents, obtain clarification before starting work.

H. Cutting and Patching:
   1. Cutting, patching and repairing for the proper installation and completion of the work specified in this division, including plastering, masonry work, concrete work, carpentry work, firestopping, and painting, shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate division of work. Additional openings required in building construction shall be made by drilling or cutting.
   2. Fill holes which are cut oversize so that a tight fit is obtained around the objects passing through.
   3. Do not pierce beams or columns without permission of the Port and then only as directed.
   4. New or existing work that is cut or damaged shall be restored to its original condition. Where alterations disturb existing finishes, the surfaces shall be repaired, refinished and left in condition existing prior to commencement of work.
   5. Equipment of higher electrical characteristics may be provided if proposed equipment is approved in writing and connecting electrical services are appropriately modified.

1.7 PERMITS, FEES, AND INSPECTIONS

A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems charges, impact fees and inspections.

B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

1.8 PROVISIONS FOR LARGE EQUIPMENT

A. Make provisions for the necessary openings in the building to allow for admittance of all equipment.

1.9 PROJECT CONDITIONS

A. Coordinate exact requirements governed by actual job conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

1.10 RECORD DRAWINGS

A. Keep a record set of the contract documents at job site and continuously update deviations from design by marking up (in red) drawings. When work is complete give Owner copies of record drawings.

1.11 FILTERS

A. Provide construction filters during construction and replace with clean filters prior to testing and balancing of system.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. PVC Pipe: ASTM D 1785, Schedule 40.

2.2 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2.3 MOTORS

A. Motor Characteristics:

1. Motors 3/4 HP and Larger: Three phase.
2. Frequency Rating: 60 Hz.
3. Voltage Rating: NEMA standard voltage for circuit voltage to which motor is connected.
4. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
5. Duty: Continuous duty at ambient temperature of 105 deg F .
6. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
7. Enclosure: Unless otherwise indicated, open dripproof.
8. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

2.4 HANGERS AND SUPPORTS

A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Powder-Actuated Fasteners: Threaded-steel stud, with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.5 VIBRATION ISOLATION AND SEISMIC CONTROL DEVICES

A. Vibration Supports:
   1. Elastomeric Isolation Pads: Arranged in single or multiple layers of oil- and water-resistant, of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match supported equipment.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., Super W; or comparable product by one of the following:
         1) Kinetics Noise Control, Inc.
         2) Vibration Mountings & Controls, Inc.
   2. Elastomeric Isolation Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate and baseplate. Provide isolator with minimum 0.5-inch (13-mm) static deflection.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., Type ND; or comparable product by one of the following:
         1) Kinetics Noise Control, Inc.
         2) Vibration Mountings & Controls, Inc.
   3. Open-Spring Isolators: Freestanding, laterally stable, open-spring isolators. Provide isolator with minimum 1-inch (25-mm) static deflection.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., Type SLFH; or comparable product by one of the following:
         1) Kinetics Noise Control, Inc.
         2) Vibration Mountings & Controls, Inc.
   4. Housed-Spring Isolators: Freestanding, laterally stable, open-spring isolators in two-part telescoping housing. Provide isolator with minimum 1-inch (25-mm) static deflection.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., Type C; or comparable product by one of the following:
         1) Kinetics Noise Control, Inc.
         2) Vibration Mountings & Controls, Inc.

B. Vibration Hangers:

1. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Provide isolator with minimum 0.5-inch (13-mm) static deflection.
    a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., HD; or comparable product by one of the following:
        1) Kinetics Noise Control, Inc.
        2) Vibration Mountings & Controls, Inc.
2. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression. Provide isolator with minimum 1-inch (25-mm) static deflection.
    a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., HS-B; or comparable product by one of the following:
        1) Kinetics Noise Control, Inc.
        2) Vibration Mountings & Controls, Inc.

2.6 PRESSURE GAGES AND TEST PLUGS

A. Pressure Gages: Direct-mounting, indicating-dial type complying with ASME B40.100. Dry metal case, minimum 2-1/2-inch diameter with red pointer on white face, and plastic window. Minimum accuracy 3 percent of middle half of range. Range two times operating pressure.

B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating of 500 psig at 200 deg F.

2.7 ACCESS DOCKS AND PANELS

A. Locate access panels for service of concealed items. Size at 12” x 12” minimum or 16” x 24” when person must pass through opening.

PART 3 - EXECUTION

3.1 INSTALLATIONS

A. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in his opinion, do not present a professional appearance. Replace or reinstall items at the expense of the Contractor.

B. Obstructions
    1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.

2. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.
3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

C. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, devices, etc. the Contractor shall provide and install all materials required to re-establish the rating of the wall, floor, roof or ceiling to the satisfaction of the authority having jurisdiction.

D. Space Requirements: Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.

E. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner.

F. Wiring Method: Install cables in raceways and cable trays except low voltage network cable above accessible ceilings. Conceal raceway and cables except in unfinished spaces.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceways and Boxes for Electrical Systems."

G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 MOTOR INSTALLATION

A. A.Anchor motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions.

3.3 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.

D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.

E. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.

F. Install unions at final connection to each piece of equipment.

G. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.

3.4 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 BASES, SUPPORTS, AND ANCHORAGES

A. Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods on 18-inch centers around the full perimeter of the base to connect concrete base to concrete floor.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

B. Mix and install grout for pump and other equipment base plates, and anchors. Place grout, completely filling equipment bases.

3.6 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.

D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

3.7 VIBRATION ISOLATION AND SEISMIC CONTROL DEVICE INSTALLATION

A. Adjust vibration isolators to allow free movement of equipment limited by restraints.

B. Install resilient bolt isolation washers and bushings on equipment anchor bolts.

C. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

3.8 FIELD QUALITY CONTROL

A. Tests:
1. Include all tests specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall also be performed as indicated herein and other sections of the specifications.
2. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to insure

proper sequence and operation throughout the range of operation. Make adjustments as required to insure proper functioning of all systems.

3. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.
4. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work.
5. Maintain a log of all tests being conducted and have it available for review by the Engineer. Log to indicate date, type of tests, duration, and defects noted and when corrected.
6. Special tests on individual systems are specified under individual sections.
7. Mechanical Contractor shall provide personnel, tools and equipment and assist the Test and Balance Contractor in making any adjustments necessary to meet the test and balance requirements.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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 the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

1.3 DEFINITIONS

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

B. Terminology: As defined in MSS SP-90, “Guidelines on Terminology for Pipe Hangers and Supports.”

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, “Structural Welding Code—Steel.”
   2. AWSD1.3, “Structural Welding Code—Sheet Steel.”
   3. AWSD1.4, “Structural Welding Code—Reinforcing Steel.”

PART 2 PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 “Hanger and Support Applications” Article for where to use specific hanger and support types.

B. Manufacturers:
   1. AAA Technology & Specialties Co., Inc.
   2. Bergen-Power Pipe Supports.
   3. B-Line Systems, Inc.; a division of Cooper Industries.
   4. Carpenter & Paterson, Inc.
   5. Empire Industries, Inc.
   6. ERICO/Michigan Hanger Co.
   7. Globe Pipe Hanger Products, Inc.
   8. Grinnell Corp.
   9. GS Metals Corp.
   10. National Pipe Hanger Corporation.
   11. PHD Industries, Inc.
   12. PHS Industries, Inc.
   13. Piping Technology & Products, Inc.
   14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

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

E. Padded Hangers: Hangers with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

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

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

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type 1 calcium silicate with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type 1 calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.

b. ITW Ramset/Red Head.

c. Masterset Fastening Systems, Inc.

d. MKT Fastening, LLC.

e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zing-coated steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.

b. Empire Industries, Inc.

c. Hilti, Inc.

d. ITW Ramset/Red Head.

e. MKT Fastening, LLC.

f. Powers Fasteners.

2.6 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Co.

b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:

a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Co.

b. MIRO Industries.

c. Portable Pipe Hangers.

2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:

a. Portable Pipe Hangers.

2. Bases: One or more plastic.

3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

2.7 EQUIPMENT SUPPORTS

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

2.8 MISCELLANEOUS MATERIALS

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

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

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

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

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS ½ to NPS 30 (DN 15 to DN 750).
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS ½ to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS ½ to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS ¾ to NPS 8 (DN 20 to DN 200).
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS ½ to NPS 8 (DN 15 to DN 200).
6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS ½ to NPS 8 (DN 15 to DN 200).
7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS ½ to NPS 2 (DN 15 to DN 50).
8. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
9. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
10. U-Bolts (MSS Type 24): For support of heavy pipes, NPS ½ to NPS 30 (DN 15 to DN 750).
11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

12. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
13. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
14. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
15. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
16. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
17. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS ¾ to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS ¾ to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 degrees F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 degrees F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS Sp-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTMA A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

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

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

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

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to

facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

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

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through opening at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

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

N. Insulated Piping:

1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
2. Shield Dimensions for Pipe: Not less than the following:
    a. NPS ¼ to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
    b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6 (D 125 and DN 150): 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.
3. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
4. Insert Material: Length at least as long as protective shield.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor or roof.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

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

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

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

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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 the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Access panel and door markers.
3. Pipe markers.
4. Duct markers.
5. Stencils.
6. Valve tags.
7. Valve schedules.

1.3 SUBMITTALS

A. Valve numbering scheme.

B. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, “Scheme for the Identification of Piping Systems,” for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

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

PART 2 PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

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

1. Data:

a. Manufacturer, product name, model number, and serial number.

b. Capacity, operating and power characteristics, and essential data.

c. Labels of tested compliances.

2. Location: Accessible and visible.

3. Fasteners: As required to mount on equipment.

B. Access Panel and Door Markers: 1/16-inch-(1.6-mm-) thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

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

2.2 PIPING IDENTIFICATION DEVICES

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

1. Colors: Comply with ASME A13.1, unless otherwise indicated.

2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.

4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

5. Arrows: Integral with piping system service lettering to accommodate both directions; or as a separate unit on each pipe marker to indicate direction of flow.

B. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

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

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: ¾ inch minimum.

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

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of ¾ inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
2. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4 –inch letters for piping system abbreviation and ½-inch numbers, with numbering scheme approved by Owner. Provide 5/32-inch hole for fastener.

1. Material: 0.0375-inch-thick stainless steel.
2. Valve-Tag Fasteners: To match tag material.

2.5 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space). Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

PART 3 EXECUTION

3.1 APPLICATIONS, GENERAL

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

3.2 EQUIPMENT IDENTIFICATION

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

1. Pumps and similar motor-driven units.

2. Heat exchangers, coils, evaporators, and similar equipment.
3. Fans, blowers, primary balancing dampers, and mixing boxes.
4. Custom air hardy units.
5. Flow meters.
6. Dust collection unit.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

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

B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

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

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run, unless otherwise indicated. Reduce intervals to 25 feet in mechanical/plumbing rooms.
7. On piping above removable acoustical ceiling, omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

A. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow for all new ducts shall be provided with lettering 2-inches high for proper identification as supply, return, general exhaust, or dust collection exhaust.

1. Supply – Blue.
2. Return – Green.
3. General Exhaust – Yellow.
4. Duct Collection Exhaust – Red.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 20 feet for all new ductwork.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule. Valve tags shall be minimum 1-1/2 inches round.

3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

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

3.8 ADJUSTING

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

3.9 CLEANING

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

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Certified TAB reports.

B. TAB Firm Qualifications: AABC, NEBB, or TABB certified.

C. TAB Report Forms: Standard TAB contractor's forms approved by Architect.

D. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

1.2 SUMMARY

A. This Section includes TAB to produce design objectives for the following:
   1. Air Systems:
      a. Exhaust fan.
   2. Grille airflow balancing.
   3. Space pressurization testing and adjusting.
   4. Existing conditions verification to insure that system modifications do not affect areas outside scope of work.
   5. Verifying that automatic control devices are functioning properly.
   6. Reporting results of activities and procedures specified in this Section.

1.3 SUBMITTALS

A. Within 15 days from Contractors' Notice to Proceed, submit two copies of evidence that TAB firm and this project's TAB team members meet the qualifications specified in the "Quality Assurance" section.

B. Existing Systems Verification: Within 30 days from Contractor's Notice to Proceed, submit two copies of certified existing systems verification test and balance report.

C. Within 60 days from Contractor's Notice to Proceed, submit two copies of TAB strategies and step-by-step procedures as specified in in Part 3 of this section. Include a complete set of report forms that contractor intends to use on the project.

D. Certified TAB Reports: Submit two copies of reports prepared on approved forms certified by the TAB firm.

1.4 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. TAB Conference: Meet with Owners' and Architects' representatives on approval of TAB procedures to develop mutual understanding of test and balance plan. Provide 7 days notice of scheduled meeting time and location. Agenda shall include:
   1. Submittal distribution requirements.
   2. The Contract Documents examination report.
   3. The TAB plan.
   4. Work schedule, project site access requirements.
   5. Coordination of trades and subcontractors.
   6. Coordination of documentation and communication flow.

C. TAB report forms: Use standard forms from AABC's National Standards for Testing and Balancing HVAC Systems" or NEBB's Procedural Standards to Test, Adjust and Balancing of Environmental Systems.

D. Instrumentation Type, Quantity, and Accuracy: Follow AABC and NEEB.

E. Instrumentation Calibration: Calibrate instruments every 6 months or less if recommended by manufacturer. Keep updated record showing date of calibration and name pf party performing calibration.

1.5 COORDINATION

A. Coordinate support of factory-authorized service representatives for systems and equipment, HVAC controls contractors, and other mechanics required to operate the equipment.

B. Provide 7 days advance notice for each test date. Include scheduled test and times.

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

1.6 GUARANTEE

A. Provide a guarantee on AABC's National Standards for Testing and Balancing of HVAC systems forms stating that AABC will assist in completing requirements of Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
   1. The certified test and balance firm has tested and balanced systems according to the Contract Documents.
   2. Systems balanced to optimum performance capabilities with design and installation limits.

B. Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine the approved submittals for HVAC systems and equipment.

C. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

F. Examine equipment performance data including fan and pump curves. Calculate system effect factors when HVAC equipment is installed differently from performance test in factory.

G. Examine the existing HVAC control system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of dampers and valves for free and full operation and for tightness of fully closed and fully open positions.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.
11. Safety interlocks and controls are properly installed.

H. Report deficiencies discovered before and during performance of test and balance procedures.

3.2 PREPARATION

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

B. Complete system readiness checks and prepare system readiness reports. Verify the following:
   1. Permanent electrical power wiring is complete.
   2. Hydronic systems are filled, clean, and free of air.
   3. Automatic temperature-control systems are operational.
   4. Equipment and duct access doors are securely closed.
   5. Balance, smoke, and fire dampers are open.
   6. Isolating and balancing valves are open and control valves are operational.
   7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Prepare a Testing and Balancing plan that includes step by step procedures.

B. Perform testing and balancing procedures on each system according to the procedures contained in AABC's National Standards for Testing and Balancing for HVAC Systems or NEBB Procedures and Standards for Testing and Balancing of Environmental Systems.

C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

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

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

F. Complete system readiness checks including verifying completion of:
   1. Electrical Wiring.
   2. Hydronic systems filled, clean, and free of air.
   3. Access drawings securely closed.
   4. Balance, Fire/Smoke dampers are open.
   5. All isolation values open, control values operational.
   6. Windows and doors are closed.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare schematic diagrams of systems' "as-built" duct layouts.

B. Prepare test reports for both fans and outlets/inlets. Obtain manufacturer's outlet factors and recommend testing procedures. Crosscheck the summation of required outlet/inlet volumes with required fan volumes.

C. Measure static pressure at fan inlet, outlet, and as far downstream of the fan as possible.

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

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

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

G. Check for airflow blockages.

H. Check condensate drains for proper connections and functioning.

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

J. Check for proper sealing of air duct system.

K. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer:
   1. Measure static pressure across each component that makes up an air-handling unit.
   2. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur.
      a. Adjust fan speed higher or lower than design and make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
   3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, and any other operating modes to determine the maximum required brake horsepower.

L. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

M. Record fan speed required to supply the airflow scheduled on the Drawings at dirty filter conditions corresponding to the scheduled maximum total pressure drop on the air handler unit schedule.

3.5 TOLERANCES

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

1. Supply, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3.

3.6 PROCEDURES FOR MOTORS

A. Motors, ½ HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 FINAL REPORT

A. Fan includes:
1. Unit identification.
2. Location.
3. Make and type.
4. Model and unit size.
5. Manufacturers serial number.
6. Discharge arrangements.
7. Sheave make, size and bore.
8. Number of belts, make and size.
9. Number of filters, type and size.
10. Total airflow rate in CFM.
11. Total system status pressure in inches wg.
12. Fan rpm.
13. Discharges static pressure.
14. OSA and RA damper positions.

B. Duct Traverse Reports

1. Location of test.
2. Duct size.
3. Duct static pressure.
4. Duct area.
5. Air flow rate.
6. Velocity.

3.8 INSPECTIONS

A. Initial Inspection:
   1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
   2. Randomly check the following for each system:
      a. Measure airflow of at least 10 percent of air outlets.
      b. Measure water flow of at least 5 percent of terminals.
      c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
      d. Measure sound levels at two locations.
      e. Measure space pressure of at least 10 percent of locations.
      f. Verify that balancing devices are marked with final balance position.
      g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:
   1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner.
   2. TAB firm test and balance engineer shall conduct the inspection in the presence of Owner.
   3. Owner shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
   4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as “FAILED.”
   5. If the number of “FAILED” measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
   6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
   7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes control equipment for HVAC systems and components. The existing HVAC control panel is located in mechanical room 104 and is the master controller of all HVAC equipment. Provide software and hardware to allow HVAC Control Panel to have a user interface at the Owner's operator workstation. Communication protocol shall be BACNET compatible.

1.2 DEFINITIONS

A. AHU: Air Handling Unit

B. AI: Analog Input

C. AO: Analog Output

D. CS: Current Sensor

E. DDC: Direct Digital Control

F. DI: Discreet Input

G. DO: Discreet Output

H. DP: Differential Pressure Sensor

I. EXF: Exhaust Fan

J. I/O: Input/Output

K. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

L. PC: Personal Computer

M. PID: Proportional plus integral derivative.

N. RH: Relative Humidity Sensor

O. SD: Smoke Detector

P. T: Temperature Sensor

Q. VFD: Variable Frequency Drive.

1.3 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:
   1. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
      a. Space Temperature: Plus or minus 1 degree F.
      b. Outside Air Temperature: Plus or minus 2 degrees F.
      c. Relative Humidity: Plus or minus 5 percent.
      d. Water Temperature: Plus or minus 1 degree F.
      e. Water Pressure: Plus or minus 2 psi.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
   2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
   3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic design.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
   2. Schematic flow diagrams showing fans, filters, coils, dampers, valves, and control devices.
   3. Wiring Diagrams: Power, signal, and control wiring.
   4. Written description of sequence of operation.
   5. Schedule of dampers including size, leakage, and flow characteristics.
   6. Schedule of valves including flow characteristics.
   7. DDC System Hardware:
      a. Wiring diagrams for control units with termination numbers.
      b. Schematic diagrams and floor plans for field sensors and control hardware.
      c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
   8. Control System Software: Provide description of any new software required to interface the new equipment controls with the existing HVAC control panel.

9. Controlled Systems:
    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

D. Data Communications Protocol Certificates: Certify that each proposed DDC system component is compatible with existing communications protocol at Owner's workstation.

E. Operation and Maintenance at Existing HVAC Control Panel Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM

A. Manufacturers:
1. Johnson Controls Corporation (must be compatible with existing HVAC control system)
2. Trane (must be compatible with existing HVAC control system)
3. KMC.

2.2 DDC EQUIPMENT

A. Operator Workstation: PC-based microcomputer (Owner's specified location).
1. Application Software:
    a. I/O capability from operator station.
    b. System security for each operator via software password and access levels.
    c. Automatic system diagnostics; monitor system and report failures.

d. Alarm processing, messages, and reactions.

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
   1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
   2. Standard Application Programs:
      a. HVAC Control Programs: Optimal run time.
      b. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
      c. Remote communications.
      d. Maintenance management.
      e. Units of Measure: Inch-pound and SI (metric).
   3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

2.3 TIME CLOCKS

A. Time clocks should only be used where direct digital control or a central building automation system is not available for start/stop control, or where use a DDC systems cannot be economically justified. Consult with DFD prior to use of mechanical time clocks.

B. UL listed, digital, 7-day, minimum of 10 on/off programs per day, holiday programming, automatic daylight savings switchover, and minimum of seven-day battery back-up.

2.4 ANALOG CONTROLLER

A. Step Controllers: 6 or 10 stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 degrees F, and single or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
   1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.5 ELECTRONIC SENSORS

A. Thermistor Temperature Sensors and Transmitters:
   1. Accuracy: Plus or minus 0.5 degrees F at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 SF.
   4. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 SF.
   5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
   6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Set-Point Adjustment: Concealed.
      b. Set-Point Indication: Exposed.
      c. Thermometer: Exposed, LCD readout.
   7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
   8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

B. Humidity Sensors: Bulk polymer sensor element.
   1. Accuracy: 2 percent full range with linear output.
   2. Room Sensor Range: 20 to 80 percent relative humidity.
   3. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Set-Point Adjustment: Concealed.
      b. Set-Point Indication: Exposed.
      c. Hygrometer: Exposed LCD readout.
   4. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
   5. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at design outdoor temperatures plus 10 degrees F, minus 20 degrees F.
   6. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

C. Pressure Transmitters/Transducers:
   1. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

2.6 STATUS SENSORS

A. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

2.7 ACTUATOR

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 inch x lbf and breakaway torque of 300 inch x lbf.
3. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 inch x lbf.
4. Nonspring-Return Motors for Dampers Larger Than 25 SF: Size for running torque of 150 inch x lbf and breakaway torque of 300 inch x lbf.
5. Spring-Return Motors for Dampers Larger Than 25 SF: Size for running and breakaway torque of 150 inch x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
   a. Belimo Aircontrols (USA), Inc.
   b. Or Equal.
2. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/SF of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/SF of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/SF of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/SF of damper.
   e. Dampers with 2 to 3 inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
   f. Dampers with 3 to 4 inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
3. Power Requirements (Two-Position Spring Return): 120-V ac.
4. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.

2.8 DAMPERS

A. Dampers: AMCA-rated, opposed-blade design; 0.108 inch minimum thick, galvanized-steel or 0.125 inch minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064 inch thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
1. Secure blades to ½ inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 degrees F.
3. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per SF of damper area, at differential pressure of 4 inch wg when damper is held by torque of 50 inch x lbf; when tested according to AMCA 500D.

2.9 CONTROL CABLE

A. Control wiring and conduits are specified in Division 26.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units and operator workstation.

3.2 INSTALLATION

A. Install control wiring concealed, except in mechanical rooms, and according to requirements specified in Division 26 Sections.

B. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

C. Connect and configure equipment and software to achieve sequence of operation specified.

D. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.
   1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

E. Install labels and nameplates to identify control components.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
   2. Test and adjust controls and safeties.
   3. Test each point through its full operating range to verify that safety and operating control set points are as required.
   4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.

5. Test each system for compliance with sequence of operation.

C. DDC Verification:
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
6. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
7. Check temperature instruments and material and length of sensing elements.
8. Check control valves. Verify that they are in correct direction.
9. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
10. Check DDC system as follows:
    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.
    e. Verify HVAC control panel properly communicates with Fire Alarm panel.

3.5 ADJUSTING

A. Calibrating and Adjusting:
1. Control System Inputs and Outputs:
    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire.
    d. Check digital outputs using ohmmeter to test for contact making or breaking.
    e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
2. Pressure:
    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
3. Temperature:
    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.
4. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.

5. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
6. Provide diagnostic and test instruments for calibration and adjustment of system.
7. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.

END OF SECTION

SECTION 23 31 13

DUCTWORK

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. Single-wall rectangular ducts and fittings.
   2. Single-wall round and flat-oval ducts and fittings.
   3. Sheet metal materials.
   4. Sealants and gaskets.
   5. Hangers and supports.
   6. Seismic-restraint devices.

B. Related Sections:
   1. Division 23 Section “Testing, Adjusting, and Balancing for HVAC” for testing, adjusting, and balancing requirements for metal ducts.
   2. Division 23 Section “Air Duct Accessories” for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 SYSTEM DESCRIPTION

A. Dimensions indicated on drawings are inside clear dimension.

1.4 PERFORMANCE REQUIREMENTS

A. Duct Design:
   1. Static-Pressure Classes:
      a. Medium Pressure Supply Ducts: 2-inch wg.
      b. Return Ducts (Negative Pressure): 2-inch wg.
      c. General Exhaust Ducts (Negative Pressure): 1-inch wg.
   2. Leakage Class:
      a. Supply Air Ducts: 1 percent of design airflow at maximum duct design static pressure.
      b. Return Air Ducts: 2 percent of design airflow at maximum duct design static pressure.
      c. General Exhaust Air Ducts: 2 percent of design airflow at maximum duct design static pressure.

B. Structural Performance:

1.5 SUBMITTALS

A. Product Data: For each type of the following products:
   1. Adhesives.
   2. Sealants and gaskets.

B. Shop Drawings:
   1. Fabrication, assembly, installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory-and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   4. Elevation of top of ducts.
   5. Dimensions of main duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.
   8. Seam and joint construction.
   9. Penetrations through fire-rated and other partitions.
   10. Equipment installation based on equipment being used on Project.
   11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
   12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1/1M, “Structural Welding Code – Steel,” for hangers and supports and AWS D9.1M/D9.1, “Sheet Metal Welding Code,” for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, “Structural Welding Code – Steel,” for hangers and supports.
   2. AWS D9.1M/D9.1, “Sheet Metal Welding Code,” for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible” based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 1-4, "Transverse (Firth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 1-5, "Longitudinal Seams – Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Shall be as indicated on drawings and fabricated according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."
   1. For mitered 90 degree ells, use single thickness turning vanes.
   2. On medium pressure ducts, use high efficiency turning vanes with a minimum 1 inch trailing edge.

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Lindab Inc.
      b. McGill AirFlow LLC.
      c. SEMCO Incorporated.
      d. Spiral Manufacturing Co., Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter (diameter of the round sides connecting the flat portions of the duct).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 3-2, "Transverse Joints – Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."
   1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 3-1, "Seams – Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width with butt-welded longitudinal seams.

E. Tees and Laterals: Shall be as indicated on drawings and fabricated according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

F. Elbows: Smooth or 5-piece for 90 degree ells with centerline radius of 1.5 times duct dimension in plane of bend. Ells of 45 degrees or less may be 3-piece.

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be non-shedding, free of pitting, seam marks, roller marks, stains, discolorations and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Fibrous-Glass Duct Board: Comply with UL 181, Class 1, 1-inch thick, fibrous glass with fire-resistant, reinforced foil-scrim-kraft barrier, and having the air-side surface treated to prevent erosion.

D. Aluminum Alloy 3003 per ASTM B209.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum duct, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, ¼ inch minimum diameter for lengths 36 inches or less; 3/8 inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiver impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 degrees F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:
1. Application Method: Brushed on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and 20-inch wg negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flange Gaskets: Butyl rubber, neoprene, or EDPM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 SF at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EDPM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 VOLUME DAMPERS

A. Manufacturers:
   1. Greenheck.
   2. Leader Industries.
   3. Ruskin Company.
   4. Vent Products Company, Inc.
   5. Air Balance, Inc.

B. General for all Volume Dampers: Volume dampers (factory fabricated, standard and low leakage) shall include a locking device to hold dampers in a fixed position and shall be provided with opposed blade design if offered by manufacturer.

C. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
   1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
   2. Damper Limit (Height): 11 inch for single-blade; greater than 11-inch shall be multiple blade.

D. Standard Volume Dampers: Single-blade or multiple opposed-blade design, standard leakage rating, suitable for horizontal or vertical applications. Material to match duct material; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
   1. Steel Frames: Hat-shaped, galvanized or stainless sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
   2. Roll-Formed Steel Blades: 0.064 inch thick, galvanized or stainless sheet steel.
   3. Aluminum Frames: Hat-shaped, 0.10 inch thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
   4. Roll-Formed Aluminum Blades: 0.10 inch thick extruded aluminum.
   5. Blade Axles: Galvanized steel, stainless steel, or nonferrous.
   6. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve.
   7. Tie Bars and Brackets: Aluminum or galvanized steel.

E. Low-Leakage Volume Dampers: Multiple-or single-blade, parallel-or opposed-blade design as indicated, low-leakage rating, and suitable for horizontal or vertical applications. Material to match duct material.
   1. Steel Frames: Galvanized or stainless sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
   2. Roll-Formed Steel Blades: 0.064 inch thick, galvanized or stainless sheet steel.
   3. Aluminum Frames: 0.10 inch thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
   4. Roll-Formed Aluminum Blades: 0.10 inch thick aluminum sheet.
   5. Extruded-Aluminum Blades: 0.10 inch thick extruded aluminum.
   6. Blade Axles: Galvanized steel.
   7. Bearings: Stainless-steel sleeve thrust or ball.
   8. Blade Seals: Neoprene.
   9. Jamb Seals: Cambered stainless steel.
   10. Tie Bars and Brackets: Galvanized steel.

F. Jackshaft: 1 inch diameter, galvanized steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
   1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

G. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32 inch thick zinc-plated steel, and a ¾ inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform (stand-off bracket) for insulated duct mounting.

2.7 FIRE DAMPERS

A. Manufacturers:
   1. Air Balance, Inc.
   2. Leader Industries.
   3. Greenheck.
   4. Ruskin Company.
   5. Vent Products Company, Inc.

B. Material to match duct material; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Each Damper shall bear an UL approved label identifying its classification as a Dynamic Rated Fire Damper, (static dampers not acceptable). Fire dampers shall be labeled according to UL 555current edition.

D. Fire Rating: 3 hours.

E. Dampers shall be capable of the following dynamic rating:

1. Dampers shall have been tested per AMCA 500-90, in which it shall have proven to close under specified static pressure and dynamic airflow conditions.

F. Frame: Curtain type with blades outside airstream, 100% free area; fabricated with roll-formed, 0.034 inch thick galvanized steel; with mitered and interlocking corners.

G. Integral Sleeve/Frame: Curtain type with blades outside airstream, 100% free area; fabricated with roll-formed, minimum 0.052 inch thick galvanized steel or adjacent duct sheet metal thickness, whichever is greater; with sleeve and frame of damper roll-formed into integral shape.

H. Mounting Sleeve: Factory-or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angels on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

I. Mounting Orientation: Vertical or horizontal as indicated.

J. Blades: Roll-formed, interlocking, 0.034 inch thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034 inch thick, galvanized-steel blade connections.

K. Vertical and Horizontal Curtain Fire Dampers: Include blade lock and two stainless steel, constant force closure springs per damper section.

L. Fire dampers shall be installed in walls/floors utilizing 16 gage UL approved Wrap Around Retaining Angles.

M. Fusible Links: Replaceable, 165 degrees F rated.

2.8 MULTI BLADED FIRE DAMPERS, DYNAMIC RATED

A. General Description: Fire dampers shall be labeled according to UL 555 for 3 hour rating.

B. Fusible Links: Replaceable, 165 degrees F rated.

C. Frame and Blades: 0.064 inch thick, galvanized sheet steel. Triple crimped blades to be on 6” centers.

D. Mounting Sleeve: Factory-installed, 0.052 inch thick, galvanized sheet steel; length to suit wall or floor application.

E. Fire dampers shall be installed in walls/floors utilizing 16 gage UL approved Wrap Around Retaining Angles.

2.9 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Nexus PDQ; Division of Shilco Holdings Inc.
   3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.10 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for vaqnes and vane runners. Vane runners shall automatically align vanes. Single thickness turning vanes may be used in ducts with velocities up to 1200 fpm.

B. Manufactured Turning Vanes: Fabricate 1-1/2 inch wide, single or double-vane, curved blades of galvanized sheet steel set ¾ inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.
   1. Manufacturers:
      a. Ductmate Industries, Inc.
      b. Duro Dyne Corp.
      c. METALAIRE, Inc.
      d. Ward Industries, Inc.

2.11 DUCT-MOUNTED ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounted, rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1 inch butt or piano hinge and cam latches.
   1. Manufacturers:
      a. Air Balance, Inc.
      b. Ductmate Industries, Inc.
      c. Kees, Inc.
      d. Leader Industries.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
   3. Provide number of hinges and locks as follows:
      a. Less Than 12 Inches Square: Secure with two sash locks.
      b. Up to 18 Inches Square: Two hinges and two sash locks.
      c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside handles.
      d. Sizes 24 by 48 Inches and Larger: One additional hinge.

e. Hinges may be replaced with latches where clearance will not allow full range of access door opening.

C. Door: Double wall, duct mounted, round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
   1. Manufacturers:
      a. Flexmaster U.S.A., Inc.
      b. McGill Airflow Corporation.
   2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Pressure Relief Access Door: Double wall and duct mounting; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.
   1. Manufacturers:
      a. Air Balance, Inc.
      b. Ductmate Industries, Inc.
      c. Greenheck.
      d. KEES, Inc.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

F. Insulation: 1 inch thick, fibrous-glass or polystyrene-foam board.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section “Air Duct Accessories” for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA’s “Duct Cleanliness for New Construction Guidelines.”

3.2 SEAM AND JOINT SEALING

A. Seal duct seams and joints for duct static-pressure and leakage classes specified in “Performance Requirements” Article, according to SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Table 1-2, “Standard Duct Sealing Requirements,” unless otherwise indicated.
   1. Seal Class:
      a. Medium Pressure Supply Ducts, up to 9 inches Positive: Seal Class A.
      b. Return Ducts, Negative 3 inches or Less” Seal Class A.
      c. Exhaust Ducts, Negative 19 inches or Less: Seal Class B.
      d. Exhaust Ducts, Negative 2 inches or Less: Seal Class B.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Chapter 4, “Hangers and Supports.”

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA’s “HVAC Dust Construction Standards – Metal and Flexible,” Table 4-1, “Rectangular Duct Hangers Minimum Size,” and Table 4-2, “Minimum Hanger Sizes for Round Duct,” for maximum hanger spacing; install hangers

and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section “Air Duct Accessories.”

B. Comply with SMACNA’s “HVAC Duct construction Standards – Metal and Flexible” for branch, outlet and inlet, and terminal unit connections.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
   1. Comply with SMACNA’s “HVAC Air Duct Leakage Test Manual.”
   2. Test the following systems:
      a. Supply air for AHU-3-1-A and AHU-3-1B.
      b. Return air for AHU-3-1A and AHU-3-1B.
      c. Exhaust air including EXF-3-1, EXF-3-2, EXF-3-3 (Dust Collection) and EXF-3-4.
   3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   4. Test for leaks before insulation application.
   5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days’ advance notice for testing.

C. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.
   2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to “Vacuum Test” in NADCA ACR, “Assessment, Cleaning, and Restoration of HVAC Systems.”
      a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 DUCT SCHEDULE

A. Intermediate Reinforcement:
   1. Galvanized-Steel Ducts: Galvanized steel.
   2. 304 Stainless Steel Ducts: Stainless steel.
   3. Aluminum Alloy 3003 per ASTM B209.

B. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Dust Construction Standards – Metal and Flexible," Figure 2-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
         1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
         2) Mitered Type RE 4 with turning vanes.
      b. Velocity 1000 to 1500 fpm:
         1) Radius Type RE 1 with minimum 1.5 radius-to diameter ratio.
         2) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
      c. Velocity 1500 fpm or Higher:
         1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
         2) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, " Vane Support in Elbows."
   2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible,"Figure 3-3, "Round Duct Elbows."
      a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
         1) Velocity 1000 fpm or Lower: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
         2) Velocity 1000 to 1500 fpm: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
         3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or welded segmented.
      c. Round Elbows, 14 Inches and Larger in Diameter: Welded segmented.

C. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 2-6, "Branch Connections."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
   a. Velocity 1000 fpm or Lower: Conical tap.
   b. Velocity 1000 to 1500: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral, or conical tap.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Products shall be licensed to use the AMCA-Certified Ratings Seal.

C. Power ventilators shall comply with UL 705.

D. 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.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL WALL AND ROOF VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Aerovent.
2. Carnes Company.
3. Greenheck Fan Corporation.
4. Loren Cook Company. (Basis of Design)
5. Penn Ventilation. Certifications: Fan shall be manufactured at an ISO 9001 certified facility, listed by Underwriters Laboratories (UL 705). Fan shall bear AMCA Certified Ratings Seal for Sound and Air Performance.

C. Construction: All Aluminum, bolted and welded construction using corrosion-resistant fasteners. Material shall be minimum of 16 gauge marine alloy aluminum.

D. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
2. Wall-Mounting Units: Aluminum rectangular base with venturi inlet cone, motor mount, and vibration isolators designed for wall mounting.

E. Fan Wheels: Precision cast Aluminum hub and wheel with backward-inclined blades.

F. Belt-Driven Drive Assembly: Resiliently mounted to housing.

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings. Heavy duty greasable ball type in a cast iron pillowblock housing selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.
5. Motor shall be totally-enclosed fan cooled, TEFC.

G. Provided Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Extended Lube Lines.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
6. Integral conduit chase with 6’ electrical pigtail that extends through roof.

H. Roof Curbs: Aluminum; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 12 inches (300 mm).
3. Pitch Mounting: Manufacture curb for roof slope.
4. Mounting Pedestal: Galvanized steel with removable access panel.

2.2 IN-LINE CENTRIFUGAL FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carnes Company.
2. Greenheck Fan Corporation.
3. Loren Cook Company. (Basis of Design)
4. PennBarry.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

D. Fan Wheels: 100% Aluminum, airfoil blades welded to aluminum hub.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Companion Flanges: For inlet and outlet duct connections.
3. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
4. Motor and Drive Cover (Belt Guard)

F. Characteristics:

1. Vibration Isolators:

a. Type: Spring hangers.
b. Static Deflection: 1 inch (25 mm).

2. Spark Arrestance Class: [A] [B] [C].

PART 3 - EXECUTION

3.1 INSTALLATION

A. Roof-Mounted Units: Install roof curb on roof structure, according to ARI Guideline B. Install and secure roof-mounted fans on curbs, and coordinate roof penetrations and flashing with roof construction.

B. In-Line Centrifugal Fans: Suspend units from structural-steel support frame using threaded steel rods and vibration isolation springs.

C. Ground power ventilators.

END OF SECTION

SECTION 23 37 13

AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and color charts for factory finishes.

PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES

A. Return Grille:
   1. Return grilles shall be TITUS Model 50F for the sizes and mounting types as shown on the plans and outlet schedule. Return grilles must provide a free area of at least 90%. Outer borders shall be constructed of heavy extruded aluminum with a thickness of 0.040-0.050 inch and shall have countersunk screw holes for a neat appearance. Border width shall be 1¼ inches on all sides and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Choice of three sizes of aluminum grid: ½ x ½ x ½ inch, ½ x ½ x 1 inch, or 1 x 1 x 1 inch shall be available.
   2. Optional opposed-blade volume damper shall be constructed of heavy gauge steel or aluminum. Damper must be operable from the face of the grille.
   3. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
   4. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel unless otherwise indicated. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL - BASIC METHODS AND REQUIREMENTS

1.1 DESCRIPTION

A. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

B. This Section, Basic Methods and Requirements (Electrical) applies to all sections of Division 26.

C. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Generally, capacities and ratings of motors, transformers, cable, switchboards, switchgear, panelboards, and other items and arrangements for the specified items are shown on drawings.

D. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

E. The general requirements for Divisions 26, 27, and 28 Commissioning are listed in this document.

1.2 MINIMUM REQUIREMENTS

A. At a minimum, the work shall be in conformance with the following codes:

Code	Title	Year
NFPA 70	National Electric Code	2011
NFPA 72	National Fire Alarm Code	2010
NFPA 101	Life Safety Code	2012
NFPA 780	Lightning Protection Code	2011
FBC	Florida Building Code	2014

B. The installation shall also comply with all applicable rules and regulations of local and state laws and ordinances. Include in the work, without extra cost, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations. Inform the Architect/Engineer of any work or material which conflict with any applicable codes, standards, laws and regulations before submitting the bid.

C. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory.

B. Definitions:

1. Listed; equipment or device of a kind mentioned which:

   a. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.

   b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

2. Labeled; equipment or device is when:

   a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.

   b. The laboratory makes periodic inspections of the production of such equipment.

   c. The labeling indicated compliance with nationally recognized standards or tests to determine safe use in a specified manner.

3. Certified; equipment or product is which:

   a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.

   b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.

   c. Bears a label, tag, or other record of certification.

4. Nationally recognized testing laboratory; laboratory which approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer's Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

2. The owner reserves the right to require the contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organization.

1.5 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.

2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

3. Components shall be compatible with each other and with the total assembly for the intended service.

4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified :

1. The owner shall have the option of witnessing factory tests. The contractor shall notify the Architect/Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.

2. Four copies of certified test reports containing all test data shall be furnished to the Architect/Engineer prior to final inspection and not more than 90 days after completion of the tests.

3. When equipment fails to meet factory test and reinspection is required, the contractor shall be liable for all additional expenses, including the expenses of the owner.

1.6 EQUIPMENT REQUIREMENTS

A. Where variations from the contract requirements are requested in accordance with Divisions 00 and 01, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

B. No substitution will be considered unless written request has been submitted to the owner at least ten (10) days prior to the date for receipt of bids.

C. If the owner approves any proposed substitutions, such approval will be set forth in an addendum.

1.7 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing, operating, final inspection, and repainting if required.

2. Damaged equipment shall be, as determined by the Architect/Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.

3. Painted surfaces shall be protected with a factory installed removable heavy kraft paper, sheet vinyl or equal.

4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

B. Rough-in:

1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

2. Verify above and below counter locations at millwork locations with Architect prior to rough-in.

3. As a general role, receptacle and telecom outlets shall be located 6” centerline to centerline unless otherwise note or prohibited by code.

4. Refer to equipment specifications in Divisions 02 through 28 for additional rough-in requirements.

1.8 WORK PERFORMANCE

A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart k in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment deenergized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory :

1. Electricians must use and wear full protective equipment (PPE) (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance

with NFPA 70E. The level of PPE shall be determined by a computer generated arc flash calculation provided and paid for by the contractor. The arc flash data shall be presented with the work plan below.

2. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the owner.

D. Arrange, phase and perform work to ensure electrical service is not interrupted for other buildings at all times. Refer to Section 01 01 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Divisions 00 and 01.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces shall not be less than specified in the NEC for all voltages specified.

C. Inaccessible Equipment :

1. Where the owner determines that the contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the owner.

2. “Conveniently accessible” is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.:

1.10 DEMOLITION

A. Visit the site before submitting a bid to observe existing conditions.

B. Work shall be performed at such times and under such conditions as suit the convenience of the owner. Plan the work to minimize disruption of normal operations. Notify owner before any existing circuit is de-energized.

C. Where circuit is interrupted by removal of a device or fixture from that circuit, install wire and conduit as required to restore service to the remaining devices and fixtures on that circuit. Ensure proper grounding is maintained.

1.11 ELECTRICAL INSTALLATIONS

A. Make a thorough examination of the site and the contract documents. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and contract documents prior to executing contract would have revealed.

B. Coordinate electrical equipment and materials installation with other building components.

C. Verify all dimensions by field measurements.

D. Arrange for chases, slots and openings to allow for electrical installations.

E. Coordinate installations of required raceways, boxes, supporting devices, and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.

G. Install electrical equipment to facilitate 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.

H. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

I. Temporary electrical service and construction lighting shall be provided under this section. Provide for all electrical service for construction period, making all connections and removal of same at job conclusion. Furnish and install temporary lighting for construction period. At job completion, all temporary lamps shall be removed and replaced with new lamps.

J. All new conduit/raceways within this project area shall be properly supported. Add support to existing conduit as required to comply with NEC.

K. Coordinate location of equipment and conduit with other trades to minimize interference. See Divisions 00 and 01.

1.12 CUTTING AND PATCHING

A. Refer to the Divisions 00 and 01 for general requirements for cutting and patching.

B. Do not endanger or damage installed work through procedures and processes of cutting and patching.

C. Arrange for repairs required to restore other work because of damage caused as a result of electrical installations.

D. No additional compensation will be authorized for cutting and patching that is necessitated by ill-timed, defective, or non-conforming installations.

E. Perform cutting, fitting, and patching of electrical equipment and materials required to :

1. Uncover work to provide installations of ill-timed work.

2. Remove and replace defective work.

3. Remove and replace work not conforming to requirements of the contract documents.

4. Remove samples of installed work as specified for testing.

5. Install equipment and materials in existing structures.

6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineer observation of concealed work.

F. 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.

G. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

H. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

I. Locate, identify, and protect electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the owner prior to changeover.

1.13 DELIVERY, STORAGE AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for smooth and efficient flow of installation.

1.14 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment. See Section 26 05 53.

1.15 SUBMITTALS

A. Submit in accordance with Divisions 00 and 01.

B. Approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval, will not be permitted at the job site.

C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Architect/Engineer to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION _____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

F. Product Options and Substitutions: Refer to the Instructions to Bidders and the Division 1 Section "Products and Substitutions" for requirements in selecting products and requesting substitutions.

G. Submittals shall include the following :

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

H. Record Documents :

1. Refer to the Divisions 00 and 01 for requirements. The following paragraphs supplement the requirements of Division 01.
2. Accurately and clearly red-line clean drawings to indicate revisions to conduit size and location, both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; change orders; concealed control system devices.
3. Accurately and clearly red-line clean specifications to indicate approved substitutions; change orders; actual equipment and materials used.

1.16 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply as many such devices as are required to complete the installation as shown on the drawings.

1.17 TRAINING

A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Divisions 00 and 01.

B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the contractor and approved by the owner at least 30 days prior to the planned training.

1.18 WARRANTIES

A. Refer to the Division 01 Section: SPECIFIC WARRANTIES for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 26 into separated set of vinyl-covered, three-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment; date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

PART 2 GENERAL - ELECTRICAL SYSTEMS COMMISSIONING

2.1 SUMMARY

A. The purpose of this Section is to define Contractor responsibilities in the commissioning process. Other electrical system testing is required under other Division 26 Specification Sections. National Electrical Installation Standards (NEIS) NECA 90-2004, "Recommended Practice for Commissioning Building Electrical Systems", 27th Volume of the NEIS Series, provides additional guidance for the commissioning of electrical systems.

B. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. General Commissioning requirements and coordination are detailed in Division 01. Divisions 26, 27, and 28 shall be familiar with all parts of Division 01 and the Commissioning Plan issued by the Commissioning Agent and shall execute all Commissioning responsibilities assigned to them in the Contract Documents and include the cost of Commissioning in the Contract price.

C. Generally, the electrical contractor (contractor) will provide full documentation to, perform testing as required by, and will fully support the Commissioning Agent throughout the commissioning process for Division 26, 27, and 28 scopes of work.

D. Electrical systems to be commissioned include the following:

1. Secondary Service Electrical Systems.
2. Distribution and Branch Circuit Panelboards.
3. Lighting Fixtures and Controls.
4. Lightning Protection System.
5. Elevator Systems.
6. Equipment Monitoring.
7. Fire Alarm Equipment/Fire Alarm Equipment Monitoring System.
8. AC Motors.
9. Grounding Equipment and Building Grounding System.
10. Access Control.
11. Television Services.
12. IT (Telecommunications) including underground fiber backbone cabling.
13. Video Surveillance.

2.2 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards.

2.3 DEFINITIONS

A. Commissioning: A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Contract Documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and that Contractor has provided Owner adequate system documentation and training. Commissioning includes deferred and/or seasonal tests as approved by Owner.

B. Commissioning Plan: Document prepared by the Commissioning Agent (CA) and approved by Owner that provides the structure, schedule, and coordination plan for the Commissioning process from the construction phase through the warranty period.

C. Commissioning Team: Working group made up of representative(s) from the Architect/Engineer (A/E), Contractor, Adjust, and Balance (TAB) Firm, Building Automation System (BAS) provider, specialty manufacturers and suppliers, and Owner. Contractor will provide ad-hoc representation of Subcontractors on the Commissioning Team as required for implementation of the Commissioning Plan.

D. Deferred Tests: Functional Performance or Integrated System Tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other Site conditions that prohibit the test from being performed prior to Substantial Completion.

E. Deficiency: Condition of a component, piece of equipment or system that is not in compliance with Contract Documents.

F. Factory Testing: Testing of equipment at the factory, by factory personnel with an Owner's representative present if deemed necessary by Owner.

G. Coordinate all tests, test procedures, requirements, and commissioning needs with Commissioning Agent.

H. Start-up: The activities where equipment is initially energized, tested, and operated. Start-up is completed prior to Functional Performance Tests.

I. Test Requirements: Requirements specifying what systems, modes and functions, etc. must be tested. Test requirements are not detailed test procedures. Test requirements and acceptance criteria are specified in the Contract Documents.

2.4 SUBMITTALS

A. Documentation required for Commissioning work. At minimum, documentation shall include: Shop drawings, detailed Start-up procedures, Full sequences of operation, Operating and Maintenance data, Performance data, Control Drawings, and details of Owner-Contracted tests.

B. Contractor shall submit installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.

PART 3 EXECUTION

3.1 PREPARATION

A. Construction Phase:

1. In each purchase order or subcontract that is written for changes in scope, include the following requirements for submittal data, Commissioning documentation, testing assistance, and training, as a minimum.

2. Attend Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled to facilitate the Commissioning process.

3. Provide manufacturer's data sheets and shop drawing submittals of equipment.

4. Provide additional requested documentation, for development of Prefunctional Checklist and Functional Performance Tests procedures.

    a. Typically, this will include detailed manufacturer's installation and Start-up, operating, troubleshooting and maintenance procedures, full details of any Owner-contracted tests, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified.

    b. In addition, the installation, Start-up, and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted.

    c. This information and data request may be made prior to normal submittals.

5. Address current A/E and Owner punch list items before Functional Performance Tests. Air and water test, adjust and balance shall be completed with discrepancies and problems remedied before Functional Performance Tests of the respective air or water related systems are executed.

6. Provide skilled technicians to execute starting of equipment and to assist in execution of tests. Ensure that they are available and present during the agreed-upon schedules and for a sufficient duration to complete the necessary tests, adjustments, and problem solving.

7. Correct deficiencies (differences between specified and observed performance) as interpreted by the Owner's Project Manager, and A/E and retest the system and equipment.

    During construction, maintain as-built marked-up Drawings and Specifications of all Contract Documents and Contractor-generated coordination Drawings. Update after completion of Commissioning activities (include deferred tests). The as-built drawings and specifications shall be delivered to the Owner both in electronic format and hard copies as required by the Owner.

8. Provide training of the Owner's operating personnel as specified.

9. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; Communications wiring; and wiring connectors and connections.

B. Related Sections:

1. Section 26 05 00 – Common Work Results for Electrical
2. Section 26 05 26 – Grounding and Bonding for Electrical Systems
3. Section 26 05 33 – Raceway and Boxes for Electrical Systems
4. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.
5. Section 02320 - Backfill: Requirements for backfill to be placed by this section.
6. Section 02324 - Trenching: Execution requirements for trenching required by this section.
7. Section 07270 – Fire Stopping Systems.

1.2 REFERENCES

Latest Adopted Editions of:

A. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.
2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:

1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
2. 44-99 – Thermoset-Insulated Wires and Cables.
3. 83-98 – Thermoplastic-Insulated Wires and Cables.
4. 467-93 – Electrical Grounding and Bonding Equipment.
5. 486A-97 – Wire Connectors and Soldering Lugs for Use with Copper Conductors.

6. 486C-97 – Splicing Wire Connectors
7. 486D-97 – Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
8. 486E-94 – Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
9. 493-95 – Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.
10. 514B-97 – Fittings for Cable and Conduit
11. 1479-94 – Fire Tests of Through-Penetration Fire Stops.

1.3 SYSTEM DESCRIPTION

A. Cable and Wire shall be:

1. Provide factory-fabricated wires of sizes, ampacity ratings and materials for applications and services indicated.
2. Annealed copper.
3. Conductor insulation shall be dual type THHN/THWN 75°C (167°F) for dry, damp, and wet locations. Conductor insulation with single type marking THHN 90°C (194°F) may be used for dry locations only.
4. Solid conductor for feeders and branch circuits 10 AWG and smaller. Shall be stranded for No. 8 AWG and larger.
5. Stranded conductors for control circuits.
6. Conductors not smaller than 12 AWG for power and lighting circuits.
7. Conductors not smaller than 14 AWG for control circuits.
8. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
9. Isolated power system wiring: Type XHHW with a dielectric constant of 3.5 or less.

1.4 SPLICES AND JOINTS

A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL and NECA's "Standard of Installation" and in accordance with recognized industry practices.

B. Branch circuits (No. 10 AWG and smaller):

1. Connectors: Solderless, screw on, reusable pressure cable type, 600 Volt, 105 degree C with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped wires.
3. The number, size, and combination of conductors, as listed on the manufacturers packaging shall be strictly complied with.
4. Branch circuits over 75 feet in length shall be No. 10 AWG unless otherwise noted.

C. Feeder Circuits:

1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material.

2. Field installed compression connectors for cable sizes 250 kcmil and larger shall have not less than two clamping elements or compression indents per wire.

3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.

4. Plastic electrical insulating tape: Fed Spec. HH-I-595 shall apply including flame retardant, cold and weather resistant.

1.5 CONTROL WIRING

A. Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

1.6 COMMUNICATION AND SIGNAL WIRING

A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.

B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.

C. Multi-conductor cables shall have the conductors color-coded.

1.7 WIRE LUBRICATING COMPOUND

A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

B. Shall not be used on wire for isolated type electrical power systems.

1.8 FIREPROOFING TAPE

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200-Ampere arc for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

1.9 WARNING TAPE

A. The tape shall be standard, 76 mm (3 inch) wide, 4-Mil polyethylene detectable type.

B. The tape shall be red with black letters indicating "CAUTION BURIED ELECTRIC LINE BELOW".

1.10 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit for each building and conductor cable assembly type.

C. Certificates; Two weeks prior to final inspection, deliver to the owner four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.11 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of components and circuits.

1.12 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Perform Work in accordance with Authority Having Jurisdiction's requirements, codes and standards, and standard industry practice.

C. Maintain minimum one copy of each document on site.

1.13 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience. Product shall be manufactured in North America.

1.14 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.15 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Where conductors and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 PRODUCTS

2.1 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods compatible with existing electrical installations and as specified.

E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 26 05 53 in each junction box, panelboards, and all terminations. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Conductors in Raceway:

1. Pull conductors into raceway at same time.
2. Install building wire 4 AWG and larger with pulling equipment.

E. Special Techniques - Cable:

1. Protect exposed cable from damage.
2. Support cables above accessible ceiling, using wire management system, spring metal clips or metal cable ties to support cables from structure. Do not rest cable on ceiling panels.
3. Use suitable cable fittings and connectors.

F. Special Techniques - Wiring Connections:

1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.4 INSTALLATION, GENERALLY

A. Install in accordance with the NEC, and as specified.

B. Install all building conductors and wiring in raceway systems unless specifically excluded.

C. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.

D. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type, which firmly clamps each individual cable and tightens due to cable weight.

E. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.

F. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a nonhardening approved compound.

G. Wire Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.

2. Use ropes made of nonmetallic material for pulling feeders.

3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the owner.

4. Pull in multiple cables together in a single conduit.

3.5 SPLICE INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure.

B. Where the owner or Architect/Engineer determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the owner/architect/engineer.

C. Prior to beginning splice work, obtain owner/architect/engineer's approval for all splices for conductors No. 3 and larger.

3.6 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION

A. Unless otherwise specified in other sections of these specifications, install wiring and connect to perform the functions shown and specified in other sections of these specifications.

B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.

C. Where power supply circuits are not shown for systems, connect them to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

E. System voltages shall not exceed 120 Volts and shall be lower voltages where shown on the drawings or required by the NEC.

3.7 CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

D. In each handhole, install embossed brass tags to identify the system served and function.

3.8 FEEDER INDENTIFICATION

A. In each interior pullbox and junction box, install labels on each circuit cables and wires to clearly designate their circuit identification and voltage.

B. In handholes, provide tags of the embossed brass type, and also show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.9 WIRE COLOR

A. General:

1. Install conductor colors in accordance with the following:

a. Black, red, and blue for circuits at 208/120 volts single or three phase.

b. Brown, orange, and yellow for circuits at 480/277 volts single or three phase.

2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:

a. Black, red, and blue for circuits at 208/120 volts single or three phase.

b. Orange, brown, and yellow for circuits at 480/277 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install home runs with each phase uniquely color coded.

D. Parallel Circuit Conductors: Uniquely identify each phase.

E. Ground Conductors:

1. For 6 AWG and smaller: Green.

2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.10 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

3.11 FIELD TESTING

A. Prior to energization of circuitry, check installed feeder wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled. A list of feeders tested shall be submitted to the engineer indicating the insulation resistance level for each cable.

B. Tests shall be performed by megger and conductors shall test free from short-circuits and grounds.

C. Test conductors phase-to-phase and phase-to-ground.

D. The Contractor shall furnish the instruments, materials, and labor for these tests.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies general grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents.

B. “Grounding Electrode system” refers to all electrodes required by NEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

D. The type of electrical grounding and bonding work specified in this Section includes the following: Solidly Grounded.

E. Applications of electrical grounding and bonding include but are not limited to:

1. Electrical Power Systems.
2. Telecommunications Systems.
3. Low Voltage Systems.
4. Separately Derived Systems.
5. Service Equipment.
6. Raceways and Enclosures.
7. Interior, Exterior, and Site Lighting.
8. Equipment – interior and exterior.

F. Related Sections:

1. Section 03 20 00 - Concrete Reinforcing: Bonding or welding bars when reinforcing steel is used for electrodes.
2. Section 09 69 00 - Access Flooring: Grounding systems for access flooring.
3. Section 26 41 00 - Facility Lightning Protection: Grounding of lightning protection system.
4. Section 33 79 00 - Site Grounding: Site related grounding components for buildings and facilities.

G. Section 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL: General electrical requirements and items that are common to more than one section of Division 26.

H. This section is a part of each Division 26 making reference to grounding specified herein, regardless of voltage level.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.
3. 142-2007 – Recommended Practice for Grounding of Industrial and Commercial Power Systems

B. International Electrical Testing Association:

1. ANSI/NETA ATS-2009 – Standard for testing specifications for electrical power equipment and systems.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories, Inc (UL):

1. 44-1999 – Thermoset-Insulated Wires and Cables.
2. 83-1998 – Thermoplastic-Insulated Wires and Cables.
3. 467-1993 – Grounding and Bonding Equipment.
4. 486A – 2000 – Wire Connectors and Soldering Lugs for Use with Copper Conductors.
5. 869 – Electrical Service Equipment.

E. American Society for Testing and Materials (ASTM):

1. B1-2001 – Standard Specification for Hard-Drawn Copper Wire.
2. B8-1999 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Metal underground water pipe.
2. Metal building frame.
3. Concrete-encased electrode.
4. Rod electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms maximum unless otherwise shown on drawings.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Perform Work in accordance AHJ requirements, codes and standards, and generally accepted industry practices.

1.8 QUALIFICATIONS

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

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

1.9 DELIVERY, STORAGE, AND HANDLING

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

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:

1. Erico, Inc.
2. O-Z Gedney Co.
3. Thomas & Betts, Electrical
4. Substitutions: Not Permitted.

B. Product Description:

1. Material: Copper-clad steel.

C. Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: size as shown on drawings.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS (DN200) by 24 inches (600 mm) long concrete or fiberglass pipe with belled end.

B. Well Cover: Cast iron or Fiberglass with legend "GROUND" embossed on cover.

2.4 MECHANICAL CONNECTORS

A. Manufacturers:

1. Erico, Inc.

2. ILSCO Corporation.
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical.
5. Substitutions: Not Permitted.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.5 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Copperweld, Inc.
2. ILSCO Corporation.
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical.
5. Substitutions: Not Permitted.

B. Furnish materials in accordance with AHJ requirements and applicable codes and standards.

C. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove all surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods as specified.

3.4 INSTALLATION

A. Install in accordance with IEEE 142 and 1100.

B. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions; applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices, to ensure that products comply with requirements.

C. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

D. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

E. Ground electrical service system neutral at service entrance to the building cold water line, building structural steel, and to a minimum three ground rods spaced minimum six feet (6') apart.

F. Install required number of rod electrodes to achieve specified resistance to ground.

G. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at related transformers.
2. Separately derived systems (Transformers downstream from the service entrance): Ground the secondary neutral to separate grounding electrode.

H. Install grounding and bonding conductors concealed from view.

I. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

J. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings. Electrically bond steel together.

K. Bond together metal siding not attached to grounded structure; bond to ground.

L. Install isolated grounding conductor for circuits as shown on drawings in accordance with IEEE 1100.

M. Equipment Grounding Conductor (E.G.): Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

N. Connect to site grounding system. Refer to Section 33 79 00.

O. Bond to lightning protection system. Refer to Section 26 41 00.

P. Install continuous grounding using underground cold water system (1" Diameter or larger) building steel and driven ground rods as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

Q. Accomplish grounding of electrical system by using insulated grounding conductor installed within feeder and branch circuit raceway. Grounding conductor sizes in accordance with drawings and NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

R. Ground electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

S. Permanently attach equipment and grounding conductors prior to energizing equipment.

T. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

U. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors and plumbing systems.

V. All raceways with No. 10 or 12 AWG phase conductors for receptacles, lighting fixtures and similar circuits shall be provided with a parity-sized green equipment ground conductor. Ground conductor shall be installed in entire raceway system, including wall switches and flexible conduit to light fixtures. Equipment ground conductor sizes for circuits with phase conductors larger than No. 12 AWG are indicated on drawings. Ground conductors shall be connected to ground bus in panelboards.

W. Terminate feeder and branch circuit insulated equipment-grounding conductors with grounding lug, bus or bushing. Conductors looped under screw or bolt heads will not be permitted.

X. Install clamp-on connectors on clean metal contact surfaces to ensure electrical conductivity and circuit integrity.

Y. Provide grounding busing and a continuous copper-bonding jumper from the busing to the equipment ground bus in all feeders. The bonding jumper shall be the same size as the equipment ground conductor.

Z. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

AA. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

BB. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

CC. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.5 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.6 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.7 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to the electrical grounding electrode system.

3.8 TELECOMMUNICATIONS SYSTEM

A. Bond telecommunications system grounding equipment to the electrical grounding electrode system.

3.9 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth.

B. Make connections by the exothermic process to form solid metal joints.

C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.10 GROUNDING FOR RF/EMI CONTROL

A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 4" wide copper strip or two No. 10 copper conductors spaced minimum 4" apart. Use No. 6 copper where exposed and subject to damage.

B. Comply with the following when shielded cable is used for data circuits.

1. Shields shall be continuous throughout each circuit.

2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground shield.

3. Do not connect shields from different circuits together.

4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

3.11 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform ground resistance testing in accordance with IEEE 142.

D. Perform leakage current tests in accordance with NFPA 99.

E. Perform continuity testing in accordance with IEEE 142.

F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channels.
3. Spring steel clips.
4. Sleeves.
5. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 27 05 29 - Hangers and Supports for Communications Systems.
3. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

1.2 REFERENCES

A. ASTM International:

ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
ASTM E1966	Standard Test Method for Fire-Resistive Joint Systems

B. FM Global:

FM	Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:

NFPA 70	National Electrical Code

D. Underwriters Laboratories Inc.:

UL 263	Fire Tests of Building Construction and Materials
UL 723	Tests for Surface Burning Characteristics of Building Materials
UL 1479	Fire Tests of Through-Penetration Firestops
UL 2079	Tests for Fire Resistance of Building Joint Systems
UL	Fire Resistance Directory

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: [ASTM E119] [ASTM E814] [UL 263] [UL 1479] to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

B. Surface Burning: UL 723 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports for feeders greater than 400 Amps.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor [and Roof] Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Coordinate with Architectural Drawings for roof penetrations.

D. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

E. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

F. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Perform Work in accordance with AHJ’s requirements and applicable codes and standards.

1.8 QUALIFICATIONS

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

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

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

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

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F (15 degrees C).

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:

1. Allied Tube & Conduit Corp.
2. Electroline Manufacturing Company.
3. O-Z Gedney Co
4. Substitutions: Not Permitted.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F (85 degrees C). Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.
2. B-Line Systems.
3. Midland Ross Corporation, Electrical Products Division.
4. Unistrut Corp.
5. Substitutions: Not Permitted.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

A. Furnish materials in accordance with AHJ, codes and standards, and generally accepted industry practices.

B. Sleeves through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

C. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.
2. NMP Corporation.
3. Substitutions: Not Permitted.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.5 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. International Protective Coating Corp.
4. 3M fire Protection Products.

5. Specified Technology, Inc.

6. Substitutions: Not Permitted.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: [Single] [Multiple] component silicone elastomeric compound and compatible silicone sealant.

2. Foam Firestopping Compounds: [Single] [Multiple] component foam compound.

3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.

4. Fiber Stuffing and Sealant Firestopping: Composite of [mineral] [ceramic] fiber stuffing insulation with silicone elastomer for smoke stopping.

5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.

6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer's full range of colors.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install materials to arrest liquid material leakage.

D. Obtain permission from Owner before using powder-actuated anchors.

E. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Install conduit and raceway support and spacing in accordance with NEC.

B. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.

C. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

D. Install hangers, supports and attachments to support piping properly from building structure. Arrange for grouping of parallel runs horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

E. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

F. Install multiple conduit runs on common hangers.

G. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panelboards with minimum of four anchors.

3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Remove dam material after firestopping material has cured.

F. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Pack void with backing material.

d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where conduit penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

G. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Install type of firestopping material recommended by manufacturer.

2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with stuffing, fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install stainless steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

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

B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:

1. Section 26 05 03 - Equipment Wiring Connections.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 26 05 34 - Floor Boxes for Electrical Systems.
5. Section 26 05 36 - Cable Trays for Electrical Systems.
6. Section 26 05 39 - Underfloor Raceways for Electrical Systems.
7. Section 26 05 53 - Identification for Electrical Systems.
8. Section 26 27 16 - Electrical Cabinets and Enclosures.
9. Section 26 27 23 - Indoor Service Poles.
10. Section 26 27 26 - Wiring Devices.
11. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
12. Section 27 05 36 - Cable Trays for Communications Systems.
13. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.
14. Section 28 05 36 - Cable Trays for Electronic Safety and Security.
15. Section 33 71 19 - Electrical Underground Ducts and Manholes.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

C. National Fire Protection Association (NFPA):
1. 70 – National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):
1. 1-93 – Flexible Metal Conduit
2. 5-96 – Surface Metal Raceway and Fittings
3. 6-97 – Rigid Metal Conduit
4. 50-95 – Enclosures for Electrical Equipment
5. 467-93 – Grounding and Bonding Equipment
6. 514A-96 – Metallic Outlet Boxes
7. 514B-97 – Fittings for Cable and Conduit
8. 651-95 – Schedule 40 and 80 Rigid PVC Conduit
9. 651A-95 – Type EB and A Rigid PVC Conduit and HDPE Conduit
10. 797-93 – Electrical Metallic Tubing

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground More than 5 feet outside Foundation Wall: Provide schedule 40 PVC conduit. Provide cast metal boxes or nonmetallic handholes.

C. Underground Within 5 feet from Foundation Wall: Provide either plastic coated RMC conduit or schedule 40 PVC. Rigid conduit shall be used when stubbing up above grade. Provide cast metal or nonmetallic boxes.

D. Outdoor Locations, Above Grade: Provide rigid steel or electrical metallic tubing (above 6' A.F.F.). Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. In Slab Above Grade: Provide rigid steel conduit or thickwall nonmetallic conduit. Provide cast boxes.

F. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet boxes in finished areas. Provide hinged enclosure for large pull boxes.

G. Exposed Dry Locations: Provide rigid steel or electrical metallic tubing (EMT above 6' A.F.F.). Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 1/2 inch unless otherwise specified.

1.5 SUBMITTALS

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

B. Product Data: Submit for the following:

1. All types of conduit planned for the project.
2. Handholes, and NEMA 3R pullboxes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

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

B. Project Record Documents:

1. Record actual routing of conduits larger than 2 inch.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

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

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 MATERIAL

A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thickness) for each service indicated.

B. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements and comply with applicable portions of NEC for raceways.

C. Conduit Size: In accordance with the NEC, but not less than 1/2 inch unless otherwise shown. Where permitted by the NEC, 1/2inch flexible conduit may be used for tap connections to recessed lighting fixtures.

D. Conduit:

1. Rigid steel (RMC): UL 6, hot dipped galvanized, threaded type.
2. Electrical metallic tubing (EMT): U.L. 797. Maximum size 5 inch. Permitted only with cable rated 600 volts or less.
3. Flexible steel conduit (commercial Greenfield): UL 1, formed from continuous length of spirally-wound, interlocked, zinc-coated strip steel. Permitted only with cable rated 600 volts or less.
4. Liquid-tight flexible metal conduit: Flexible galvanized steel tubing covered with extruded liquid-tight jacket of polyvinyl chloride (PVC). Provide conduit with a continuous copper bonding conductor wound spirally between convolutions. Permitted only with cable rated 600 volts or less.
5. Underground PVC plastic conduit: UL 651 and UL 651A, heavy wall PVC or high density PE. Heavy Wall Conduit: C, UL-rated, constructed of Schedule 40, polyvinyl chloride. For direct burial, UL listed and in conformity with NEC Article 347.
6. Surface metal raceway: UL 5. Permitted only with cable rated 600 volts or less.

E. Conduit Fittings:

1. Rigid steel conduit fittings:
    a. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable.
    b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
    c. Bushings: Metallic insulation type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

d. Erickson (union-type) and set screw type couplings: Approved for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fitting to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank coverplates having the same finishes as that of other electrical plates in the room.

2. Electrical metallic tubing fittings:

   a. Only steel or malleable iron material are acceptable.

   b. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes over 2 inches. If set screw type is used, then set screw or compression types are permitted for conduits less than 2 inches. Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

   c. Indent type connectors of couplings prohibited.

   d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

3. Flexible steel conduit (greenfield) fittings:

   a. UL 5. Only steel or malleable iron materials are acceptable.

   b. Straight Terminal Connectors: One piece body. Female end with clamp and deep slotted machine screw for securing conduit and male threaded end provided with locknut.

   c. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit and male threaded end provided with locknut.

4. Liquid-tight flexible metal conduit fittings:

   a. Only steel or malleable iron materials are acceptable.

   b. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

5. Underground PVC plastic conduit fittings: As recommended by the conduit manufacturer. Make solvent cemented joints in accordance with recommendations of manufacturer.

6. Surface metal raceway fittings: As recommended by the raceway manufacturer.

7. Expansion and deflection couplings:

   a. UL 467 and UL 514B.

   b. Accommodate, 0.75 inch deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

F. Conduit Supports:

1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

3. Multiple conduit (trapeze) hangers: Not less than 1-1/2 by 1-1/2 inch, 12 gage steel, cold formed, lipped channels; with not less than 3/8 inch diameter steel hanger rods.

4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

G. Outlet, Junction, and Pull Boxes:

1. UL-50 and UL-514A.

2. Cast metal where required by the NEC and equipped with waterproof, rustproof covers.

3. Sheet metal boxes: Galvanized steel, except where otherwise shown.

H. Wireways: Equip with hinged covers, except where removable covers are shown.

I. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRIC LINE BELOW".

2.2 OUTLET BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Not Permitted.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

C. Nonmetallic Outlet Boxes: NEMA OS 2.

D. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

E. Wall Plates for Finished Areas: As specified in Section 26 27 26.

F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.3 PULL AND JUNCTION BOXES

A. Manufacturers:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Substitutions: Not Permitted.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Surface Mounted Cast Metal Box: NEMA 250, Type [4] [4X] [6]; flat-flanged, surface mounted junction box:

1. Material: Galvanized cast iron.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, flanged, recessed cover box for flush mounting:

1. Material: Galvanized cast iron.
2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: "ELECTRIC" or “TELECOM” as needed.
4. Size as required. Minimum size is 18”x18”x18”.
5. Minimum 10,000 lb. rated.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point.

K. Maximum Size Conduit in Slab Above Grade: ¾ inch. Do not cross conduits in slab larger than 1/2 inch (DN 13).

L. Maintain clearance between raceway and piping for maintenance purposes.

M. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

N. Cut conduit square using saw or pipe cutter; de-burr cut ends.

O. Bring conduit to shoulder of fittings; fasten securely.

P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

Q. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

R. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.

S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

T. Install fittings to accommodate expansion and deflection where raceway crosses control and expansion joints.

U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

W. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

X. Close ends and unused openings in wireway.

3.5 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 1 foot prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate requirements, sealing, and locations with architect prior to work.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.7 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.8 CLEANING

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

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 34 - EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:

1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables (600 volts and below).

2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

C. Related Documents:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

2. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 23 and Division 26 section making reference to electrical connections for equipment specified herein.

1.2 REFERENCES

Latest Adopted Editions of:

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.

2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

B. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices) for junction boxes, motor starters, and disconnect switches.

C. UL Compliance: Comply with UL Std 486A, “Wire Connectors and Soldering Lugs for Use with Copper Conductors” including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

1.3 SUBMITTALS

A. Section 01 33 23 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

D. Adjusted circuit breaker trip and time delay settings to values as indicated on Drawings.

E. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.4 COORDINATION

A. Section 01 00 00 – General Requirements: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide complete assembly of materials; including, but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices and terminations of types indicated.

B. Wire, Cables, and Connectors:
General: Provide wires, cables, and connectors complying with Division 26.

C. Connectors and Terminals: Provide electrical connectors and terminals that mate and match (including sizes and ratings) with equipment terminals, and are recommended by equipment manufacturer for intended applications.

D. Manufacturers:

1. Pass & Seymour.
2. Hubbell.
3. Cooper.
4. Substitutions: Not Permitted.

E. Attachment Plug Construction: Conform to NEMA WD 1.

F. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

G. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations. Only allowed where shown on drawings.

H. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 PART 3 - EXECUTION

3.1 3.1 EXAMINATION

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

B. B.Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 3.2 INSTALLATION

A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions, with recognized industry practices, and complying with applicable requirements of UL and NEC to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway, and equipment installation as necessary to properly interface installation of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Make electrical connections.

E. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in exterior, damp, wet, corrosive, oil and grease locations.

F. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

G. Install receptacle outlet to accommodate connection with attachment plug.

H. Install cord and cap for field-supplied attachment plug.

I. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

J. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

K. Install terminal block jumpers to complete equipment wiring requirements.

L. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.3 ADJUSTING

A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

B. Field Quality Control: Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

End of Section

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Underground Warning Tape.
7. Lockout Devices.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.
2. Section 27 05 53 - Identification for Communications Systems.
3. Section 28 05 53 - Identification for Electronic Safety and Security.

1.2 SUBMITTALS

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

B. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminate in sizes and thicknesses indicated, engraved with engraver’s standard letter style of sizes and wording indicating; punched for mechanical fastening.

2. Signs shall be colored face with white core plies (letter color).
    a. Thickness: 1/16", except as otherwise indicated.
    b. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot, or should not, penetrate substrate.
    c. Nameplate colors shall be:
        1. Black – Normal, utility power, less than 600 Volts
        2. Red – Fire alarm system.
        3. Blue – UPS power.

2.2 LABELS

A. Dymo-Labels: Identify all receptacles and wall switches (new and existing) with panelboard and branch circuit number. Attach to coverplate.

2.3 CONDUIT AND RACEWAY MARKERS

A. Description: Nameplate fastened with straps or Stencils.

B. Color:
    1. 480 Volt System: Black lettering on white background.
    2. 208 Volt System: Black lettering on white background.

2.4 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 PREPARATION

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

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

C. Coordinate names, abbreviations, and other designations used in electrical identification work with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated, or if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

3.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment.

C. Replace lost nameplates.

D. Re-stencil existing equipment.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.
2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
4. Secure nameplate to equipment front using screws, rivets, or adhesive.
5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
6. Install nameplates on the following:
    a. Switchgear/Switchboards.
    b. Panelboards.
    c. Transformers.
    d. Disconnect Switches.
    e. Motor Starters.
    f. Fire Alarm Equipment Panels.

C. Label Installation:

1. Install label parallel to equipment lines.

D. Wire Marker Installation:

1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
3. Install labels at data outlets identifying patch panel and port designation.

E. Stencil Installation:

1. Apply stencil painting in accordance with Section 09 90 00.

F. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes two-winding transformers; shielded transformers; autotransformers; and buck-and-boost transformers.

B. Related Sections:

1. Section 26 05 26 – Grounding and Bonding.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA ST 1 - Specialty Transformers (Except General Purpose Type).
2. NEMA ST 20 - Dry Type Transformers for General Applications.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:

1. National Electrical Code (NEC).

1.3 SUBMITTALS

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

B. Product Data: Submit and outline and support point dimensions of enclosures and accessories if mounted above floor, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

C. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

D. Complete nameplate data including manufacturer’s name and catalog number.

1.4 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of transformers.

1.5 QUALIFICATIONS

A. Manufacturers:

1. Square D.
2. Cutler-Hammer
3. G.E.
4. Siemens.

B. Substitutions: Not Permitted.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 GENERAL PURPOSE DRY TYPE TWO-WINDING TRANSFORMERS

A. Transformers shall be UL listed or labeled.

B. Product Description: TP-1 rated, NEMA ST 20, factory-assembled, air-cooled, dry type transformers.

C. Primary and secondary voltages as shown on drawings. Delta-Wye grounded configuration unless shown otherwise.

D. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.

E. Sound Levels: Maximum sound levels are as follows:

1. 1-9 kVA: 40 dB.
2. 10-50 kVA: 45 dB.
3. 51-150 kVA: 50 dB.
4. 151-300 kVA: 55 dB.
5. 301-500 kVA: 60 dB.

F. Enclosure: NEMA ST 20, Type 1. Furnish lifting eyes or brackets.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data.

I. Dry type transformers shall have the following features:

1. Self-cooled by natural convection, isolating windings, indoor, dry type. Autotransformers will not be accepted.
2. Rating and winding connections shall be as shown on the drawings.
3. Transformers shall have copper windings.
4. Ratings shown on the drawings are for continuous-duty without the use of cooling fans.
5. Insulation systems:
    a. Transformers 30 KVA and larger: UL rated 220 degrees C system having an average maximum rise by resistance of 150 degrees C in a maximum ambient of 40 degrees C.
    b. Transformers below 30 KVA: Same as for 30 KVA and larger or UL rated 185 degrees C system having an average maximum rise by resistance of 115 degrees C in a maximum ambient of 40 degrees C.
6. Core and coil assemblies:
    a. Rigidly braced to withstand the stresses caused by short circuit currents and rough handling during shipment.
    b. Cores shall be grain oriented, non-aging, and silicon steel.
    c. Coils shall be continuous windings without splices except for taps.
    d. Coil loss and core loss shall be minimum for efficient operation.
    e. Primary and secondary tap connections shall be brazed or pressure type.
    f. Coil windings shall have end fillers or tie downs for maximum strength.
7. Nominal impedance shall be as shown on the drawings. If not shown on drawings, nominal impedance shall be as permitted by NEMA.
8. Single phase transformers rated 15 KVA through 25 KVA shall have two, 5 percent full capacity taps below normal rated primary voltage. All transformers rated 30 KVA and larger shall have two, 2 ½ percent full capacity taps above, and four, 2 ½ percent full capacity taps below normal rated primary voltage.
9. Core assemblies shall be grounded to their enclosures by adequate flexible ground straps.
10. Enclosures:
    a. Not less than code gage steel.
    b. Outdoor enclosures shall be NEMA 3R.

c. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.

d. Ventilation openings shall prevent accidental access to live components.

e. Thoroughly clean and paint enclosure at the factory with manufacturer's prime coat and standard finish.

11. Standard NEMA features and accessories including ground pad, lifting provisions and nameplate with the wiring diagrams and sound level indicated on it.

12. Dimensions and configurations shall conform to the spaces designated for their installations.

13. Transformers shall meet the minimum energy efficiency values per NEMA TP1 as listed below:

KVA Rating	Output efficiency (%)
15	97
30	97.5
45	97.7
75	98
112.5	98.2
150	98.3
225	98.5
300	98.6
500	98.7
750	98.8

2.2 SOURCE QUALITY CONTROL

A. Production test each unit according to NEMA ST20.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 EXISTING WORK

3.3 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, in accordance with Section 26 05 33, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Support transformers in accordance with Section 26 05 29.

1. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer. Coordinate exact requirements with architect and structural engineer.

2. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.

3. Mount trapeze-mounted transformers as indicated on Drawings. Coordinate exact requirements with architect and structural engineer.

4. Stacked transformers: Construct and anchor painted angled steel frame suitable for weight and size of transformer. Ground frame with min. #8AWG

D. Installation of transformers shall be in accordance with the NEC, as recommended by the equipment manufacturer and as shown on the drawings.

E. Install the transformers with adequate clearance at a minimum of 6 inches from wall and adjacent equipment for air circulation to remove the heat produced by transformers.

F. Install grounding and bonding in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.2.1.

3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 24 13 - SWITCHBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes main switchboards.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.
3. Section 26 25 00 - Enclosed Bus Assemblies.
4. Section 26 28 13 - Fuses.
5. Section 33 71 73 - Electrical Utility Services: Utility metering equipment.

1.2 REFERENCES

A. American National Standards Institute:

ANSI C12.1	Code for Electricity Metering
ANSI C39.1	Requirements, Electrical Analog Indicating Instruments

B. Institute of Electrical and Electronics Engineers:

IEEE C57.13	Standard Requirements for Instrument Transformers
IEEE C62.41	Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

C. National Electrical Manufacturers Association:

NEMA AB 1	Molded Case Circuit Breakers and Molded Case Switches
NEMA FU 1	Low Voltage Cartridge Fuses
NEMA KS 1	Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA PB 2	Deadfront Distribution Switchboards
NEMA PB 2.1	General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less
NEMA SG - 3	“Low Voltage Power Circuit Breakers” pertaining to Switchboard Assemblies.

D. International Electrical Testing Association:

NETA ATS	Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

E. National Fire Protection Association (NFPA): National Electric Code

F. UL Listing:

489-02	Molded Case Circuit Breakers and Circuit Breakers Enclosures
891-98	Dead-Front Switchboards
1283-98	Electromagnetic Interference Filters
1449-96	Transient Voltage Surge Suppressors

G. ANSI Compliance: Comply with applicable requirements of ANSI standards pertaining to switchboard assemblies.

1.3 SUBMITTALS

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

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, temperature rise, wiring and connection diagrams, plan, front, side, and rear elevations, sectional views, bus work, circuit breaker frame sizes, trip and short-circuit rating, long-time, short-time, instantaneous and ground default settings, coordinated breaker and fuse curves, accessories, and device nameplate data.

3. Show the size, ampere-rating, number of bars per phase and neutral in each bus run (horizontal and vertical), bus spacing, equipment ground bus, and bus material.

C. Manuals:

1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.

a. Wiring diagrams shall have their terminals identifies to facilitate installation, maintenance, and operation.

b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnection between the items of equipment.

c. Provide a clear and concise description of operation, which gives, in detail, the information required to properly operate the equipment.

1.4 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations, configurations, and ratings of switchboards and their components on single line diagrams and plan layouts.

C. Operation and Maintenance Data: Submit per 01700 and include recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Coordinate equipment installations and building/door openings with general contractor prior to ordering equipment. Make necessary adjustments as required.

C. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

D. Accept switchboards on site. Inspect for damage.

E. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

F. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 SEQUENCING

A. Section 01 10 00 - Summary: Work sequence.

B. Sequence Work to avoid interferences with building finishes and installation of other products.

C. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 3.

D. Coordinate with other electrical work including raceways, electrical boxes and fittings, and cabling/wiring work, as necessary to interface installation of switchboard with other work.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 DISTRIBUTION SWITCHBOARDS

A. Manufacturers:

1. Square D.
2. Cutler-Hammer.
3. Siemens.
4. GE Electrical.
5. Substitutions: Not Permitted.

B. Product Description: NEMA PB 2, enclosed switchboard with electrical ratings and configurations as indicated on Drawings.

C. Service Conditions:

1. Temperature: 40 degrees C.

2.2 EQUIPMENT SECTIONS AND COMPONENTS:

A. General: Except as otherwise indicated, provide switchboards and ancillary components of types, sizes, characteristics, and ratings indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.

2.3 BASIC ARRANGEMENT

A. Type I: Switchboard shall be front accessible with the following features:

1. Device Mounting:

a. Main breaker: Individually mounted and compartmented or group mounted with feeder breakers.

b. Feeder breakers: Group mounted.

2. Section alignment: As shown on the drawings.

3. Accessibility:

a. Main section line and load terminals; Front and side.

b. Distribution section line and load terminals: Front.

c. Through bus connections: Front and end.

4. Bolted line and load connections.

5. Full height wiring gutter covers for access to wiring terminals.

6. Short Circuit Current Rating: 65,000 Amperes RMS symmetrical, minimum, or as shown on the drawings, whichever is higher.

B. Short Circuit Current Rating: The switchboard as a complete unit shall be given a single short-circuit current rating by the manufacturer. Such ratings shall be established by the actual tests by the manufacturer in accordance with UL specifications on equipment constructed similarly to the subject switchboard.

C. Series rating is not allowed.

D. Vertical and horizontal sections shall be fully rated.

2.4 HOUSING

A. Enclosure Construction: The Switchboard shall be dead-front with front accessibility. The switchboard frame shall be of formed code-gauge steel, rigidly welded and bolted together to support all cover plates, bussing, and component devices during shipment and installation. Steel base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. Each switchboard section shall have a barriered bottom and an individually removable top plate for installation and termination of conduit. The switchboard enclosure shall be painted on all exterior and interior surfaces. The paint finish shall be a medium light gray, ANSI #49, applied by the electro-deposition process over and iron phosphate pretreatment. All front covers shall be screwed on and removable, and all doors shall be hinged with removable hinge pins. Top and bottom conduit areas shall be clearly indicated on shop drawings.

B. Provide ventilation louvers where required to limit the temperature rise of current carrying parts. All openings shall be protected against entrance of falling dirt, water, or foreign matter.

C. Group the meters and their control switches on a hinged front cover. Provide concealed hinges and latch.

2.5 BUSES

A. General: Buses shall be arranged for 3 phase, 4 wire distribution. Main phase buses (through bus), full size neutral bus, and ground bus shall be full capacity the entire length of

the switchboard. Provide for future extensions by means of bolt holes or other approved method. Brace the bus to withstand the available short circuit current at the particular location and as shown on the drawings. No magnetic material shall be used between buses to form a magnetic loop.

B. Material and Size: Buses and connections shall be hard drawn copper of 98 percent conductivity. Bus temperature rise shall not exceed 65 degrees C (149 degrees F). Section busing shall be sized based on UL and NEMA Switchboard Standards.

C. Bus Connections: All contact surfaces shall be copper. Provide a minimum of two plated bolts per splice. Where physical bus size permits only one bolt, provide a means other than friction to prevent turning, twisting or bending. Torque bolts to the manufacturer's recommended values.

D. Neutral Bus: Provide bare or plated bus and mount on insulated bus supports. Provide neutral disconnect link to permit isolation on neutral bus from the common ground bus and service entrance conductors.

E. Ground Bus: Provide an uninsulated 1/4 inch by 2 inch copper equipment ground bus bar sized per UL 891 the length of the switchboard and secure at each section.

F. Main Bonding Jumper: Connect an uninsulated 1/4 inch by 2 inch copper bus between the neutral ground buses to establish the system common ground point.

G. Bus:

1. Insulation: Fully insulate load side bus bars. Do not reduce spacing of insulated bus.

H. Ground Bus: Insulated, extend length of switchboard.

2.6 CONTROL WIRING

A. Control wiring shall be 600 Volt Class B stranded SIS. Install all control wiring complete wiring complete at the factory adequately bundled and protected. Wiring across hinges and between shipping units shall be Class C stranded. Size in accordance with NEC. Provide control circuit fuses.

2.7 MAIN CIRCUIT BREAKERS

A. Type I Switchboard: Provide UL listed and labeled molded case circuit breakers in accordance with NEC and as shown on the drawings. Circuit breakers shall be the solid state adjustable trip type.

1. Trip units shall have field adjustable tripping characteristics as follows:

a. Ampere setting (continuous).

b. Long time band.

c. Short time trip point.

d. Short time delay.

e. Instantaneous trip point.

f. Ground fault trip point.

g. Ground fault trip delay.

2. Trip settings shall be as indicated on the drawings. Final settings shall be as shown on the electrical system protective device study.

3. Breakers, which have the same rating, shall be interchangeable with each other.

2.8 FEEDER CIRCUIT BREAKERS

A. Provide UL listed and labeled molded case circuit breakers, in accordance with the NEC, as shown on the drawings, and as herein specified.

B. Non-adjustable Trip Molded Case Circuit Breakers:

1. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 Ampere frame size or less. Magnetic trip shall be adjustable from 3X to 10X for breakers with 250 Ampere frame size and higher. Factory setting shall be LOW unless otherwise noted.

2. Breaker features shall be as follows:

a. A rugged, integral housing of molded insulating material.

b. Silver alloy contacts.

c. Arc quenchers and phase barriers for each pole.

d. Quick-make, quick-break, operating mechanisms.

e. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.

f. Electrically and mechanically trip free.

g. An operating handle which indicates ON, TRIPPED and OFF positions.

h. Line and load connections shall be bolted.

i. Interrupting rating shall not be less than the maximum short circuit current available at the line.

j. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

C. Branch circuit breakers shall be bolt-on, group-mounted molded plastic case, air circuit breaker type. Breakers shall have thermal-magnetic trip units and a common trip bar so that the tripping of one pole will automatically trip all the poles of the breaker. Breakers shall be trip-free and trip-indicating and shall have quick-make, quick-break contacts.

D. Adjustable Trip Molded Case Circuit Breakers:

1. Provide molded case, solid state adjustable trip type circuit breakers.

2. Trip units shall have field adjustable tripping characteristics as follows:
    a. Ampere setting (continuous).
    b. Long time band.
    c. Short time trip point.
    d. Short time delay.
    e. Instantaneous trip point.
    f. Ground fault trip point (See drawings if required).
    g. Ground fault trip delay (See drawings if required).
3. Trip settings shall be as indicated on the drawings. Final settings shall be shown on the electrical system protective device study.
4. Breakers, which have same rating, shall be interchangeable with each other.

E. Line and Load Terminations: Accessible from front only of switchboard, suitable for conductor materials and sizes as indicated on Drawings.

F. Utility Metering Compartment: Furnish metering transformer compartment for Utility Company's use, in accordance with Utility Company requirements.

G. Pull Section: Size as indicated on Drawings and width, depth and height to match switchboard. Arrange as indicated on Drawings.

H. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents.

I. Enclosure: Type 1 - General Purpose.

J. Align sections at front only.

K. Switchboard Height: As shown on drawings, excluding floor sills, lifting members and pull boxes.

L. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

M. Mimic Bus: Show bussing, connections and devices in single line form on front panels of switchboard using black color light metal strips, fastened flat against panel face with screws or rivets.

N. All circuit breakers shall have A.I.C ratings as shown on drawings.

2.9 POWER METERS

A. Furnish digital meters and display for volts, amps, kW, kVA, and power factor. Square ‘D’ ‘ION 7550’ or equivalent.

2.10 ACCESSORIES

A. Circuit Breaker Lifting Device: Carriage and track on top of each switchboard with lifting device to serve draw-out circuit breakers in switchboard.

2.11 SOURCE QUALITY CONTROL

A. Furnish shop inspection and testing in accordance with NEMA PB 2.

B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.

C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Architect/Engineer at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify surface is suitable for switchboard installation.

3.2 INSTALLATION

A. Install in accordance with NEMA PB 2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install engraved plastic nameplates in accordance with Section 26 05 53.

D. Install breaker circuit directory.

E. Ground and bond switchboards in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.1.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust operating mechanisms for free mechanical movement.

C. Tighten bolted bus connections.

D. Adjust circuit breaker trip and time delay settings to values as instructed by Architect/Engineer.

3.5 CLEANING

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

B. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes distribution and branch circuit panelboards.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.
3. Section 26 28 19 – Low Voltage Electrical Power Conductors and Cables (600 volts and below)

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:

1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
5. NEMA PB 1 - Panelboards.
6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc.:

1. UL 67 - Safety for Panelboards.
2. UL 1283 - Electromagnetic Interference Filters.

3. UL 1449 - Transient Voltage Surge Suppressors.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate as a minimum outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating and circuit breaker arrangement and sizes.

C. Product Data: Submit catalog data showing specified features of standard products.

D. Complete nameplate data including manufacturer's name and catalog number.

1.4 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of panelboards and enclosures, of types, sizes and ratings required; whose products have been in satisfactory use in similar service for not less than (5) five years.

B. Installer's Qualifications: A firm with at least three (3) years of successful installation experience on projects utilizing panelboards similar to those required for this project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to the installation and construction of electrical panelboards and enclosures.

2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards", and UL Codes 50, 869 and 1053 pertaining to panelboards, accessories and enclosures. Provide panelboard units that are UL listed and labeled.

1.6 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance products.

B. Furnish two of each panelboard key. Panelboards keyed alike to Owner's current keying system.

PART 2 PRODUCTS

2.1 PANELBOARDS

A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.

B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.

C. All panelboards shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.

D. All panelboards shall be completely factory assembled with molded case circuit breakers.

E. Main circuit breaker shall have vertical mounting position.

F. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as shown on scheduled and on the drawings.

G. Power Distribution Panelboards shall be Square D type 'I Line', General Electric type 'Spectra', Cutler Hammer type 'PRL3a'or Siemens equivalent. Voltage shall be indicated.

H. Lighting and Appliance: Panelboards shall be Square D type 'NQOD' or 'NF', General Electric A-series or 'S2', Cutler-Hammer type PRL2 or Siemens equivalent. Panelboard boxes shall be five and three-fourths (5 ¾") deep. Voltage shall be as indicated.

I. Panelboards shall have the following features:

1. Nonreduced size copper bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.

2. Full size, copper neutral bar (unless shown otherwise on drawings), mounted on insulated supports.

3. Copper ground bar with sufficient terminals for all grounding wires. Buses braced for the available short circuit current, but not less than 10,000 amperes symmetrical for 120/208 volt panelboards, and 14,000 amperes symmetrical for 277/480 volt panelboards.

4. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 30 Amps or less and frame size is 100 amperes or less, without having to drill and tap the main bus bars at bus straps.

5. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping. Panel phase bus connections to protective devices shall not be riveted to the panel bus and shall be field removable by means of a screw driver.

6. Where designated on panel schedule as “space”, include all necessary bussing, device support and connections. Provide blank cover for each space.

7. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed or feed-through lugs as shown on drawings on the line side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.

8. Series rated panelboards are not permitted.

9. Provide keyed alike system for all panelboards. In existing buildings where new panels are installed, provide keyed alike locks as directed by owner.

10. Provide a type written directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.

J. Painting: Factory primed and painted.

2.2 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

A. Breakers shall be UL listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.

C. Molded case circuit breakers shall have minimum interrupting rating and not less than shown above.

1. 120/208 volt Panelboard: 10,000 amperes symmetrical.

2. 277/480 volt Panelboard: 14,000 amperes symmetrical.

D. Breaker features shall be as follows.

1. A rugged, integral housing of molded insulating material.

2. Silver alloy contacts.

3. Arc quenches and phase barriers for each pole.

4. Over-center, trip-free, toggle-type, quick-make, quick-break, operating mechanisms.

5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.

6. Electrically and mechanically trip free.

7. An operating handle which indicates ON, TRIPPED, and OFF positions.

a. Line connections shall be bolted.

b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings.

8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

9. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory.

10. Factory assembled.

11. Construct breakers for mounting and operating in any physical position and operating in ambient temperature of 40°C.

12. Provide breakers with mechanical screw type removable connector lugs; /CU rated.

E. Circuit Breakers shall be UL Listed for air conditioning branch circuits.

2.3 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.

B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Installation shall be in accordance with NEC, as shown on the drawings, and as specified.

E. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of the cabinets with designated closet space.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque-tightening values for equipment connectors.

G. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.

H. Install a typewritten schedule of circuits in each. Schedules shall be typed on the panel directory cards and installed in the appropriate panelboards, incorporating all applicable contract changes pertaining to that schedule. Include the room numbers and items served on the cards.

I. Mount top of panelboard at 6'- 6". If panelboard length is longer than standard, then mount panelboard so that maximum height of the top circuit breaker above finished floor shall not

exceed 78 inches. For panelboards, which are too high, mount panelboard so that the bottom of the cabinets will not be less than 6 inches above the finished floor.

J. Circuit numbers indicated on the drawings are shown for the purpose of clarifying the grouping of outlets. The actual number assigned to the circuit in the panelboard shall suit the bussing and branch circuiting of the panel. Provide owner as-built drawings showing the actual circuit numbers being used for each device on each brand circuit.

K. Panelboards shall be installed complete with connectors and associated hardware for all circuit breakers and circuit breaker spaces listed in the panelboard schedule.

L. When connecting equipment to existing panelboards, the new and existing circuit breakers shall be identified. A new circuit directory card shall be provided.

M. Provide equipment grounding connections for panelboard enclosures as indicated.

N. Prior to energization, check panelboards for electrical continuity of circuits and for short-circuits.

O. Install filler plates for unused spaces in panelboards.

P. Install engraved plastic nameplates in accordance with Section 26 05 53.

Q. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Minimum spare conduits: 5 empty ¾ inch. Identify each as SPARE.

R. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements [01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS.

3.3 ADJUSTING

A. Section [01 70 00 - Execution and Closeout Requirements]: Requirements for starting and adjusting.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

C. Adjust operating mechanisms for free mechanical movement.

D. Touch-up scratched or marred surfaces to match original finishes.

.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; multioutlet assembly; and device plates and decorative box covers.

B. Related Sections:

1. Section 26 05 21 - Undercarpet Cable.
2. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.
3. Section 26 05 00 - Basic Methods and Requirements (Electrical).
4. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
5. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

NEMA WD 1	General Requirements for Wiring Devices
NEMA WD 6	Wiring Devices-Dimensional Requirements

B. National Fire Protection Association (NFPA):

70	National Electrical Code (NEC)

C. Underwriter's Laboratories, Inc. (UL):

UL-5	Surface Metal Raceways and Fittings
UL-20	General-Use Snap Switches
UL-231	Power Outlets
UL-467	Grounding and Bonding Equipment
UL-498	Attachment Plugs and Receptacles
UL-943	Ground-Fault Circuit Interrupters

1.3 SUBMITTALS

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

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALIFICATIONS

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

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:

1. Pass & Seymour.
2. Cooper.
3. Hubbell.
4. Leviton.
5. Substitutions: Not permitted.

B. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles shall be ivory in color unless otherwise specified. The rocker type switch is not acceptable and will not be approved.

1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
3. Ratings: 20 amperes at 120/277 volts AC.
    a. The switches shall be mounted on the striker plate side of doors.
    b. Incorporate barriers between switches with multigang outlet boxes where required by the NEC.
    c. Switches connected to isolated type electrical power systems shall be double pole.
    d. All toggle switches shall be of the same manufacturer.

2.2 WALL DIMMERS

A. Manufacturers, commercial, specification grade only:

1. Lutron.
2. Pass & Seymour.

3. Cooper.
4. Leviton.
5. Substitutions: Not permitted.

B. Use low voltage dimmers for low voltage lighting, fluorescent for fluorescent dimming.

C. Body and Handle: color to match switches, receptacles, and wall switches.

D. Voltage: 277 volts unless otherwise shown on drawings.

E. Power Rating: As indicated on Drawings.

F. Accessory Wall Switch: Match dimmer appearance.

2.3 RECEPTACLES

A. Manufacturers:
1. Pass & Seymour.
2. Cooper.
3. Hubbell.
4. Leviton.
5. Substitutions: Not permitted.

B. General: All receptacles shall be listed by Underwriters Laboratories, Inc.
1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four min.) and side wiring from four captively held binding screws.

C. Duplex receptacles shall be single phase, 20 Ampere, 120 Volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.
1. Color shall be by Architect. All receptacles shall be unswitched unless otherwise noted.

D. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete with appropriate cord grip plug. Devices shall meet UL 231.

E. Weatherproof Receptacles: Shall consist of a weather resistant type duplex receptacle, mounted in box with a gasketed, weatherproof, metallic cover over receptacle. The weatherproof integrity shall not be affected when heavy duty specification attachment plug caps are inserted.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel and smooth nylon for finished areas as specified or directed by Architect. Oversize plates are not acceptable.

B. Nylon plates shall match color of device unless otherwise specified.

C. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.

D. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

E. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification and shall match switch and receptacle wall plates.

F. Phenolic Labels, showing panel and circuit, shall be attached to each wall plate.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

A. Disconnect and remove abandoned wiring devices.

B. Modify installation to maintain access to existing wiring devices to remain active.

C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

A. Installation shall be in accordance with the NEC and NECA's "Standard of Installation", and in accordance with standard industry practices.

B. Install devices in clean boxes, free from dirt and debris.

C. Install wall plates after painting.

D. Wall plates shall not project out from wall.

E. Install a No.12 green ground wire from device grounding terminal to grounding bus in panelboard.

F. Install devices plumb and level.

G. Install switches with OFF position down.

H. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

I. Do not share neutral conductor on load side of dimmers.

J. Install receptacles with grounding pole on bottom.

K. Connect wiring device grounding terminal to outlet box with green bonding jumper and branch circuit equipment grounding conductor.

L. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

M. Use jumbo size plates for outlets installed in masonry walls.

N. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets in unfinished locations.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified and as indicated on drawings.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 20” to Top above finished floor.

D. Install convenience receptacle 6 inches above back splash of counter unless otherwise noted or shown differently on architectural plans. Mount horizontally where shown on plans or directed by Architect.

E. Install switches and dimmers 48 inches above finished floor.

F. Coordinate installation of wiring devices with floor box service fittings.

3.6 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

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

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 19 - ENCLOSED SWITCHES AND MOTOR STARTERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fusible and nonfusible switches.

B. Related Sections:

1. Section 26 05 00 - Common Work Results for Electrical.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 26 05 53 - Identification for Electrical Systems.
5. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
6. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
3. ICS 1-00 – Industrial Control and Systems General Requirements.
4. ICS 1.1-03 – Safety Guidelines for the Application, Installation and Maintenance of Solid State Control.
5. ICS 2-00 – Industrial Control and Systems, Controllers, Contractors and Overload Relays Rated 600 Volts DC.
6. ICS 6-01 – Industrial Control and Systems Enclosures.
7. ICS 7-00 – Industrial Control and Systems Adjustable-Speed Drives
8. ICS 7.1-00 – Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association (NFPA):

70	National Electrical Code (NEC)

D. Underwriters Laboratories, Inc (UL):

98	Enclosed and Dead-Front Switches
198C	High-Interrupting-Capacity Fuses, Current Limiting Types
198E	Class R Fuses
977	Fused Power-Circuit Devices
508	Industrial Control Equipment

1.3 SUBMITTALS

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

B. Product Data: Submit switch ratings and enclosure dimensions.

C. Shall label each switch/starter with its associated equipment tag (i.e. AHU-1).

1.4 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

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

PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. Square D.
   2. Cutler-Hammer.
   3. G.E.
   4. Siemens.
   5. Substitutions: Not Permitted.

B. Product Description: Enclosed load interrupter knife switch.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Fuses shall be Class RK1.

E. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray. Stainless steel if marine application.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

F. Furnish switches with entirely copper current carrying parts.

G. Shall be quick-make, quick-break type in accordance with UL 98, NEMA KS 1 and NEC.

H. Shall have a minimum duty rating, NEMA Heavy Duty (HD) classification for voltage required.

I. Shall be horsepower rated.

J. Shall have the following features:

1. Switch mechanism shall be the quick-make, quick-break type.
2. Copper blades, visible in the OFF position.
3. An arc chute for each pole.
4. External operating handle shall indicate ON and OFF position and shall have lock-open padlocking provisions.
5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.
6. Fuse holders for the sizes and types of fuses specified.
7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
8. Ground Lugs: One for each ground conductor.
9. Handle lockable in OFF position.
10. Entirely copper current carrying parts.

K. Where switch is located on the load side of a VFD, provide one (1) normally open (NO) auxiliary contact to interlock the VFD run permissive circuit. Disconnecting on-line motor shall shut down VFD. When the switch is closed, a permissive run signal shall restart the VFD at low voltage and frequency. Interlock equipment with two (2) #12 AWG in 3/4 inch conduit.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Shall be same as fusible switch assembly (2.1 above) except it shall not accept fuse.

2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes minimum without fuses. 200,000 rms symmetrical amperes when used with or protected by Class R fuses (30-600 ampere switches employing appropriate fuse rejection schemes). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

2.4 MOTOR STARTERS, GENERAL

A. Shall have the following features:

1. Separately enclosed unless part of another assembly.
2. Circuit breakers and safety switches within the motor controller enclosures shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.
3. Motor control circuits:
    a. Shall operate at not more than 120 Volts.
    b. Shall be grounded except as follows:
        1. Where isolated control circuits are shown.
        2. Where manufacturers of equipment assemblies recommend that the control circuits be isolated.
    c. Incorporate a separate, heavy duty, control transformer within each motor controller enclosure to provide the control voltage for each motor operating over 120 Volts.
    d. Incorporate over current protection for both primary and secondary windings of the control power transformers in accordance with the NEC.
4. Overload current protective devices:
    a. Overload relay thermal.
    b. One for each pole.
    c. Manual reset on the door or each motor controller enclosure.
    d. Correctly sized for the associated motor's rated full load current.
    e. Check every motor controller after installation and verify that correct sizes of protective devices have been installed.
    f. Deliver four copies of a summarized list to the owner, which indicates and adequately identifies every motor controller installed. Include the catalog numbers for the correct sizes of protective devices for the motor controllers.
5. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular starter. H-O-A switch is not required for manual motor starters.
6. Incorporate into each control circuit a 120 Volt, solid state time delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time delay relay is not required where H-O-A switch is not required.

7. Auxiliary contacts, pilot lights, pushbuttons and other devices and accessories as shown on the drawings or otherwise required.

8. Enclosures:

   a. Shall be the NEMA types shown on the drawings for the motor controllers.

   b. Shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.

   c. Doors mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open. Provision for padlock must be provided.

   d. Enclosures shall be primed and finish coated at the factory with the manufacturer's prime coat and standard finish.

B. Motor controllers incorporated with equipment assemblies shall also be designed for the specific requirements of the assemblies.

C. For motor controllers being installed in existing motor control centers or panelboards, coordinate with the existing centers or panelboards.

D. Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.

E. Provide a disconnecting means or safety switch near and within sight of each motor. Provide all wiring and conduit required to facilitate a complete and code complied installation.

F. Refer to paragraph, MOTOR CONTROL STATIONS, in this section for additional requirements.

2.5 MANUAL MOTOR STARTERS

A. Shall be in accordance with applicable requirements of 2.4 above.

B. Manual motor starters.

1. Starters shall be AC, general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.

2. Units shall include overload protection, red pilot light, NO auxiliary contact and toggle operator.

C. Fractional horsepower manual motor starters.

1. Starters shall be AC, general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.

2. Units shall include thermal overload protection, red pilot light and toggle operator.

D. Motor starting switches.

1. Starters shall be AC, general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
2. Units shall include thermal overload protection, red pilot light and toggle operator.

2.6 MAGNETIC MOTOR STARTERS

A. Shall be in accordance with applicable requirements of 2.4 above.

B. Starters shall be AC, general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum size 0.

C. Where combination motor starters are used, combine starter with protective or disconnect device in a common enclosure.

D. Provide phase loss protection for each starter serving motors 15 h.p. or larger with contacts to de-energize the starter upon loss of any phase.

E. Combination magnetic, full voltage starters for three phase motors shall be three pole horsepower rated, magnetically operated switches with four auxiliary contacts.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned enclosed switches.

B. Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing enclosed switches to remain or to be reinstalled.

3.2 INSTALLATION

A. Install disconnect switches in accordance with the NEC.

B. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 feet to operating handle.

D. Install fuses for fusible disconnect switches.

E. Install engraved plastic nameplates in accordance with Section 26 05 53.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

G. Install motor control equipment in accordance with manufacturer's recommendations, the NEC, NEMA and as shown on the drawings.

H. Install Variable Speed Motor Controllers in accordance with manufacturer's recommendations, the NEC, as shown on the drawings and in accordance with NEMA ICS 7.1.C.

I. Furnish and install heater elements in motor starters to match the installed motor characteristics.

J. Ensure proper direction of rotation of each motor.

K. Two weeks prior to the final inspection, provide one complete set of spare fuses (including heater elements) for each starter/controller installed on this project.

L. Motor starters or any other electrical equipment located in smoke or fire rated walls shall be mounted on Unistrut channels. Channels shall be supported from floor and structure above the ceiling. There shall be no penetrations of the fire rated assembly pursuant to the equipment installation.

M. Unless otherwise indicated, motor starters shown on the drawing shall be furnished and installed under this Section. The full load current and starting characteristics of each motor shall be verified for proper selection of motor over load devices.

N. Furnish and install all steel shapes, etc, necessary for a support of all motor starters.

O. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

3.3 IDENTIFICATION SIGNS

A. Install nameplate identification signs on each disconnect switch to identify the equipment controlled.

B. Nameplates shall be laminated black phenolic resin with a white core, with engraved lettering, a minimum of 1/4 inch high. Secure nameplates with screws.

3.4 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION

SECTION 26 41 00 - LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, complete installation of a complete master labeled lightning protection system, complying with NFPA 780, UL 96 and UL 96A.

1.2 RELATED WORK

A. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL: General electrical requirements and items that are common to more than one section of Division 16.

B. Section 26 05 26, GROUNDING: Requirements for personnel safety and to provide a low impedance path to ground for possible ground faults.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings:

1. Isometric and plan views showing layout and connections to the required metal surfaces.

2. Show the methods of mounting the system to the adjacent construction.

C. Qualifications: Submit proof that the installer of the lightning protection system has had suitable and adequate experience installing other lightning protection systems, and is capable of installing the system as recommended by the manufacturer of the equipment.

D. Certification that the lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA):

70	National Electric Code (NEC)
780	Standard for the Installation of Lightning Protection Systems

C. Underwriters Laboratories, Inc. (UL):

90	Lightning Protection Components
96A	Installation Requirements for Lightning Protection Systems

D. LPI Compliance: Comply with requirements of Lightning Protection Institute (LPI) Standards 175, 176, and 177, pertaining to lightning protection system material, components, installation, and testing procedures.

1.5 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of lightning protection system components of types, sizes, and ratings required; whose products have been in satisfactory use in similar service for not less than three (3) years, and who are Class I manufacturer - members of Lightning Protection Institute.

PART 2 PRODUCTS

2.1 MATERIALS

A. Attach master labels “A” or “B” to each item by its manufacturer as evidence that the materials have been manufactured in conformance with the UL Standards for master label lightning protection materials.

B. In addition to conformance to UL 96, the component material requirements are as follows:

1. Conductors: Electrical grade copper.
2. Air terminals: Solid copper, not less than 3/8 inch diameter, with sharp nickel-plated points.
3. Ground rods: Copper clad steel, not less than 3/4 inch diameter by 10 feet long.
4. Ground plates: Solid copper, not less than 1/16 inch thick.
5. Tubing: Stiff copper or brass.

C. Anchors and fasteners: Bolt type which are most suitable for the specific anchor and fastener installations.

D. Ground rods shall be copper clad, size as shown on drawings.

E. See drawings for additional information and requirements.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Install the conductors as inconspicuously as practical and with the proper bends.

B. Install the vertical conductors within the concealed cavity of exterior walls. Run the conductors to the exterior at elevations below the finished grade and make the ground connections to the earth outside of the building or stack perimeter.

C. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.

D. Use the exothermic welding type connections that form solid metal joints in the main vertical and horizontal conductors, and for connections that are not exposed in the finish work.

E. Protect copper conductors with stiff copper or brass tubing, which enclose the conductors from the top to the bottom of the tubing, between one foot below and seven feet above the finished grade.

F. Sheath copper conductors, which pass over cast stone, cut stone, architectural concrete and masonry surfaces, with not less than a 1/16 inch thickness of lead to prevent staining of the exterior finish surfaces.

G. For the earth connections, install ground rods and ground plates, and the conductor connections to them and the main water pipes in the presence of the owner's representative. For the conductors located outside of the building or stack, install the conductors not less than two feet below the finished grade.

H. For structural steel buildings, connect the steel framework of the buildings to the main water pipe near the water system entrance to the building.

I. Connect exterior metal surfaces, located within three feet of the lightning protection system conductors, to the lightning protection system conductors to prevent flashovers.

J. Grounding: Test the ground resistance to earth by standard methods and conform to the ground resistance requirements specified in Section, GROUNDING.

K. Where shown, use the structural steel framework or reinforcing steel as the main conductor:

1. Weld or bond the non-electrically-continuous sections together and make them electrically continuous.

2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building or stack, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.

3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 60 foot intervals.

4. Install ground connections to earth at not more than 60 foot intervals around the perimeter of the building.

5. Weld or braze bonding plates, not less than eight inches square, to cleaned sections of the steel and connect the conductors to the plates.

6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to UL Publication No. 96A.

L. Coordinate with other work, including electrical wiring and roofing work, as necessary to interface installation of lightning protection system with other work.

M. Install conductors with direct paths from air terminals to ground connections avoiding sharp bends and narrow loops. Install arresters as close as practical to equipment which they are to protect.

N. When the lightning protection systems have been installed, have the systems inspected by a UL representative. Obtain and install a UL numbered master label "C" for each of the lightning protection systems at the location directed by the UL representative.

O. Where the drawings show the new lightning protection system connected to an existing lightning protection system without a UL master label, the new portion of the lightning system still requires inspection and labels as specified above for new work.

P. Provide equipment grounding and bonding connections, sufficiently tight to assure permanent and effective grounds and bonds, for lighting protection connection devices as indicated.

END OF SECTION

SECTION 26 43 00 - SURGE PROTECTIVE DEVICES (SPDs)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions Divisions 00 and 01 Specification sections, apply to work of this Section.

B. The Section is Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26 section making reference to electrical surge suppression specified herein.

1.2 DESCRIPTION OF WORK

A. The work required under this division shall include all materials, labor, and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line-induced transient voltage surge and lightning discharge, as indicated on drawings or specified in this section.

B. Types of surge suppression specified in this section include the following:

1. Distribution and branch circuit panels.

2. Fire alarm control panel.

1.3 QUALITY ASSURANCE

A. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.

B. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.

C. Submittals: Surge suppression submittal shall include:

1. Manufacturer’s performance data on each suppressor type.

2. Dimensioned drawing of each suppressor type.

D. Equipment Certification: Items shall be listed by Underwriters’ Laboratories, shall bear the UL seal, and be marked in accordance with referenced standard.

E. Surge suppression devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) Codes.

1.4 WARRANTY

A. All surge suppression devices shall be warranted to be free from defects in materials and workmanship under normal use in accordance with the instructions provided for a period of five (5) years.

B. Any suppressor which shows evidence of failure or incorrect operating during the warranty period shall be repaired or replaced by the manufacturer and installer.

1.5 CODES AND STANDARDS

A. The following standards and publications are referenced in various parts of this specification and shall apply:

UL 1449, 3rd Edition	Standard for Safety, Transient Voltage Surge Suppressors.
ANSI/IEEE C62.41 (IEEE 587)	Guide for Surge Voltages in Low-Voltage AC Power Circuits.
ANSI/IEEE C62.33	Standard Test Specifications for Varistor Surge Protection Devices.
ANSI/IEEE C62.45	IEEE Guide for Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

1.6 REQUIRED SUPPRESSORS

A. Provide surge suppression for the equipment described herein:

1. On distribution and branch circuit panels as shown in the project drawings.
2. On 120 volt power connections for the fire alarm control panel.
3. On all equipment identified in the project drawings.

PART 2 PRODUCTS

2.1 SUPPRESSORS

A. The surge suppressor manufacturer shall offer a complete line of surge suppression products to support the required suppressors listed in Part 1.

B. The service entrance surge suppressors shall be designed with replaceable modules for purposes of in-service replacement. The unit suppressor shall be designed with redundant back-up surge protection in the event of a module failure.

C. Module status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure.

D. Unit status indicators shall be provided to indicate the status of the complete unit suppressor. The LED status indicators shall be located on the hinged front cover to

redundantly indicate module or unit failure. The unit suppressor shall include alarm contacts (one N.O. and one N.C.) for remote annunciation of unit status.

E. Suppressors shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (L-N-G) mode protection.

F. Service entrance suppressors shall utilize normal and common modes of protection - each phase line to neutral, each phase line to ground and neutral to ground.

G. Distribution and branch circuit panel suppressors shall utilize protection of each phase line to ground and neutral to ground (if neutral conductor present).

H. Suppressors shall be of a hybrid design and include circuitry with tight, wave-tracking clamping characteristics.

I. Suppressors shall be designed to withstand a maximum continuous operating voltage of not less than 115% of nominal RMS line voltage.

J. Suppressors shall utilize internal safety fusing or a UL/IEEE approved method to disconnect the suppressor from the electrical source if the suppressor fails. The suppressor shall be internally protected from fault current damage as a result of a suppressor failure.

K. Each suppressor shall have an internal disconnect switch when not connected to a separate circuit breaker or fused disconnect switch which is dedicated specifically for the suppressor.

L. Suppressors shall be failsafe, shall allow no follow-through current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.

M. Suppressors shall be UL 1449, 3rd Edition listed and shall be approved for the location in which they are installed.

N. Suppressors shall have an operating temperature range of -40°C to +85°C.

2.2 SUPPRESSOR CRITERIA

A. Shall be equivalent to the basis-of-design shown on drawings.

B. Alternate manufacturers: Atlantic Scientific, APT.

PART 3 EXECUTION

3.1 INSTALLATION OF SUPPRESSORS:

A. Suppressors shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space. Suppressors shall be close nippled to the device being protected in a position near the point of connections, which will minimize lead length between the suppressor connects. Suppressor leads shall not extend

beyond the suppressor manufacturer's recommended maximum lead length without specific approval of the engineer.

B. Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.

C. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and approved connections, unless otherwise noted. Referenced to a common earth ground.

D. Suppressors shall be installed in a manner that allows simple replacement within short periods of downtime.

E. Service entrance and panel type suppressors shall be installed with a means of disconnecting the suppressor. If no dedicated circuit breaker is included in panel, manufacturer shall provide an integral fused disconnect.

F. The surge suppression equipment shall be UL listed and installed per the NEC and the manufacturer's specifications.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories.

B. Related Sections:

1. Section 09 58 00 - Integrated Ceiling Assemblies.
2. Section 26 05 00 - Common Work Results for Electrical.
3. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
4. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
5. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
6. Section 26 27 26 - Wiring Devices
7. Section 26 52 00 - Emergency Lighting.

1.2 REFERENCES - LATEST EDITIONS OF:

A. American National Standards Institute:

ANSI C82.1	American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
ANSI C82.4	American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

B. National Fire Protection Association (NFPA):

70	National Electrical Code (NEC)
101	Life Safety Code

C. National Electrical Manufacturer's Association (NEMA):

C82.1	Ballasts for Fluorescent Lamps – Specifications
C82.2	Method of Measurement of Fluorescent Lamp Ballasts
C82.4	Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps

D. Underwriters Laboratories, Inc. (UL):

496	Edison-Base Lampholders
542	Lampholders, Starters, and Starter Holders for Fluorescent Lamps

844	Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
924	Emergency Lighting and Power Equipment
935	Fluorescent-Lamp Ballasts
1029	High-Intensity-Discharge Lamp Ballasts
1598	Luminaires

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures {01330 - Submittal Procedures}: Submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.

C. Product Data: Submit dimensions, ratings, and performance data.

D. Samples: When requested, submit two color chips 3 x 3 inch (75 x 75 mm) in size illustrating luminaire finish color where indicated in luminaire schedule.

E. Product Data: Submit manufacturer's product data and installation instructions on each type building lighting fixture, lamp type and ballast.

F. Shop Drawings: Submit fixture shop drawings in booklet form, with separate sheet for each fixture assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system.

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, lenses, louvers, lamps, and controls.

1.4 QUALIFICATIONS

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

PART 2 PRODUCTS

2.1 INTERIOR LUMINAIRES

A. Product Description: Complete interior luminaire assemblies, with features, options, and accessories as scheduled.

B. Refer to Section 01 60 00 - Product Requirements for product options. Substitutions are not permitted.

C. Shall be in accordance with NFPA 70, UL 1598 and shall be as shown on drawings and as specified.

D. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.

2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.

3. Where lighting fixtures are detailed with minimum 20 gauge housing, minimum 22 gauge housings will be acceptable provided they have strengthening embossed rib and break formations, which give the equivalent rigidity of a 20 gauge housing.

4. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.

5. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

E. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

F. Lamp Sockets:

1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Contacts for recessed double contact Lampholders and for slimline Lampholders shall be silver plated. Lampholders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.

G. Fluorescent fixtures with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vapor tight fixtures shall have pressure clamping devices in lieu of the latches.

H. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

I. Metal Finishes:

1. The manufacturer shall apply his standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface (s). Fixture finish shall be free of stains or

evidence of rusting, blistering, or flaking. All metal parts shall be painted after fabrication.

2. Interior light reflecting finishes shall be white with not less than 85 percent reflectance, except where otherwise shown on the drawing.

3. Exterior finishes shall be as shown on the drawings.

J. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.

K. Light Transmitting Components for Fluorescent Fixtures:

1. Lenses: Plastic lenses where specified for enclosed fluorescent lighting fixtures shall be acrylic and have minimum overall thickness including prism of 0.125 inches.

2. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.

L. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall be designed for lamps as specified.

2.2 FLUORESCENT BALLASTS

A. Ballasts (Electronic):

1. Ballasts for fluorescent lamps shall be high frequency electronic for use with Octic type (265mA) lamps. The total harmonic distortion (%THD) shall be less than 10%. The power factor shall be .95 or higher.

2. Non-dimming electronic ballasts for fluorescent lamps shall be General Electric (Magnetek), Osram Sylvania Quicktronic, Advance or Motorola.

3. All ballasts shall be individually fused on the line side of the ballast.

4. All ballasts shall bear the ETL/CBM and UL labels.

5. Shop drawings shall be submitted for ballast types.

6. Instant start ballast shall be used with non-occupancy sensor controlled luminaries; programmed rapid start ballast shall be used for occupancy sensor controlled luminaries.

2.3 FLUORESCENT DIMMING BALLASTS AND CONTROLS

A. Product Description: Electrical assembly of control unit and ballast to furnish smooth dimming of fluorescent lamps.

B. See Digital - Network Lighting System

2.4 LAMPS

A. Manufacturers:

1. Sylvania.
2. Phillips.
3. G.E.
4. Substitutions: Not Permitted.

B. Lamps: Fluorescent lamps shall be rapid start with a minimum 85 CRI, 4100K, unless otherwise noted on drawings, all lamps shall be 'TCLP' compliant as manufactured by General Electric, Sylvania or Phillips. T-8, U-shaped lamps shall have 6" spacing between ends. Shop drawings shall be submitted for all lamp types.

C. LED: Minimum 50,000 hour expected life, minimum CRI 85, 4000K temperature.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Extend existing interior luminaire installations using materials and methods compatible with existing installations, and as specified.

C. Clean and repair existing interior luminaires to remain or to be reinstalled.

3.2 INSTALLATION

A. Installation shall be in accordance with NEC

B. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.

C. Support luminaires 2 x 4 foot size and larger independent of ceiling framing.

D. Locate recessed ceiling luminaires as indicated on Drawings.

E. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

F. Exposed Grid Ceilings: Support surface-mounted luminaires on grid ceiling directly from building structure.

G. Install recessed luminaires to permit removal from below.

H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Install wall-mounted luminaires at height as indicated on Drawings.

J. Install accessories furnished with each luminaire.

K. Connect luminaires to branch circuit outlets provided under Section 26 05 33 using flexible conduit.

L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

M. Install specified lamps in each luminaire.

N. Ground and bond interior luminaires in accordance with Section 26 05 26.

O. Examination: Examine areas and conditions under which lighting fixtures are to be installed and substrate for supporting lighting fixtures, including architectural elevations and sections. Notify owner in writing of condition detrimental to installation of fixtures or completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

P. Align, mount and level the lighting fixtures uniformly.

Q. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by owner.

R. Install flush-mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.

S. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

T. Fasten fixtures securely to indicate structural supports and ensure that pendant fixtures are plumb and level.

U. Recessed fixtures shall be centered in the ceiling tile, structural pan, or other visually controlling feature, unless otherwise noted on drawings. Fixtures installed in sloped ceilings shall be furnished with manufacturer's standard adapters for mounting lamps vertical to floor. Verify architectural drawings for applicable notes and details.

V. Lay-in fixtures shall have T-bar clips installed.

W. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

X. Support surface mounted fixtures greater than two feet (2') in length at a point in addition to the outlet box fixture stud.

Y. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the owner.

Z. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.

AA. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable.

BB. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed fixtures:
    a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
    b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
5. Hardware for surface mounting fixtures to suspended ceilings:
    a. In addition to being secured to any require outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
    b. In addition to being secured to any required outlet box, fixtures shall be bolted to a plaster ceiling at four points spaced near the corners of each fixture. Pre-positioned 1/4 inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4 inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

CC. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.

DD. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

EE. At completion of project, relamp all fixtures which have failed/burned-out lamps. Clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.

FF. Protect installed fixtures for damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Aim and adjust luminaires as indicated on Drawings or directed by Architect/Engineer.

3.5 CLEANING

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

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Relamp luminaires having failed lamps at Substantial Completion.

END OF SECTION

SECTION 26 51 01 - DIGITAL-NETWORK LIGHTING CONTROL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital-Network Lighting Control System.

B. Related Sections:

1. Section 26 05 00, Common Work Results for Electrical.
2. Section 26 05 26, Grounding and Bonding for Electrical Systems.
3. Section 26 05 34, Equipment Wiring Connections.
4. Section 26 51 00, Interior Lighting Fixtures.
5. Section 26 56 00, Exterior Lighting.

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) (and www.ieee.org)

C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. International Electrotechnical Commission.

(IEC) 801-2 Electrostatic Discharge Testing Standard.

C. International Organization for Standardization (ISO)

9001:2000 – Quality Management Systems.

D. National Electrical Manufacturers Association (NEMA)

WD1 (R2005) - General Color Requirements for Wiring Devices.

E. Underwriters Laboratories, Inc. (UL):

1. 489 (2002) - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
2. 508 (1999) - Standard for Industrial Control Equipment.
3. 924 (2003) - Emergency Lighting and Power Equipment
4. 1472 (1996) - Solid-State Dimming Controls.

1.3 SYSTEM DESCRIPTION

A. This specification requires a complete and comprehensive requirement for a total lighting control system comprised but not limited to lighting control panels, dimming ballasts, controls, conductors, conduits, servers, and environmental sensors. Commissioning shall be included and shall coordinate with the project 3rd party commissioning agent. The system shall be complete and operable in all ways to the owner's satisfaction. The contractor shall provide all documentation and support as needed to the commissioning agent.

B. Lutron is basis of design. Equivalent systems in all respects are allowed subject to owner/engineer review and approval. See below.

C. System includes:

1. Factory assembled switching panels.
2. Low voltage wall stations and control interfaces and sensors.
3. Solid-state high frequency fluorescent dimming ballasts.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Specification Conformance Document: Indicate whether the submitted equipment:

1. Meets specification exactly as stated.
2. Meets specification via an alternate means and indicate the specific methodology used.

C. Shop Drawings; include:

1. Schematic (one-line diagram) of system.

D. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

E. Sequence of Operation to describe how each area operates and how any building wide functionality is described.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum 5 years experience in manufacture of lighting management systems.

B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.

C. Lighting control system components:

1. Listed by UL specifically for the required loads. Provide evidence of compliance upon request.

1.6 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 0° to 40° C (32° to 104° F).

2. Relative humidity: Maximum 90 percent, non-condensing.

3. Lighting control system must be protected from dust during installation.

1.7 WARRANTY

A. See Division 01 and provide manufacturer's standard parts and labor warranties. Components from the date of system commissioning.

B. For ballasts, see Section 26 51 00.

1.8 SERVICE AND SUPPORT

A. STARTUP AND PROGRAMMING

1. Provide factory certified field service engineer to make minimum of two site visits to ensure proper system installation and operation under following parameters

a. Qualifications for factory certified field service engineer:

1. Minimum experience of 2 years training in the electrical/electronic field.

2. Certified by the equipment manufacturer on the system installed.

B. Tech Support

1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Lutron Electronics Co., Inc. or subject to compliance and prior approval with specified requirements of this section, one of the following:

B. Substitutions: Under provisions of Division 1.

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.

2. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

2.2 GENERAL

A. Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32°F) to 40° C (104°F) and 90 percent non-condensing relative humidity.

B. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.

2.3 RELAY PERFORMANCE REQUIREMENTS

A. Electrolytic capacitors to operate at least 20° C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.

B. Load Handling Thyristors (SCRs and triacs), Field Effect Transistors (FETs), and Isolated Gate Bipolar Transistors (IGBTs): The component's maximum current rating to be at least two times the relay's rated operating current.

C. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of relay.

D. Design and test relays to withstand line-side surges without impairment to performance.

1. Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41 and per IEC 61000-4-5 surge requirements.

2. Other power handling devices: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41.

E. Utilize air gap off to disconnect the load from line supply.

F. Power failure memory and relay recovery:

1. When power is interrupted and subsequently returned, within 3 seconds lights will automatically return to same levels (full on, or off) prior to power interruption.

G. Non-dim circuits to meet the following requirements:

1. Rated life of relay at full load: Minimum 1,000,000 cycles.

2. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.

3. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

2.4 POWER PANELS

A. Product: Lutron XP Series.

B. Mechanical:

1. Listed to UL 508 (United States) as industrial control equipment. CSA (Canada) certified, or NOM (Mexico) approved as applicable.

2. Delivered and installed as a UL listed factory assembled panel.
3. Field wiring accessible from front of panel without need to remove components.
4. Panels passively cooled via free-convection, unaided by fans or other means.

C. Electrical:

1. Panels contain branch circuit protection for each input circuit unless the panel is a dedicated feed-through type panel or otherwise indicated on the drawings.
2. Minimum UL listed Short Circuit Current Rating (SCCR) of 35,000A.

D. Lutron XP Softswitch Series Switching Panels:

1. Surface mounted.
2. Rated life of relay: Minimum 1,000,000 cycles.
3. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
4. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

E. LCD Panel Processor

1. System to be password protected.
2. Language selection: English.
3. Integral contact closure inputs.
4. Programming and system operations:
    a. Control stations, control interfaces, and contact closure inputs:
        1. Assign functionality of each control station button or infrared interface.
            a. Select patterns
            b. Select customized pattern
            c. Enable/Disable time clock
            d. Initiate delay to off
            e. Toggle one, some, or all zones
        2. RS232 interface or Ethernet interface
        3. Contact closure output: Momentary or maintained
    b. Time Clock:
        1. Integral astronomical time clock
            a. Geographic location (city or latitude/longitude).
            b. Adjustable date and time format.
            c. Adjustable starting and ending of daylight saving time.
            d. Review and modify time clock schedule to add, copy, modify, and delete events.

2. Overrides:
    a. Set circuit status
    b. Select pattern
    c. Time clock override
    d. Control station overrides
    e. After-hours override

F. Diagnostics and Service:
1. Replacing relay does not require re-programming of system or processor.
2. Relays: Include diagnostic LEDs to verify proper operation and assist in system troubleshooting.
3. Relay panels: Include tiered control scheme for dealing with component failure that minimizes loss of control for occupant.
    a. If lighting control system fails, lights to remain at current level. Panel processor provides local control of lights until system is repaired.
    b. If panel processor fails, lights to remain at current level. Circuit breakers can be used to turn lights off or to full light output, allowing non-dim control of lights until panel processor is repaired.

2.5 LOW-VOLTAGE WALL STATIONS

A. System Wall Stations
1. Allows controls of any devices part of the Lutron System.
2. Electronics:
    a. Use RS485 wiring for low voltage communication.
3. Functionality:
    a. Upon button press, LEDs to immediately illuminate.
    b. LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or the LEDs turn off if the button press was not processed.
    c. Allow for easy reprogramming without replacing unit.
    d. Replacement of units does not require reprogramming.
4. Color: By architect
5. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.
6. Provide faceplates with concealed mounting hardware.
7. To help building occupants understand how to use the lighting control system, Architect should provide engraving requirements for all controls. Engraving details should include text size and style.

8. Unlike traditional scene control wall stations, centralized low voltage controls can be programmed so that the buttons can have a variety of functions.

B. One Button Control

1. Toggle on/off for group of fixtures.

2. “Press and Hold” button programming for creating and modifying groups.

2.6 SOURCE QUALITY CONTROL

A. Perform full-function testing on all completed assemblies at end of line. Statistical sampling is not acceptable.

B. Audit burn-in at 40° C (104° F) ambient temperature of dimming assemblies and panels at full load for two hours.

2.7 INSTALL SURGE SUPPRESSION

A. Install surge suppression at each panel and computer as recommended by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer’s installation instructions.

B. Provide complete installation of system in accordance with Contract Documents.

C. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

D. Define each relay’s load type, assign each load to a zone, and set control functions.

E. Mount exterior daylight sensors to point due north with constant view of daylight

F. Systems Integration:

1. Equipment Integration Meeting Visit: Contractor to coordinate meeting between owner, architect, engineer, Lighting Control System Manufacturer, Project Commissioning Agent and other related equipment manufacturers to discuss equipment and integration procedures.

3.2 FIELD QUALITY CONTROL

A. Manufacturer Services

1. Aim and Focus Visit

a. Contractor to coordinate on-site meeting with owner, architect, engineer, Project Commissioning Agent, Lighting Control System Manufacturer and Lighting Design

Consultant to make required lighting adjustments to the system for conformance with the Lighting Design Consultant's original design intent.

3.3 CLOSEOUT ACTIVITIES

A. Training Visit

1. Lighting Control System Manufacturer to provide 1day on-site system training to site personnel.

B. Attend LEED commissioning agent on-site walk through to demonstrate system functionality. During this visit, the manufacturer's Field Service Engineer will perform tasks, at the request of the facility representative or Commissioning Agent, such as to demonstrate wall control functions, explain timeclock schedules or describe occupancy and/or daylight sensor functionality.

C. On-site Walkthrough (LSC-WALK)

1. Lighting Control System Manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

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.

B. Applicable provisions of this Section apply to all sections of Division 22, Plumbing.

1.2 CONTRACT DOCUMENTS

A. Examine all drawings and specifications carefully before submitting a bid. Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction. If discrepancies or conflicts occur between drawings, or between drawings and specifications, notify the Engineer in writing prior to bid date; however, the most stringent requirement shall govern.

B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, Contractor shall make use of all data in all of the contract documents and shall verify this information at the building site.

C. The drawings indicate required size and points of termination of pipes, conduits and ducts and suggest proper routes to conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the responsibility of the Contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.

D. Furnish, install and/or connect with appropriate services all items shown on any drawing without additional compensation.

E. Consider the terms "provide" and "install" as synonymous with "furnish and install".

1.3 CODE REQUIREMENTS

A. Perform work in accordance with the following codes and any applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.

1. ASHRAE:
    a. Standard 90.1 – Energy Standard for Buildings Except Low Rise Residential Buildings
2. Occupational Safety and Health Regulations (OSHA)

3. National Fire Protection Association (NFPA):
    a. NFPA 1 – Uniform Fire Code
    b. NFPA 54 – National Fuel Gas Code
    c. NFPA 70 – National Electrical Code
    d. NFPA 101 – Life Safety Code
4. Florida Building Code 2010 Edition:
    a. Accessibility Code
    b. Energy Conservation Code
    c. Fuel Gas Code
    d. Mechanical Code
    e. Plumbing Code
5. Florida Administrative Code
    a. Chapter 61G15-34 Responsibility Rules of Professional Engineers Concerning the Design of Mechanical Systems
    b. Chapter 69A-3 Fire Prevention – General Provisions
    c. Chapter 69A-47 Uniform Fire Safety Standards for Elevators
    d. Chapter 69A-53 Uniform Fire Safety Standards for Hospitals and Nursing Homes
    e. Chapter 69A-60 The Florida Fire Prevention Code
6. ADA Accessibility Guidelines for Buildings (ADAAG)

B. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.

C. The installer shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Specifications and standards are minimum requirements for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

B. Whenever a reference is made to a standard, installation and materials shall comply with the latest published edition of the standard at the time project is bid unless otherwise specified herein.

1.5 QUALITY ASSURANCE

A. The intent of the Division 22 specifications and the accompanying drawings is to provide a complete, operable, and satisfactory plumbing system as shown, specified, and required by applicable codes. Include all work specified in Division 22 and shown on the accompanying drawings.

B. The drawings that accompany the Division 22 specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Follow the drawings as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the building, subject to approval, and without additional cost to the contract.

C. Coordinate exact requirements governed by actual job conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

D. Systems shall be built and installed to deliver their full rated capacity at the efficiency for which they were designed.

E. The entire plumbing system shall operate at full capacity without objectionable noise or vibration.

F. Materials and Equipment:

1. Furnish new and unused materials and equipment. Work shall be of good quality, free of faults and defects.
2. All equipment shall fit in the space provided.
3. Each piece of equipment provided shall meet all detailed requirements of the drawings and specifications and shall be suitable for the installation shown.
4. Where two or more units of the same class of equipment are provided, use products of the same manufacturer; component parts of the entire system need not be products of the same manufacturer.
5. Manufacturer's model names and numbers used in these drawings and specifications are subject to change per manufacturer's action. Contractor shall therefore verify model names and numbers with manufacturer's representative before ordering any product or equipment.

G. Workmanship:

1. Install all materials in a neat and workmanlike manner.
2. Follow manufacturer’s directions. If they are in conflict with the contract documents, obtain clarification before starting work.

H. Cutting and Patching:

1. Cutting, patching and repairing for the proper installation and completion of the work specified in this division, including plastering, masonry work, concrete work, carpentry work, firestopping, and painting, shall be performed by

skilled craftsmen of each respective trade in conformance with the appropriate division of work. Additional openings required in building construction shall be made by drilling or cutting.

2. Fill holes which are cut oversize so that a tight fit is obtained around the objects passing through.

3. Do not pierce beams or columns without permission of the Port and then only as directed.

4. New or existing work that is cut or damaged shall be restored to its original condition. Where alterations disturb existing finishes, the surfaces shall be repaired, refinished and left in condition existing prior to commencement of work.

1.6 SUBMITTALS

A. Submittals: Product Data. Submit in accordance with project contract documents.

B. If not specified in the project contract documents, then submit either a minimum of five hard copies in 3-ring binders or electronic PDFs, as required by the Engineer.

C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Engineer to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

D. Submit Product Data for review on all scheduled pieces of equipment, equipment requiring electrical connections or connections by other trades, and as required by the contract documents. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures and similar data. Manufacturer's abbreviations or codes are not acceptable.

1.7 PERMITS, FEES, AND INSPECTIONS

A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems charges, impact fees and inspections.

B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

1.8 WARRANTY

A. Warranty work and equipment for one year from the date of final acceptance of the project. During the warranty period provide labor and materials to make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship.

PART 2 PRODUCTS

2.1 SLEEVES

A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. PVC Pipe: ASTM D 1785, Schedule 40.

2.2 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2.3 MOTORS

A. Motor Characteristics:

1. Frequency Rating: 60 Hz.
2. Voltage Rating: NEMA standard voltage for circuit voltage to which motor is connected.
3. Service Factor: 1.15.
4. Duty: Continuous duty at ambient temperature of 105 degrees F (40 degrees C) and at altitude of 3300 feet (1005 m) above sea level.
5. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
6. Enclosure: Unless otherwise indicated, open dripproof.
7. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

2.4 HANGERS AND SUPPORTS

A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.

B. Powder-Actuated Fasteners: Threaded-steel stud, with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.5 VIBRATION ISOLATION CONTROL DEVICES

A. Vibration Supports:

1. Elastomeric Isolation Pads: Arranged in single or multiple layers of oil- and water-resistant, of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match supported equipment.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., Super W; or comparable product by one of the following:

        1. Kinetics Noise Control, Inc.
        2. Vibration Mountings & Controls, Inc.

2. Elastomeric Isolation Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate and baseplate. Provide isolator with minimum 0.5-inch (13-mm) static deflection.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., Type ND; or comparable product by one of the following:

        1. Kinetics Noise Control, Inc.
        2. Vibration Mountings & Controls, Inc.

3. Open-Spring Isolators: Freestanding, laterally stable, open-spring isolators. Provide isolator with minimum 1-inch (25-mm) static deflection.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., Type SLFH; or comparable product by one of the following:

        1. Kinetics Noise Control, Inc.
        2. Vibration Mountings & Controls, Inc.

4. Housed-Spring Isolators: Freestanding, laterally stable, open-spring isolators in two-part telescoping housing. Provide isolator with minimum 1-inch (25-mm) static deflection.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., Type C; or comparable product by one of the following:

        1. Kinetics Noise Control, Inc.
        2. Vibration Mountings & Controls, Inc.

B. Vibration Hangers:

1. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Provide isolator with minimum 0.5-inch (13-mm) static deflection.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., HD; or comparable product by one of the following:

1. Kinetics Noise Control, Inc.
2. Vibration Mountings & Controls, Inc.

2. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression. Provide isolator with minimum 1-inch (25-mm) static deflection.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc., HS-B; or comparable product by one of the following:

1. Kinetics Noise Control, Inc.
2. Vibration Mountings & Controls, Inc.

2.6 PRESSURE GAGES AND TEST PLUGS

A. Pressure Gages: Direct-mounting, indicating-dial type complying with ASME B40.100. Dry metal case, minimum 2-1/2-inch (63-mm) diameter with red pointer on white face, and plastic window. Minimum accuracy 3 percent of middle half of range. Range two times operating pressure.

B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating 500 psig at 200 degrees F (3450 kPa at 93 degrees C).

PART 3 EXECUTION

3.1 INSTALLATIONS

A. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in his opinion, do not present a professional appearance. Replace or reinstall items at the expense of the Contractor.

B. Obstructions

1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.

2. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.

3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

C. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, devices, etc. the Contractor shall provide and install all materials required to re-establish the rating of the wall, floor, roof or ceiling to the satisfaction of the authority having jurisdiction.

D. Space Requirements: Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.

E. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner.

F. Wiring Method: Install cables in raceways and cable trays except low voltage network cable above accessible ceilings. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceways and Boxes for Electrical Systems."

G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 MOTOR INSTALLATION

A. Anchor motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions.

3.3 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.

E. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.

F. Install unions at final connection to each piece of equipment.

G. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.

H. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.4 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 BASES, SUPPORTS, AND ANCHORAGES

A. Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base to connect concrete base to concrete floor.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete"

B. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors. Place grout, completely filling equipment bases.

3.6 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.

D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

3.7 VIBRATION ISOLATION CONTROL DEVICE INSTALLATION

A. Adjust vibration isolators to allow free movement of equipment limited by restraints.

B. Install resilient bolt isolation washers and bushings on equipment anchor bolts.

C. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

3.8 FIELD QUALITY CONTROL

A. Tests:

1. Include all tests specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall also be performed as indicated herein and other sections of the specifications.
2. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to insure

proper sequence and operation throughout the range of operation. Make adjustments as required to insure proper functioning of all systems.

3. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.
4. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work.
5. Maintain a log of all tests being conducted and have it available for review by the Engineer. Log to indicate date, type of tests, duration, and defects noted and when corrected.
6. Special tests on individual systems are specified under individual sections.
7. Mechanical Contractor shall provide personnel, tools and equipment and assist the Test and Balance Contractor in making any adjustments necessary to meet the test and balance requirements.

END OF SECTION 220500

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Bronze angle valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Bronze swing check valves.
5. Iron swing check valves.
6. Iron, grooved-end swing check valves.
7. Iron, center-guided check valves.
8. Iron gate valves.
9. Bronze globe valves.
10. Iron globe valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.

2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 150, Bronze Angle Valves with Nonmetallic Disc:

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

a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Or equal.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

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

    a. Conbraco Industries, Inc.; Apollo Valves.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    e. Or equal.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Stainless steel.
    i. Ball: Stainless steel, vented.
    j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Milwaukee Valve Company.
    b. NIBCO INC.
    c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    d. Or equal.

2. Description:

    a. Standard: MSS SP-67, Type I.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
    e. Seat: EPDM.
    f. Stem: One- or two-piece stainless steel.
    g. Disc: Aluminum bronze.

2.5 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

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

    a. Shurjoint Piping Products.
    b. Tyco Fire Products LP; Grinnell Mechanical Products.
    c. Victaulic Company.
    d. Or equal.

2. Description:

    a. Standard: MSS SP-67, Type I.
    b. CWP Rating: 175 psig (1200 kPa).
    c. Body Material: Coated, ductile iron.
    d. Stem: Two-piece stainless steel.
    e. Disc: Coated, ductile iron.
    f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:

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

    a. Mueller Steam Specialty; a division of SPX Corporation.
    b. NIBCO INC.
    c. Shurjoint Piping Products.
    d. Tyco Fire Products LP; Grinnell Mechanical Products.
    e. Victaulic Company.
    f. Or equal.

2. Description:

    a. Standard: MSS SP-67, Type I.
    b. NPS 8 (DN 200) and Smaller CWP Rating: 300 psig (2070 kPa).
    c. NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
    d. Body Material: Coated, ductile iron.
    e. Stem: Two-piece stainless steel.
    f. Disc: Coated, ductile iron.
    g. Seal: EPDM.

2.6 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

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

    a. Milwaukee Valve Company.
    b. NIBCO INC.
    c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    d. Or equal.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Milwaukee Valve Company.
   b. NIBCO INC.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   d. Or equal.

2. Description:

   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.
   e. Ends: Flanged.
   f. Trim: Bronze.
   g. Gasket: Asbestos free.

2.8 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

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

   a. Shurjoint Piping Products.
   b. Tyco Fire Products LP; Grinnell Mechanical Products.
   c. Victaulic Company.
   d. Or equal.

2. Description:

   a. CWP Rating: 300 psig (2070 kPa).
   b. Body Material: ASTM A 536, ductile iron.
   c. Seal: EPDM.
   d. Disc: Spring-operated, ductile iron or stainless steel.

2.9 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:

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

   a. Milwaukee Valve Company.
   b. Mueller Steam Specialty; a division of SPX Corporation.
   c. NIBCO INC.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Or equal.

2. Description:

   a. Standard: MSS SP-125.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM A 126, gray iron.
   d. Style: Globe, spring loaded.
   e. Ends: Flanged.
   f. Seat: Bronze.

2.10 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

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

   a. Milwaukee Valve Company.
   b. NIBCO INC.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   d. Or equal.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM A 126, gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

2.11 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

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

a. Milwaukee Valve Company.
b. NIBCO INC.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
d. Or equal.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.12 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

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

a. Milwaukee Valve Company.
b. NIBCO INC.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
d. Or equal.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness free of foreign matter and for signs of corrosion.

B. Remove special packing material to allow proper functioning of valve.

C. Operate valves in fully-open and fully-dead position and examine guides and seats.

D. Examine valve threads and mating piping for form and cleanliness.

E. Examine mating flange faces for condition that might cause leakage. Verify gasket is proper size, material, suitable for usage and free from defects.

3.2 INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Globe or angle valves.
4. Pump-Discharge Check Valves:

    a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with nonmetallic disc.
    b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Center-guided, metal-seat check valves.
    c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 150, nonmetallic disc.
3. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 150, nonmetallic disc.
5. Bronze Globe Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. Iron, Grooved-End Swing Check Valves: 300 CWP.
5. Iron, Center-Guided Check Valves: Class 125, globe, metal seat.
6. Iron Globe Valves: Class 125.

3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 150, nonmetallic disc.
3. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 150, nonmetallic disc.
5. Bronze Globe Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
3. Iron Gate Valves: Class 125, OS&Y.

3.7 COMPRESS AIR VALVE SCHEDULE

A. Pipe NPS 2 (DN50) and smaller:
   1. Bronze and brass valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball valve: Two-piece regular port, brass or bronze.
   3. Bronze swing check valves: Class 150, bronze disc.

B. Pipe NPS 2 ½ (DN65) and larger:
   1. Iron valves may be provided with threaded or flanged ends.
   2. Iron swing check valves: Class 250 metal seats.
   3. Iron gate valves. Class 250 NPS.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Quality Assurance: Labeled with maximum flame-spread index of 25 and maximum smoke-developed index of 50 according to ASTM E 84.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. The most common jacket for equipment applications is ASJ.

C. Mineral-Fiber, Preformed Pipe Insulation: Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.

D. Mineral-Fiber, Pipe and Tank Insulation: Complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB; and having factory-applied FSK jacket. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 degrees F (55 degrees C) is 0.29 Btu x in./h x sq. ft. x degrees F (0.042 W/m x K) or less.

E. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

F. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

G. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

H. Factory-Applied Jackets: When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

I. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

J. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 3 - EXECUTION

3.1 PIPE INSULATION INSTALLATION

A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Division 07 Section "Penetration Firestopping."

D. Flexible Elastomeric Insulation Installation:

1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Mineral-Fiber Insulation Installation:

1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

F. Interior Piping System Applications: Insulate the following piping systems:

1. Domestic hot water.
2. Recirculated domestic hot water.
3. Roof drain bodies and horizontal rainwater leaders of storm water piping.
4. Exposed water supplies and sanitary drains of fixtures for people with disabilities.

G. Do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Sanitary drainage and vent piping.
3. Drainage piping located in crawlspaces unless otherwise indicated.
4. Chrome-plated pipes and fittings, except for plumbing fixtures for people with disabilities.
5. Piping specialties, including air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.2 EQUIPMENT INSULATION SCHEDULE

A. Domestic hot-water storage tank insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 1 inch thick.

3.3 INDOOR PIPING INSULATION SCHEDULE

A. Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawlspaces.
2. Underground piping.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. Manufactured Protective Shielding Pipe Covers.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Comply with NSF 14 for plastic, potable domestic water piping and components.

B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Hard Copper Tubing: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper with wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Copper Unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
2. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

B. Soft Copper Tubing: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper with copper pressure fittings, cast-copper-alloy or wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

C. PVC Pipe: ASTM D 1785, Schedule 40.

1. PVC Fittings: ASTM D 2466, Schedule 40, socket type.

D. Special-Duty Valves:

1. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
2. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

E. Transition Fittings: Manufactured piping coupling or specified piping system fitting. Same size as pipes to be joined and pressure rating at least equal to pipes to be joined.

F. Flexible Connectors: Stainless-steel, corrugated-metal tubing with wire-braid covering. Working-pressure rating a minimum of 200 psig (1380 kPa).

2.2 PIPING JOINING MATERIALS

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

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.3 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section “General-Duty Valves for Plumbing Piping” for general-duty metal valves.

B. Comply with requirements in Division 22 Section “Domestic Water Piping Specialties” for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.4 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Plastic-to-Metal Transition Fittings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Charlotte Pipe and Foundry Company.
      b. Harvel Plastics, Inc.
      c. Spears Manufacturing Company.
   2. Description: CPVC or PVC one-piece fitting with manufacturer’s Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Colonial Engineering, Inc.
      b. NIBCO INC.
      c. Spears Manufacturing Company.

2. Description: CPVC or PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union rut.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. EPCO Sales, Inc.
      d. Hart Industries International, Inc.
      e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      f. Zurn Plumbing Products Group; Wilkins Water Control Products.
   2. Description:
      a. Pressure Rating: 150 psig at 180 degrees F.
      b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. EPCO Sales, Inc.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Factory-fabricated, bolted, companion-flange assembly.
      b. Pressure Rating: 150 psig.
      c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. 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 Couplings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Calpico, Inc.
b. Lochinvar Corporation.
2. Description:
a. Galvanized-steel coupling.
b. Pressure Rating: 300 psig at 225 degrees F.
c. End Connections: Female threaded.
d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.
2. Description:
a. Electroplated steel nipple complying with ASTM F 1545.
b. Pressure Rating: 300 psig at 225 degrees F.
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.6 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with set screws.

C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One Piece, Stamped Steel: Chrome-plated finish with set screw.

E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and set screw.

F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, set screw.

G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.7 SLEEVES

A. Galvanized-Steel-Sheet Sleeves: 0.0239 inch minimum thickness; round tube closed with welded longitudinal joint.

B. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Drawings plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.

C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for wall penetration systems.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shut off valve immediately upstream of dielectric fittings.

F. Install domestic water piping without pitch for horizontal piping and plumb for vertical piping.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

1. Soldered Joints: Comply with procedures in ASTM B 828 unless otherwise indicated.

I. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.

J. Support vertical piping at each floor.

K. Install flexible connectors in suction and discharge piping connections to each domestic water pump.

L. Install piping parallel or at 90 degree angles from building walls.

M. Install piping above ceilings to allow space for ceiling panel removal and coordinate with other services in space.

N. Install piping to allow service and maintenance.

O. Install pipe fittings at pressure rating higher than system

P. Install fittings for each change of direction.

Q. Install unions at final connection to each piece of equipment it is serving.

3.2 INSPECTING AND CLEANING

A. Inspect and test piping systems as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

B. Clean and disinfect potable domestic water piping by filling system with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

3.3 PIPING SCHEDULE

A. Underground, Service Entrance Piping: Soft copper tubing.

B. Aboveground Distribution Piping: Type L hard copper tubing.

3.4 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Drain Duty: Hose-end drain valves.

B. Install gate valves close to main on each branch and riser serving two or more plumbing fixtures or equipment connections and where indicated.

C. Install gate or ball valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated.

D. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.

E. Install swing check valve on discharge side of each pump and elsewhere as indicated.

F. Install ball valves in each hot-water circulating loop and discharge side of each pump.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

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. Temperature-actuated, water mixing valves.
2. Strainers for domestic water piping.
3. Hose bibbs.
4. Wall hydrants.
5. Water-hammer arresters.
6. Air vents.
7. Trap-seal primer device.
8. Flexible connectors.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1.4 MINIMUM

A. Minimum working pressure for domestic water piping specialties: 180 psig.

PART 2 - PRODUCTS

2.1 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Inc.; T1710 or comparable product by one of the following:

a. Conbraco Industries, Inc.
b. Milwaukee Valve Company.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
4. Size: NPS 2 (DN 50) or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.2 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

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

    a. Leonard Valve Company.
    b. Powers; a division of Watts Water Technologies, Inc. (LFLM490)
    c. Symmons Industries, Inc.
    d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 120 degrees F (49 degrees C).
9. Tempered-Water Design Flow Rate: 0.5 gpm (0.032 L/s).
10. Valve Finish: Rough bronze.

B. Individual-Fixture, Water Tempering Valves:

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

    a. Lawler Manufacturing Company, Inc.
    b. Leonard Valve Company.
    c. Powers; a division of Watts Water Technologies, Inc. (LFLM495)
    d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1069 & 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.

6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Tempered-Water Setting: 105 degrees F (41 degrees C).
10. Minimum Tempered-Water Design Flow Rate: 0.5 gpm (0.03 L/s).

2.3 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm) .
    b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm) .
    c. Strainers NPS 5 (DN 125) and Larger: 0.10 inch (2.54 mm) .

6. Drain: Factory-installed, hose-end drain valve.

2.4 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.5 WALL HYDRANTS

A. Moderate-Climate Wall Hydrants:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Woodford; B65 or comparable product by one of the following:

    a. Josam Company.
    b. Zurn
    c. MIFAB, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Watts Drainage Products.

2. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig (860 kPa).
4. Operation: Loose key.
5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
6. Outlet:

    a. Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7.

7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Operating Keys(s): One with each wall hydrant.

2.6 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn; 1250XL or comparable product by one of the following:

    a. AMTROL, Inc.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Precision Plumbing Products, Inc.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    g. Watts Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston, lead-free.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.7 AIR VENTS

A. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig (1035-kPa) minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 (DN 10) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.8 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Precision Plumbing Products; P1-500 or comparable product by one of the following:

    a. MIFAB, Inc.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
8. Provide adjusting screw to adjust between high and low pressures.

2.9 FLEXIBLE CONNECTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex; BBS (Bronze) or SST/MLP (Steel) or comparable product by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.10 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Rain Bird Corporation.
   e. Toro Company (The); Irrigation Div.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Size: NPS ½ to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.
   b. MIFAB, Inc.
   c. Watts Industries, Inc.; Water Products Div.
   d. Woodford Manufacturing Company.
   e. Zurn Plumbing Products Group; Light Commercial Operation.
   f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Toro Company (The); Irrigation Div.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.

4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Accessories:
   a. Valves: Ball type, on inlet and outlet.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
   1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
   2. Pressure Rating: 400 psig minimum CWP.
   3. Size: NPS ¾ (DN 20).
   4. Body: Copper alloy.
   5. Ball: Chrome plated brass.
   6. Seats and Seals: Replaceable.
   7. Handle: Vinyl-covered steel.
   8. Inlet: Threaded or solder joint.
   9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:
   1. Standard: MSS SP-80 for gate valves.
   2. Pressure Rating: Class 125.
   3. Size: NPS ¾ (DN 20).
   4. Body: ASTM B 62 bronze.
   5. Inlet: NPS ¾ (DN 20).
   6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:
   1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
   2. Pressure Rating: 200 psig minimum CWP or Class 125.
   3. Size: NPS ¾ (DN 20).
   4. Body: Copper alloy or ASTM B 62 bronze.
   5. Drain: NPS 1/8 (DN 6) side outlet with cap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

B. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Install Y-pattern strainers for water on supply side of each control valve water pressure-reducing valve solenoid valve and pump.

F. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

G. Install water-hammer arresters in water piping according to PDI-WH 201.

H. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Primary, thermostatic, water mixing valves.
2. Manifold, thermostatic, water mixing-valve assemblies.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer and double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Minimum Pressure Requirement for Soil, Waste, and Vent: 10-foot head of water (30 kPa).

B. Comply with NSF 14, "Plastic Piping Components and Related Materials," for plastic piping components.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. Copper Drainage Tube and Fittings: ASTM B 306, Type DWV drawn temper with wrought copper, Type DWV drainage fittings.

B. Hub-and-Spigot Cast-Iron Soil Pipe and Fittings: ASTM A 74, Service class; ASTM C 564 rubber gaskets.

C. Hubless Cast-Iron Soil Pipe and Fittings: ASTM A 888 or CISPI 301, with ASTM C 1277 shielded couplings.

D. PVC Plastic, DWV Pipe and Fittings: ASTM D 2665, Schedule 40, plain ends with PVC socket-type, DWV pipe fittings.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.

B. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

C. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for wall penetration systems.

1. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

G. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

H. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

K. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure unless otherwise indicated.

L. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.

3.2 PIPE SCHEDULE

A. Aboveground Applications: PVC plastic, DWV pipe and fittings with solvent-cemented joints.

B. Belowground Applications: Hubless, cast-iron soil pipe and fittings.

END OF SECTION

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

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

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn; Z1400-K or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Watts Drainage Products Inc.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.

6. Clamping Device: Required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn; Z1446 or a comparable product by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; d of Smith Industries, Inc.
   d. Watts Drainage Products Inc (CO-460-RD).

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; FD-100-A or a comparable product by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation (Z415B).

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top or Strainer Material: Nickel bronze.

10. Top Shape: Round; except square in tile floors.
11. Dimensions of Top or Strainer: 6-inch (152-mm).
12. Top Loading Classification: Medium Duty.
13. Funnel: Provide where indicated on plans.
14. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
15. Trap Material: Cast iron.
16. Trap Pattern: Deep-seal P-trap.
17. Trap Features: Cleanout and trap-seal primer valve drain connection.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Acorn Engineering Company; Elmdor/Stoneman Div.
   b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft. 0.0938-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor unless otherwise indicated.

1. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

C. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

D. Install air-gap fittings on indirect-waste piping discharge into sanitary drainage system.

E. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data for each type of plumbing fixture, including trim, fittings, accessories, appliances, appurtenances, equipment, and supports.

1.2 QUALITY ASSURANCE

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. See construction documents.

2.2 WALL-MOUNTED WATER CLOSETS

A. Support:

1. Standard: ASME A112.6.1M.
2. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
3. Water-Closet Mounting Height: Standard Child or Handicapped/elderly according to ICC/ANSI A117.1 as indicated.

2.3 WALL HUNG URINALS

A. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.4 WALL-MOUNT LAVATORY

A. Vitreous-China Lavatory: Wall-mounting,

1. Basis-of-Design Product: Product indicated on Drawings, or equivalent.

B. Fixture Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier with rectangular, steel uprights.

2.5 SERVICE SINKS

A. Support: ASME A112.6.1M, Type II, sink carrier.

2.6 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Cross handle.

F. Risers:

1. NPS 1/2 (DN 15).
2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose.

2.7 ELECTRIC WATER COOLERS

A. Electric Water Coolers: Wall-mounted,

1. Basis-of-Design Product: Product indicated on Drawings, or equivalent.

B. Fixture Support: ASME A112.6.1M, Type I, water-cooler carrier with rectangular, steel uprights.

2.8 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine walls, floors, and counters for suitable conditions where plumbing fixtures will be installed.

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

3.2 INSTALLATIONS

A. Install fixtures level and plumb according to roughing-in drawings.

B. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "GENERAL-DUTY VALVES FOR PLUMBING PIPING"

C. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

D. Connect water closets and urinals with water supplies, and soil/ waste, and vent piping. Connect lavatories and sinks with water supplies, stops, and risers, and with traps, soil, waste and vent piping. Use size fittings required to match fixture.

E. Where installing piping adjacent to plumbing fixtures, allow space for service and maintenance.

F. Install fixtures with flanges and gasket seals.

G. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

H. Install accessible, wall-mounted fixtures at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

I. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate.

J. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.

K. Water Closet Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

L. Urinal Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

M. Fasten wall-mounted fittings to reinforcement built into walls.

N. Fasten counter-mounting plumbing fixtures to casework.

O. Secure supplies to supports or substrate within pipe space behind fixture.

P. Set shower receptors and mop basins in leveling bed of cement grout.

Q. Install individual supply inlets, supply stops, supply risers, and tubular brass traps with cleanouts at each fixture.

R. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding fittings.

S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

T. Install piping connections between plumbing fixtures and piping systems and plumbing equipment.

U. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible fixtures.

V. Ground equipment.

3.3 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning plumbing fixtures, fittings, and controls.

B. Adjust water pressure at flushometer valves and faucets to produce proper flow.

C. Adjust water-cooler flow regulators for proper flow and stream height.

D. Adjust water-cooler temperature settings.

E. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.4 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures and fittings with manufacturers' recommended cleaning methods and materials.

C. Install protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

DUCT & DUCT INSULATION SCHEDULE

DUCT SYSTEM	DUCT TYPE	DUCT MATERIAL	PRESSURE CLASS	MINIMUM SMACNA SEAL CLASS	VAPOR BARRIER	SMACNA LEAKAGE CLASS	INSULATION TYPE	INSULATION THICKNESS	INSULATION DENSITY	INSULATION JACKET
SUPPLY AIR	CONCEALED, SINGLE WALL, ROUND OR RECTANGULAR	G-60 GALVANIZED STEEL	POSITIVE 2 IN. W.G.	CLASS 'A'	YES	6	MINERAL-FIBER BLANKET	2 IN.	1.5 LB/CU. FT.	FACTORY APPLIED FSK ALUMINUM FOIL WITH FIBERGLASS REINFORCED SCRIM
SUPPLY AIR	EXPOSED, SINGLE WALL, ROUND	G-60 GALVANIZED STEEL; PAINT WITH COLOR AS DIRECTED BY ARCHITECT	POSITIVE 2 IN. W.G.	CLASS 'A'	YES	6	N/A	N/A	N/A	N/A
RETURN AIR	CONCEALED OR EXPOSED SINGLE WALL, RECTANGULAR	GALVANIZED STEEL; PAINT WITH COLOR AS DIRECTED BY ARCHITECT	POSITIVE OR NEGATIVE 2 IN. W.G.	CLASS 'A'	YES	6	N/A	N/A	N/A	N/A
EXHAUST AIR (ALL)	CONCEALED OR EXPOSED, SINGLE WALL, RECTANGULAR	ALUMINUM ALLOY, 3003-H14, ASTM B 209	NEGATIVE 2 IN. W.G.	CLASS 'A'	YES	12	N/A	N/A	N/A	N/A
OUTSIDE AIR	CONCEALED, SINGLE WALL, ROUND OR RECTANGULAR	ALUMINUM ALLOY, 3003-H14, ASTM B 209	POSITIVE OR NEGATIVE 2 IN. W.G.	CLASS 'A'	YES	6	MINERAL-FIBER BOARD	2 IN.	3.0 LB/CU. FT.	N/A

FAN SCHEDULE

MARK	TYPE	SERVICE	AIR VOLUME	STATIC PRESSURE	FAN DRIVE	FAN SPEED	MOTOR POWER	ELECTRICAL	SOUND LEVEL	MANUFACTURER & MODEL	DETAIL REFERENCE	ROOF OPENING (APPOXIMATE)	NOTES
			CFM	IN. WC.		RPM	HP	V/PH/Hz	SONES				
EF-1	ROOF UPBLAST	WOMEN 103 MEN 105	560	0.75	BELT	1,700	1/4	115/1/60	8.3	COOK ACRUB/100	D/M5.1	14" x 14"	1,3,4,5,6,7,9,10,11, 12
EF-2	INLINE	MEN 120	345	0.75	BELT	2,400	1/2	115/1/60	5.6	COOK 70 SQN-B	E/M5.1	N/A	1,2,5,6,7,9,10,11,12
EF-3	ROOF UPBLAST	WOMEN 113	485	0.75	BELT	1,600	1/4	115/1/60	5.6	COOK ACRUB/100	D/M5.1	14" x 14"	1,3,4,5,6,7,8,9,10,11,12

NOTES:
1. PROVIDE FACTORY-INSTALLED, NON-FUSIBLE DISCONNECT SWITCH MOUNTED IN WEATHERPROOF ENCLOSURE, NEMA 4 OR EQUAL.
2. PROVIDE VIBRATION ISOLATION PACKAGE (MODEL RC OR SC) AS RECOMMENDED BY FAN MANUFACTURER.
3. PROVIDE TOTALLY-ENCLOSED, FAN-COOLED TEFC PREMIUM EFFICIENT MOTOR.
4. PROVIDE 12"HIGH STANDARD ALUMINUM ROOF CURB.
5. PROVIDE A MINIMUM 6' LENGTH PIGTAIL FOR ELECTRICAL CONNECTION.
6. PROVIDE MOTORIZED DAMPER THAT WILL CLOSE WHEN FAN IS DE-ENERGIZED.
7. PROVIDE FLEXIBLE CONNECTION AT DUCT CONNECTION TO FAN.
8. PROVIDE SIDE DISCHARGE WITH BOTTOM ACCESS.
9. BELT DRIVES SHALL BE SIZED FOR 150% OF MOTOR HP.
10. PROVIDE REGREASABLE BALL TYPE BEARINGS WITH L50 LIFE IN EXCESS OF 200,000 HOURS.
11. PROVIDE 100% ALL ALUMINUM WHEEL WITH BACKWARD INCLINED FAN BLADES.
12. FAN SHALL MEET ALL REQUIREMENTS LISTED IN SPECIFICATION SECTION 23 3423 HVAC POWER VENTILATORS.

MECHANICAL NOTES

GENERAL:

A. THE COMPLETE MECHANICAL SYSTEM WHICH SHALL BE PROVIDED BY THE CONTRACTOR SHALL INCLUDE ALL WORK, MATERIALS AND APPARATUSES SPECIFIED HEREINAFTER AND INDICATED ON THE DRAWINGS. ALL WORKMANSHIP SHALL BE OF THE HIGHEST QUALITY AND NO SUBSTANDARD WORK WILL BE ACCEPTED.

B. PROVIDE ALL WORK AND MECHANICAL SYSTEM COMPONENTS REQUIRED, AS SPECIFIED, AND INDICATED ON THE DRAWINGS. THE WORK SHALL INCLUDE COMPLETE TESTING OF ALL MECHANICAL SYSTEMS AT THE COMPLETION OF THE WORK AND MAKING ANY CHANGES AND ADJUSTMENTS NECESSARY FOR THE PROPER FUNCTIONING OF THE SYSTEMS.

C. MAKE A THOROUGH EXAMINATION OF THE SITE AND THE CONTRACT DOCUMENTS PRIOR TO EXECUTING THE CONTRACT. NO CLAIM FOR ADDITIONAL COMPENSATION WILL BE RECOGNIZED FOR DIFFICULTIES ENCOUNTERED WHICH AN EXAMINATION OF SITE CONDITIONS AND CONTRACT DOCUMENTS WOULD HAVE REVEALED.

D. THE PLANS ARE GENERALLY DIAGRAMMATIC. COORDINATE ALL WORK WITH OTHER TRADES AS REQUIRED TO AVOID INTERFERENCES BETWEEN TRADES (i.e. BEAMS, CONDUITS, EQUIPMENT, PIPING, ETC).

E. ALL CONTRACTORS ARE RESPONSIBLE TO EXAMINE THE EXISTING CONDITIONS AND PROJECT DOCUMENTS PRIOR TO COMMENCING WORK ON BIDS.

F. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE DESIGN INTENT OF WORK TO BE PERFORMED UNDER THIS CONTRACT.

G. COORDINATE LOCATION OF ALL DUCTWORK, PIPING, EQUIPMENT, ETC WITH ALL TRADES PRIOR TO INSTALLATION. PROVIDE THE REQUIRED CLEARANCES AROUND ALL ELECTRICAL PANELS, SWITCHGEAR, ETC. IF CONFLICTS EXIST, THEY SHALL BE BROUGHT TO THE ENGINEER OF RECORD PRIOR TO RESOLVING CONFLICT AND PRIOR TO INSTALLATION.

H. THE COMPLETE MECHANICAL SYSTEM WHICH SHALL BE PROVIDED BY THE CONTRACTOR SHALL INCLUDE ALL WORK, MATERIALS AND APPARATUSES SPECIFIED HEREINAFTER AND INDICATED ON THE DRAWINGS. ALL WORKMANSHIP SHALL BE OF THE HIGHEST QUALITY AND NO SUBSTANDARD WORK WILL BE ACCEPTED.

I. PROVIDE ALL WORK AND MECHANICAL SYSTEM COMPONENTS REQUIRED, AS SPECIFIED, AND INDICATED ON THE DRAWINGS. THE WORK SHALL INCLUDE COMPLETE TESTING OF ALL MECHANICAL SYSTEMS AT THE COMPLETION OF THE WORK AND MAKING ANY CHANGES AND ADJUSTMENTS NECESSARY FOR THE PROPER FUNCTIONING OF THE SYSTEMS.

J. MAKE A THOROUGH EXAMINATION OF THE SITE AND THE CONTRACT DOCUMENTS PRIOR TO EXECUTING THE CONTRACT. NO CLAIM FOR ADDITIONAL COMPENSATION WILL BE RECOGNIZED FOR DIFFICULTIES ENCOUNTERED WHICH AN EXAMINATION OF SITE CONDITIONS AND CONTRACT DOCUMENTS WOULD HAVE REVEALED.

K. THE PLANS ARE GENERALLY DIAGRAMMATIC. COORDINATE ALL WORK WITH OTHER TRADES AS REQUIRED TO AVOID INTERFERENCES BETWEEN TRADES (i.e. BEAMS, CONDUITS, EQUIPMENT, PIPING, ETC).

AIR DEVICE SCHEDULE

MARK	PANEL SIZE	NECK SIZE	TYPE	MAX. AIRFLOW	MIN. AIRFLOW	MANUFACTURER & MODEL	NOTES
	IN.	IN.		CFM	CFM		
EG-1	12x12	6x6	CEILING	150	40	TITUS 50F	1,2,3

NOTES:
1. PROVIDE DUCT BRANCH SIZE LEADING TO REGISTER EQUAL TO NECK SIZE OF REGISTER.
2. PROVIDE ALUMINUM MANUAL AIR VOLUME DAMPER IN DUCT PRIOR TO EACH REGISTER TO ALLOW TEST AND BALANCE CONTRACTOR TO BALANCE REGISTER TO MEET AIRFLOW INDICATED ON DRAWINGS.
3. GRILLES SHALL MEET ALL REQUIREMENTS LISTED IN SPECIFICATION SECTION 23 3713 DIFFUSERS, REGISTERS, AND GRILLES.

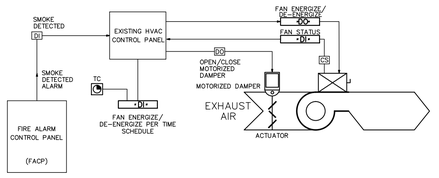
DESIGN TEMPERATURES

OUTSIDE TEMPERATURES			INSIDE TEMPERATURES	
COOLING DESIGN	DEHUMIDIFICATION DESIGN	HEATING DESIGN	COOLING DESIGN	HEATING DESIGN
°Fdb-°Fwb	°Fdb-°Fwb	°Fdb	°Fdb-%RH	°Fdb
92-77	88-80	38	75-50	70

CONTROL POINT LIST - EXHAUST FAN (EF-1,2,3)

INPUTS			OUTPUTS	
POINT	DESCRIPTIONS	ALARM	POINT	DESCRIPTIONS
DI-1	EXHAUST FAN STATUS	EXHAUST FAN MALFUNCTION	DO-1	EXHAUST FAN ENERGIZE/DE-ENERGIZE
DI-2	SMOKE DETECTED	SMOKE	DO-2	OPEN/CLOSE MOTORIZED DAMPER

EXHAUST FAN CONTROL SCHEMATIC
TYPICAL FOR: EF-1, EF-2, EF-3



B CONTROL SCHEMATIC - EXHAUST FAN
SCALE: NTS

SEQUENCE OF OPERATIONS - EF

TYPICAL FOR EF-1, EF-2, EF-3

A. OFF/AUTO CONTROL:

WHEN EXHAUST FAN IS TOGGLED TO "AUTO" MODE, MOTORIZED DAMPER SHALL BE OPENED AND EXHAUST FAN SHALL BE ENERGIZED AND RUN CONTINUOUSLY.

B. OFF

WHEN EXHAUST FAN IS TOGGLED IN THE "OFF" MODE, MOTORIZED DAMPER SHALL BE CLOSED AND THE EXHAUST FAN SHALL BE DE-ENERGIZED.

C. SMOKE DETECTION:

IF THE FIRE ALARM CONTROL SYSTEM DETECTS SMOKE, THEN A SIGNAL SHALL BE SENT TO CLOSE MOTORIZED DAMPER AND DE-ENERGIZE EXHAUST FAN.

D. TIMECLOCK SCHEDULING

TIMECLOCK SHALL ALLOW OWNER TO PROVIDE SCHEDULE TO OPEN MOTORIZED DAMPER AND ENERGIZE FANS WHEN BUILDING IS OCCUPIED. CLOSE MOTORIZED DAMPER AND DE-ENERGIZE FANS WHEN BUILDING IS NOT OCCUPIED.

MECHANICAL LEGEND

SYMBOL	DESCRIPTION
'EQUIP'	EQUIPMENT MARK
(#)	KEYED NOTES
	CONNECTION DATUM: NEW TO EXISTING

ABBREVIATIONS:

A/E	ARCHITECT/ENGINEER	FPM	FEET PER MINUTE
AFF	ABOVE FINISHED FLOOR	FT	FOOT (FEET)
AHU	AIR HANDLING UNIT	GPM	GALLONS PER MINUTE
AHJ	AUTHORITY HAVING JURISDICTION	HP	HORSEPOWER
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	IN	INCHES
AI	ANALOG INPUT	kW	KILOWATT
AO	ANALOG OUTPUT	MAX	MAXIMUM
AP	ACCESS PANEL	MB	MIXING BLOCK
BFG	BELOW FINISHED GRADE	MBtuH	THOUSAND BTU PER HOUR
BHP	BRAKE HORSEPOWER	MCA	MINIMUM CIRCUIT AMPACITY
BTU	BRITISH THERMAL UNITS	MIN	MINIMUM
CFM	CUBIC FEET PER MINUTE	MOCP	MAXIMUM OVERCURRENT PROTECTION
CH	CHILLER	NA	NOT APPLICABLE
CHWR	CHILLED WATER RETURN	NC	NOISE CRITERIA
CHWS	CHILLED WATER SUPPLY	NTS	NOT TO SCALE
COND	CONDENSATE	OA	OUTSIDE AIR
DDC	DIRECT DIGITAL CONTROL	P	PUMP
DI	DIGITAL INPUT	RA	RETURN AIR
DO	DIGITAL OUTPUT	RAR	RETURN AIR REGISTER
DP	DIFFERENTIAL PRESSURE SENSOR	RPM	REVOLUTIONS PER MINUTE
EA	EXHAUST AIR	SA	SUPPLY AIR
EF	EXHAUST FAN	SP	STATIC PRESSURE SENSOR
EL	ELEVATION	TAB	TEST, ADJUST & BALANCE
ER	EXHAUST REGISTER	TEMP	TEMPERATURE OR TEMPORARY
EXIST	EXISTING	TYP	TYPICAL
°Fdb	DEGREES FAHRENHEIT DRY BULB	UL	UNDERWRITERS LABORATORY
°Fwb	DEGREES FAHRENHEIT WET BULB	VFD	VARIABLE FREQUENCY DRIVE
FLA	FULL LOAD AMPS	WC	WATER COLUMN

	DIRECTION OF FLOW
	PIPING UP
	PIPING DOWN
	TOP BRANCH CONNECTION
	BOTTOM BRANCH CONNECTION
	SUPPLY AIR DUCT SECTION
	RETURN OR OUTSIDE AIR DUCT SECTION
	EXHAUST AIR DUCT SECTION
	FLEXIBLE DUCT
	ROUND OR RECTANGULAR DUCT TAKE-OFF FITTING WITH BALANCING DAMPER - SEE DETAIL G/M5.1.
	MOTORIZED AIR CONTROL DAMPER
	MANUAL AIR BALANCING DAMPER
	DUCT MOUNTED SMOKE DETECTOR
	DOOR UNDERCUT (3/4" UON)
T	THERMOSTAT CONTROLLER
	SPACE TEMPERATURE/HUMIDITY SENSOR
	MOTOR STARTER / DISCONNECT
HVAC	HVAC CONTROL PANEL
FACP	FIRE ALARM CONTROL PANEL
	TIME CLOCK
CS	CURRENT SENSOR

OBJECT STATE LINETYPES:
EXISTING OBJECT OR CONSTRUCTION: _____
EXISTING OBJECT OR CONSTRUCTION TO BE DEMOLISHED: - - - - - - - - - - - - - - - -
NEW OBJECT OR CONSTRUCTION TO BE PROVIDED: _____

OBJECT STATE SUBSCRIPTS:

D	EXISTING OBJECT TO BE DEMOLISHED	M	EXISTING OBJECT TO BE REMOVED & RELOCATED
E	EXISTING OBJECT TO REMAIN	R	RELOCATED EXISTING OBJECT

100% DOCUMENTS
NOVEMBER 25, 2015

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 - f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy, Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-8868

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER
ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
RM

REVISIONS

PROFESSIONAL SEAL

JOHN M. SPIERTO, P.E.; FL. REG. #: 58182

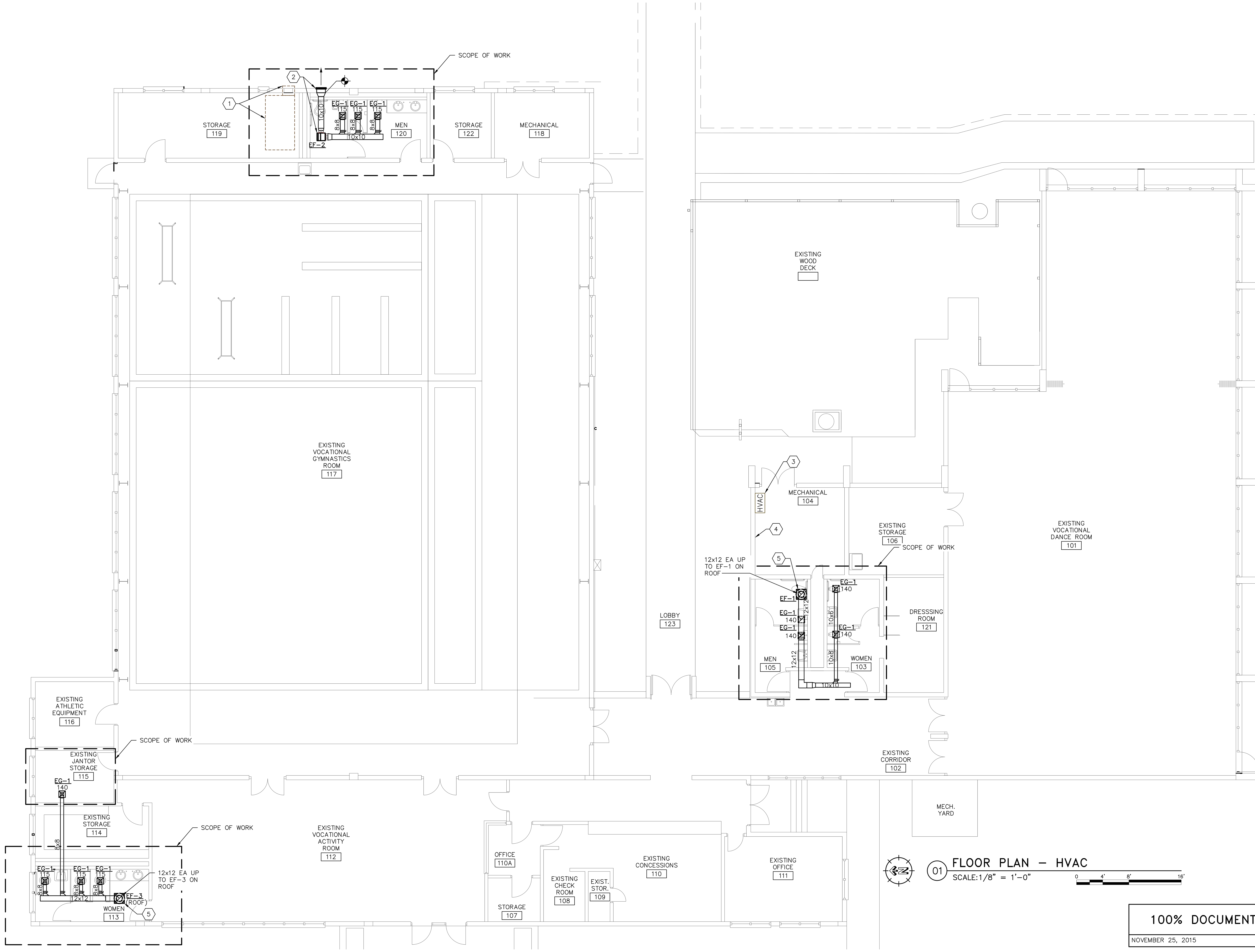
SCALE: AS NOTED

MECHANICAL NOTES, LEGEND, SCHEDULES, & CONTROLS

SHEET NUMBER
M1.0
---- OF X

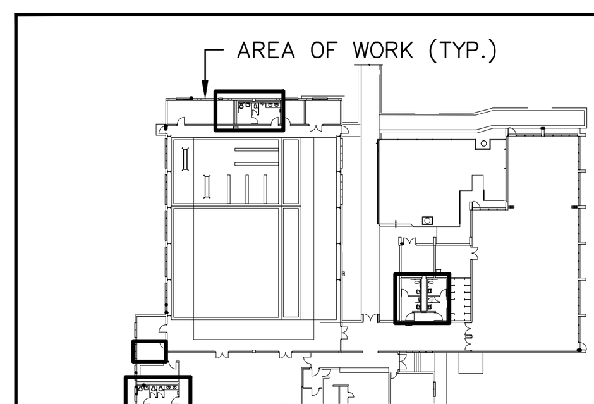
HVAC DRAWING KEYNOTES

1. CONTRACTOR TO DEMOLISH EXHAUST FAN, DUCTWORK, AIR DISTRIBUTION DEVICES, EXTERIOR WALL VENTS, AND ALL ASSOCIATED COMPONENTS INCLUDING CONTROLS. PATCH HOLE IN EXTERIOR WALL WITH WEATHERPROOF METHOD OF SEALING HOLE.
2. PROVIDE NEW IN–LINE EXHAUST FAN TO BE SUPPORTED FROM STRUCTURE. PROVIDE ASSOCIATED DUCTWORK, GRILLES, AND EXTERIOR ALUMINUM DRAINABLE STATIONARY LOUVER (18" X 18"), RUSKIN ELF 375 DX. CONTRACTOR MAY UTILIZE EXISTING EXTERIOR OPENING AND/OR MAKE NECESSARY CHANGES TO ALLOW INSTALLATION OF NEW WALL LOUVER. PAINT WALL LOUVER AS DIRECTED BY OWNER AND/OR CLIENT.
3. CONTRACTOR TO COORDINATE WITH CONTROLS MANUFACTURER OF EXISTING CONTROL SYSTEM SERVING BUILDING. PROVIDE AND INSTALL ALL NECESSARY CONTROL DEVICES TO ALLOW EXISTING HVAC CONTROL PANEL TO CONTROL AND MONITOR THE (3) NEW EXHAUST FANS. FURTHER, ALLOW COMMUNICATION BETWEEN THE FIRE ALARM PANEL AND HVAC PANEL FOR SMOKE SHUTDOWN.
4. PROVIDE (3) HAND/AUTO TOGGLE SWITCHES TO BE LOCATED IN MECHANICAL ROOM 104ON WALL AT LOCATION ACCEPTABLE TO OWNER THAT WILL ALLOW (3) NEW FANS TO BE MANUALLY DE–ENERGIZED OR PLACED IN "AUTO" MODE. COORDINATE WITH ELECTRICAL CONTRACTOR. PROVIDE TIMECLOCK IF NOT PRESENT SO THAT EXHAUST FANS CAN BE SCHEDULED TO BE DE–ENERGIZED PER OCCUPANCY SCHEDULE.
5. PROVIDE NEW ROOF–MOUNTED EXHAUST FAN. PROVIDE ASSOCIATED DUCTWORK, GRILLES, AND ROOF CURB, FLASHING, AND ALL COMPONENTS TO SEAL WATERTIGHT.



01 FLOOR PLAN – HVAC
SCALE: 1/8" = 1'–0"

100% DOCUMENTS
NOVEMBER 25, 2015



00 KEY PLAN
SCALE: N.T.S

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 – f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER
ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
RM

REVISIONS

PROFESSIONAL SEAL
JOHN M. SPIERTO, P.E.; FL. REG. #: 58182

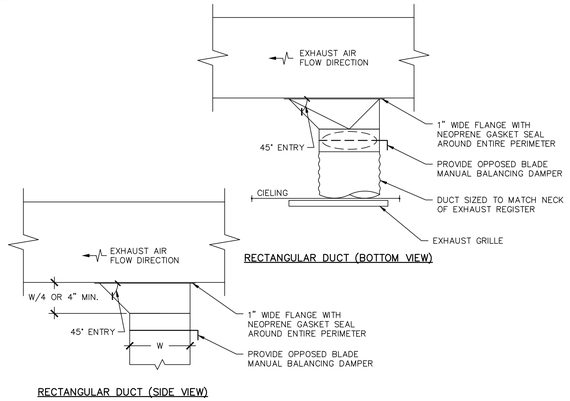
SCALE: AS NOTED

HVAC PLANS

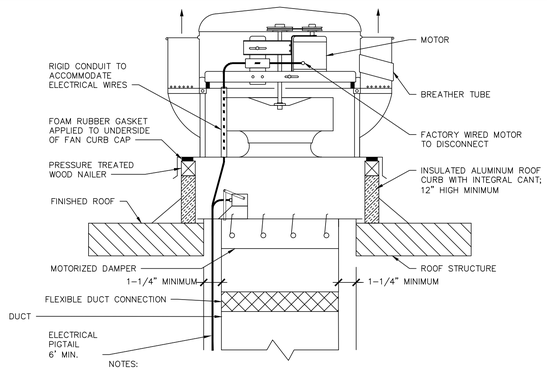
SHEET NUMBER
M1.1

---- OF x

Z:\2014 projects\0414b wayne c papy athletic center-lobby exp\Drawings\MEP\sheet set\0414B_M1.1 HVAC Plans.dwg Nov.25.2015 2:52 pm



G TYPICAL DUCT TAKE-OFF FITTINGS
SCALE:NTS

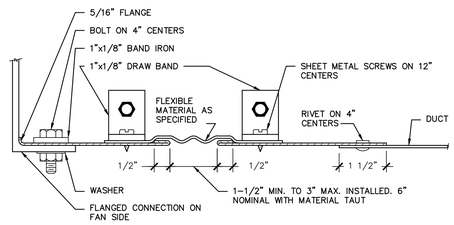


NOTES:

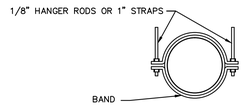
A. SECURE FAN TO CURB AS NECESSARY TO MEET WIND LOADING CODE AS PER MIAMI-DADE REQUIREMENTS IF AUTHORITY HAVING JURISDICTION (AHJ) DEMANDS THIS.

B. SECURE ROOF CURB TO ROOF USING SHEET METAL SCREWS, EXPANSION BOLTS, OR OTHER METHOD CONSISTENT WITH ROOF CONSTRUCTION AS NECESSARY TO MEET WIND LOADING CODE REQUIREMENTS.

D UPBLAST ROOF EXHAUST FAN
SCALE:NTS



H ROUND FLEXIBLE DUCT CONNECTION DETAIL
SCALE:NTS



NOTES:

1. PROVIDE TWO (2) 3/8" HANGER RODS OR (2) (1" X 16) GAGE STRAPS SPACED AT 10'-0" MAX. INTERVALS.
2. ROD DIAMETER BASED ON DUCT ONLY, NO EXTERNAL LOADS SHALL BE HUNG FROM DUCTWORK.
3. FOLLOW SMACNA STANDARDS

F ROUND DUCT HANGERS DETAIL
SCALE:NTS

100% DOCUMENTS
NOVEMBER 25, 2015

CITY OF TAMPA
CONTRACT ADMINISTRATION
DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 - f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER
ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
RM

REVISIONS

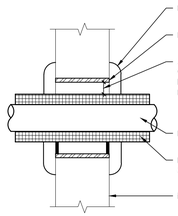
PROFESSIONAL SEAL

JOHN M. SPIERTO, P.E.; FL. REG. #: 58182

SCALE: AS NOTED

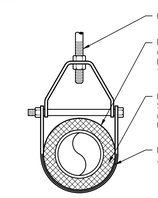
HVAC DETAILS

SHEET NUMBER
M5.1
---- OF X

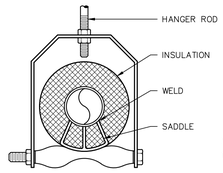


PIPE PENETRATION THROUGH NON-FIRE RATED WALL

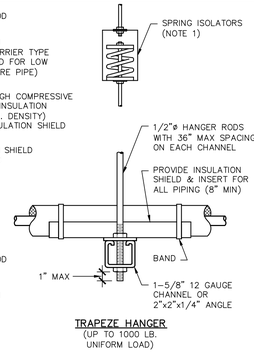
C PIPE PENETRATION THROUGH NON-FIRE RATED WALL
SCALE:NTS



ADJUSTABLE CLEVIS HANGER
(FOR STATIONARY PIPES)



ADJUSTABLE ROLLER HANGER
(USE WHEN HORIZONTAL MOVEMENT CAUSED BY PIPE EXPANSION AND CONTRACTION MIGHT OCCUR)



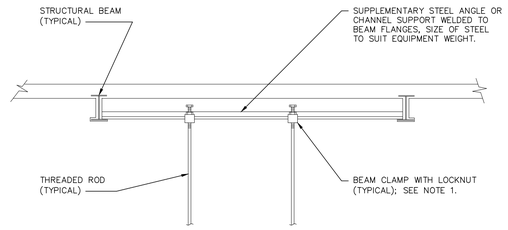
TRAPEZE HANGER
(UP TO 1000 LB. UNIFORM LOAD)

PIPE SUPPORT MAX. SPACING	
NOMINAL PIPE SIZE	PIPE RUN
IN.	LINEAR FT.
≤ 3/4"	7
1	7
1 1/4	7
1 1/2	9
2	10
2 1/2	11
3	12
4	14
5	16
6	17
8	19
10	22
12	23
14	25
16	27
18	28
20	30
24	32

NOTE: FOR TRAPEZE HANGERS USE SPACING OF SMALLEST SIZE ON TRAPEZE.

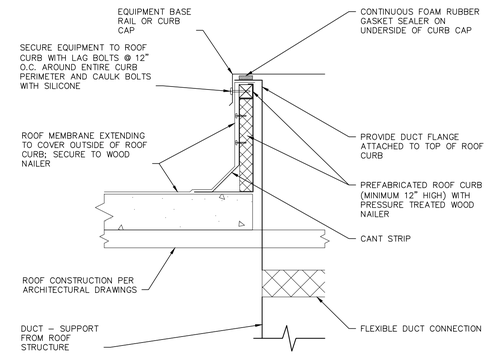
NOTES:
1. PROVIDE SPRING ISOLATORS IN MECHANICAL ROOMS, AND ON FIRST THREE (3) HANGERS BEFORE AND AFTER EQUIPMENT CONNECTIONS.

A TYPICAL PIPE HANGERS
SCALE:NTS



NOTE:
1. BEAM CLAMPS TO BE B-LINE B-351L (OR EQUAL) FOR EQUIPMENT; B-LINE B-3036L (OR EQUAL) FOR DUCTWORK & PIPING.

D SUSPENDED EQUIPMENT STRUCTURE ATTACHMENT DETAIL
SCALE:NTS



B ROOF CURB DETAIL
SCALE:NTS

100% DOCUMENTS
NOVEMBER 25, 2015

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p. 813. 274. 8456 - f. 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
RM

REVISIONS

PROFESSIONAL SEAL

JOHN M. SPIERTO, P.E.; FL. REG. # 58182

SCALE: AS NOTED

HVAC DETAILS

SHEET NUMBER
M5.2
---- OF X

DRAWING SPECIFICATIONS

GENERAL:

A. PROVIDE SHALL MEAN FURNISH AND INSTALL.

B. THE COMPLETE ELECTRICAL SYSTEM WHICH SHALL BE PROVIDED BY THE CONTRACTOR SHALL INCLUDE ALL WORK, MATERIALS AND APPARATUSES SPECIFIED HEREINAFTER AND INDICATED ON THE DRAWINGS. ALL WORKMANSHIP SHALL BE OF THE HIGHEST QUALITY AND NO SUBSTANDARD WORK WILL BE ACCEPTED.

C. PROVIDE ALL WORK AND ELECTRICAL SYSTEMS COMPONENTS REQUIRED TO SERVE LOADS AS SPECIFIED HEREINAFTER AND INDICATED ON THE DRAWINGS. THE WORK SHALL INCLUDE COMPLETE TESTING OF ALL ELECTRICAL SYSTEMS AT THE COMPLETION OF THE WORK AND MAKING ANY CHANGES AND ADJUSTMENTS NECESSARY FOR THE PROPER FUNCTIONING OF THE SYSTEMS.

D. MAKE A THOROUGH EXAMINATION OF THE SITE AND THE CONTRACT DOCUMENTS PRIOR TO EXECUTING THE CONTRACT. NO CLAIM FOR ADDITIONAL COMPENSATION WILL BE RECOGNIZED FOR DIFFICULTIES ENCOUNTERED WHICH AN EXAMINATION OF SITE CONDITIONS AND CONTRACT DOCUMENTS WOULD HAVE REVEALED.

E. THE PLANS ARE GENERALLY DIAGRAMMATIC. COORDINATE ALL WORK WITH OTHER TRADES AS REQUIRED TO AVOID INTERFERENCES BETWEEN TRADES (i.e. BEAMS, CONDUITS, EQUIPMENT, DUCTWORK, ETC).

F. REMOVE ALL EXISTING LIGHTING FIXTURES, EQUIPMENT, DEVICES, CONDUCTORS, RACEWAYS, ETC. MADE UNNECESSARY BY THE NEW INSTALLATION. PRIOR TO REMOVAL FROM SITE, COORDINATE WITH OWNER TO DETERMINE IF OWNER WISHES TO RETAIN ANY REMOVED EQUIPMENT.

WORK PERFORMANCE:

A. JOB SITE SAFETY AND WORKER SAFETY IS THE RESPONSIBILITY OF THE CONTRACTOR.

B. ARRANGE, PHASE AND PERFORM ALL WORK DURING TIME PERIODS SCHEDULED WITH AND ACCEPTABLE TO THE OWNER BEFORE PROCEEDING. NO ADDITIONAL COMPENSATION WILL BE AUTHORIZED FOR WORK NECESSITATED BY ILL-TIMED, DEFECTIVE, OR NON-CONFORMING WORK.

C. THE CONTRACTOR SHALL ENSURE THAT ALL SYSTEMS OPERATE AS DESIGNED AND/OR REQUIRED AND SHALL REVIEW THEIR OPERATION WITH THE OWNER UPON COMPLETION OF CONSTRUCTION AND TESTING. COMPILE COMPLETE AND UPDATED AS-BUILT DRAWINGS/DOCUMENTS AND ISSUE ONE (1) SET TO THE OWNER.

D. ELECTRICAL WORK SHALL BE ACCOMPLISHED WITH ALL AFFECTED CIRCUITS OR EQUIPMENT DE-ENERGIZED. WHEN AN ELECTRICAL OUTAGE CANNOT BE ACCOMPLISHED IN THIS MANNER FOR THE REQUIRED WORK, THE FOLLOWING REQUIREMENTS ARE MANDATORY:

   1. ELECTRICIANS MUST USE AND WEAR FULL PROTECTIVE EQUIPMENT (PPE) (i.e. CERTIFIED AND TESTED INSULATING MATERIAL TO COVER EXPOSED ENERGIZED ELECTRICAL COMPONENTS, CERTIFIED AND TESTED INSULATED TOOLS, ETC.) WHILE WORKING ON ENERGIZED SYSTEMS IN ACCORDANCE WITH NFPA 70E. THE LEVEL OF PPE SHALL BE DETERMINED BY A COMPUTER GENERATED ARC FLASH CALCULATION PROVIDED AND PAID FOR BY THE CONTRACTOR. THE ARC FLASH DATA SHALL BE PRESENTED WITH THE SUBMITTAL BELOW.
   2. WORK ON ENERGIZED CIRCUITS OR EQUIPMENT CANNOT BEGIN UNTIL PRIOR WRITTEN APPROVAL IS OBTAINED FROM THE OWNER.

E. NEW WORK SHALL BE INSTALLED AND CONNECTED TO EXISTING WORK NEATLY AND CAREFULLY. PROVIDE PROTECTIVE MATS, COVERS, ETC. AS REQUIRED FOR ALL EXISTING WORK SUSCEPTIBLE TO DAMAGE. VERIFY SPECIFIC LOCATIONS AND REQUIREMENTS WITH THE OWNER. DISTURBED OR DAMAGED WORK AS A RESULT OF ELECTRICAL WORK SHALL BE REPLACED OR REPAIRED TO ITS PRIOR CONDITIONS.

F. ENSURE THAT ELECTRICAL SERVICE REMAINS UNINTERRUPTED FOR OTHER BUILDINGS AND FACILITIES AT ALL TIMES. PERFORM ALL TEMPORARY WORK NECESSARY TO MAINTAIN CONTINUITY OF ELECTRICAL SERVICE WHEN CONNECTION IS MADE TO EXISTING SYSTEMS. EXISTING SERVICE SHALL NOT BE INTERRUPTED WITHOUT PRIOR CONSENT OF THE OWNER AND MAY BE INTERRUPTED ONLY AT AND FOR THE SPECIFIED TIME DESIGNATED BY THE OWNER. THE CONTRACTOR SHALL BE GUIDED BY THE OWNER AT ALL TIMES IN MATTERS AFFECTING THE EXISTING FACILITIES.

G. ELECTRICAL EQUIPMENT SHALL NOT BE STORED OUTDOORS. EQUIPMENT SHALL BE STORED IN AN OWNER/ENGINEER APPROVED MEDIUM AND LOCATION.

CODES & STANDARDS:

A. PERFORM WORK IN COMPLIANCE WITH THE LATEST ADOPTED EDITION OF ALL APPLICABLE, FEDERAL, STATE AND LOCAL CODES, REGULATIONS AND STANDARDS, TO INCLUDE THOSE LISTED BELOW, ADOPTED BY THE AUTHORITY HAVING JURISDICTION. WHERE DIFFERENCES MAY OCCUR THE MORE STRINGENT REQUIREMENTS SHALL GOVERN. IN CASE OF CONFLICT PROVIDE WRITTEN NOTIFICATION AND OBTAIN A DECISION FROM THE ARCHITECT.

   1. NFPA 70: NATIONAL ELECTRICAL CODE (2011)
   2. NFPA 70E: STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE (2012)
   3. NFPA 72: NATIONAL FIRE ALARM CODE (2012)
   4. NFPA 90A: STANDARD FOR THE INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS
   5. NFPA 101: LIFE SAFETY CODE (2012)
   6. NFPA 241: STANDARD FOR SAFEGUARDING CONSTRUCTION, ALTERATION AND DEMOLITION OPERATIONS (2013)
   7. FBC: FLORIDA BUILDING CODE (2014)
   8. OSHA PART 1910: OCCUPATIONAL SAFETY AND HEALTH STANDARDS
   9. OSHA PART 1926: SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

WARRANTY:

A. CONTRACTOR SHALL WARRANTY ALL WORK FOR A PERIOD OF ONE (1) YEAR FROM DATE OF SUBSTANTIAL COMPLETION. CONTRACTOR SHALL RECTIFY ANY DEFECTS DUE TO FAULTY MATERIALS OR WORKMANSHIP AND PAY FOR ANY DAMAGE TO OTHER WORK RESULTING THEREFROM WITHIN SAID PERIOD. THE OWNER WILL GIVE NOTICE OF DEFECTS WITH REASONABLE PROMPTNESS.

B. PROVIDE COMPLETE WARRANTY INFORMATION FOR EACH ITEM TO INCLUDE PRODUCT OR EQUIPMENT; DATE OR BEGINNING OF WARRANTY OR BOND; DURATION OF WARRANTY OR BOND; AND NAMES, ADDRESSES, AND TELEPHONE NUMBERS AND PROCEDURES FOR FILING A CLAIM AND OBTAINING WARRANTY SERVICES.

SUBMITTALS:

A. SUBMIT FIVE (5) COMPLETE BOUND HARDCOPY SETS OR ONE (1) ELECTRONIC COPY. THE ENGINEER WILL RETURN MIN ONE (1) COPY OF SUBMITTAL AND/OR SUBMITTAL REVIEW COMMENTS NO LATER THAN 21 CALENDAR DAYS OF RECEIPT.

B. APPROVAL SHALL BE OBTAINED FOR ALL EQUIPMENT AND MATERIAL BEFORE DELIVERY TO THE JOB SITE. DELIVERY, STORAGE OR INSTALLATION OF EQUIPMENT OR MATERIAL WHICH HAS NOT HAD PRIOR APPROVAL, WILL NOT BE PERMITTED AT THE JOB SITE.

C. ALL SUBMITTALS SHALL INCLUDE ADEQUATE DESCRIPTIVE LITERATURE, CATALOG CUTS, SHOP DRAWINGS AND OTHER DATA NECESSARY FOR THE ARCHITECT/ENGINEER TO ASCERTAIN THAT THE PROPOSED EQUIPMENT AND MATERIALS COMPLY WITH SPECIFICATION REQUIREMENTS. CATALOG CUTS SUBMITTED FOR APPROVAL SHALL BE LEGIBLE AND CLEARLY IDENTIFY EQUIPMENT BEING SUBMITTED.

D. SUBMITTALS FOR INDIVIDUAL SYSTEMS AND EQUIPMENT ASSEMBLIES WHICH CONSIST OF MORE THAN ONE ITEM OR COMPONENT SHALL BE MADE FOR THE SYSTEM OR ASSEMBLY AS A WHOLE. PARTIAL SUBMITTALS WILL NOT BE CONSIDERED FOR APPROVAL

E. SUBMITTAL OF SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES WILL BE ACCEPTED ONLY WHEN SUBMITTED BY THE CONTRACTOR. DATA SUBMITTED FROM SUBCONTRACTORS AND MATERIAL SUPPLIERS DIRECTLY TO THE ARCHITECT/ENGINEER WILL NOT BE PROCESSED.

F. SUBMITTALS SHALL BE MARKED TO SHOW SPECIFICATION REFERENCE INCLUDING THE SECTION AND PARAGRAPH NUMBERS. SUBMIT EACH SECTION SEPARATELY AND INCLUDE THE FOLLOWING:

   1. INFORMATION THAT CONFIRMS COMPLIANCE WITH CONTRACT REQUIREMENTS. INCLUDE THE MANUFACTURER'S NAME, MODEL OR CATALOG NUMBERS, CATALOG INFORMATION, TECHNICAL DATA SHEETS, SHOP DRAWINGS, PICTURES, NAMEPLATE DATA AND TEST REPORTS AS REQUIRED.
   2. PARTS LIST WHICH SHALL INCLUDE THOSE REPLACEMENT PARTS RECOMMENDED BY THE EQUIPMENT MANUFACTURER, QUANTITY OF PARTS, CURRENT PRICE AND AVAILABILITY OF EACH PART.

MATERIALS AND METHODS:

A. MATERIALS AND APPARATUSES SHALL COMPLY WITH ALL APPLICABLE TESTS, RATINGS, SPECIFICATIONS, AND REQUIREMENTS OF THE IEEE, NEMA, NFPA AND UL, SHALL BEAR THE UL LABEL OF APPROVAL AND BE LISTED FOR THE PROPOSED APPLICATION.

B. FINISHED PRODUCTS SHALL BE FACTORY PRIMED AND FINISH COATED WITH THE MANUFACTURER'S PRIME COAT AND STANDARD FINISH UNLESS SPECIFIED OTHERWISE BY THE ARCHITECT.

C. UNLESS OTHERWISE SPECIFIED, UNFINISHED PRODUCTS SHALL BE GALVANIZED, COATED OR PLATED TO RESIST CORROSION.

D. INSTALLATIONS SHALL BE IN ACCORDANCE WITH ALL APPLICABLE CODES, AS RECOMMENDED BY THE MANUFACTURER AND AS CLOSE AS PRACTICABLE TO LOCATIONS INDICATED ON DRAWINGS.

E. INSTALLATIONS SHALL FACILITATE MAINTENANCE AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. ACCESS, WORKING SPACES AND CLEARANCES SHALL NOT BE LESS THAN SPECIFIED BY THE NEC FOR ALL VOLTAGES SPECIFIED.

IDENTIFICATION:

A. INSTALL LABEL TAGS ON ALL WIRE AND CABLE IN JUNCTION BOXES, WIREWAYS AND WIRING GUTTERS OF PANELS. TAGS SHALL IDENTIFY WIRE OR CABLE CIRCUIT NUMBER AND/OR EQUIPMENT SERVED AS INDICATED ON DRAWINGS.

B. JUNCTION BOXES SHALL BE LABELED IN A PERMANENT MANNER REFLECTING PANELBOARD/CIRCUIT NUMBER OF BRANCH CIRCUIT WIRING CONTAINED WITHIN.

C. PANELBOARD DIRECTORIES SHALL BE TYPEWRITTEN, REFLECTING RECORD CONDITIONS TO INCLUDE CIRCUIT NUMBER, TYPE AND LOCATION OF LOAD.

D. INSTALL PLASTIC PLACARDS ON EQUIPMENT REFLECTING, EQUIPMENT NAME, NUMBER AND RATING.

RACEWAYS:

A. RACEWAYS:

   1. INTERIOR EXPOSED, CONCEALED IN WALLS OR ABOVE CEILINGS: ELECTRICAL METALLIC TUBING (EMT)
   2. INTERIOR CONNECTIONS TO MOTORS, TRANSFORMERS AND VIBRATING EQUIPMENT: FLEXIBLE METAL CONDUIT (FMC)

B. ALL CONDUIT SHALL BE PROPERLY ALIGNED, GROUPED AND SUPPORTED. EXPOSED CONDUIT SHALL BE INSTALLED AT RIGHT ANGLES TO OR PARALLEL TO THE PRINCIPAL STRUCTURAL MEMBERS. PROVIDE SUPPORT A MINIMUM OF 18" FROM BENDS AND OUTLET BOXES AND ON INTERVALS NOT TO EXCEED 8'-0". CONDUIT IS NOT TO SPAN ANY SPACE UNSUPPORTED. ALL CONDUIT SHALL BE SUPPORTED FROM STRUCTURE AND NOT FROM CEILING SUPPORT SYSTEM.

C. PROVIDE NYLON PULL CORD AND LEAVE IN PLACE IN EACH EMPTY CONDUIT.

D. THIN WALL CONDUIT SHALL BE UL APPROVED GALVANIZED ELECTRICAL METALLIC TUBING. COUPLINGS AND CONNECTORS FOR CONDUIT SHALL BE STEEL HEX-NUT, ZINC OR CADMIUM PLATED SET SCREW TYPE FITTINGS.

E. FLEXIBLE METALLIC CONDUIT IN DRY LOCATIONS SHALL BE UL APPROVED, ZINC COATED, SINGLE STRIP TYPE. FITTINGS SHALL BE AS MANUFACTURED BY THOMAS AND BETTS "TITE-BITE", STRAIGHT OR ANGLE CONNECTORS OR APPROVED EQUAL.

BOXES:

A. ALL BOXES SHALL BE RIGIDLY MOUNTED AND SHALL BE EQUIPPED WITH SUITABLE SCREW FASTENED COVERS. OPEN KNOCK-OUTS OR HOLES IN BOXES SHALL BE PLUGGED WITH A SUITABLE BLANKING DEVICE.

CONDUCTORS:

A. UNLESS OTHERWISE INDICATED, ALL BRANCH CIRCUIT CONDUCTORS SHALL BE NO. 12 AWG. BRANCH CIRCUITS RUN OVER 75 FEET IN LENGTH, MEASURING ONE WAY FROM THE FIRST OUTLET OF THE CIRCUIT TO THE PANEL, SHALL BE NO. 10 AWG FOR THE ENTIRE CIRCUIT.

B. CONDUCTORS SHALL BE COPPER WITH THHN/THWN-2 90°C INSULATION. THE FOLLOWING SYSTEMS OF COLOR CODING SHALL BE STRICTLY ADHERED TO AND SHALL BE CONSISTENTLY FOLLOWED THROUGHOUT:

   1. GROUND WIRES: GREEN
   2. GROUNDED NEUTRAL WIRES: WHITE
   3. 208/120 VOLT, UNGROUNDED PHASE WIRES: BLACK, RED AND BLUE

   NOTE: WHERE EXISTING BASE BUILDING COLOR CODING DIFFERS FROM COLOR CODING ASSIGNED HERE-IN, USE EXISTING COLOR CODING AS REQUIRED TO MAINTAIN CONSISTENCY.

C. ALL WIRING IN CEILING SPACE OR IN AIR HANDLING PLENUMS NOT IN CONDUIT SHALL BE UL LISTED AS SUITABLE FOR PLENUM USE.

D. ALL CONDUITS AND WIRING PENETRATING RATED FLOORS AND WALLS SHALL BE SEALED TO MAINTAIN FIRE RATING AND INTEGRITY OF SEPARATION.

E. FOR NEW CIRCUITS, MULTIPLE CIRCUITS IN SAME CONDUIT SHALL NOT SHARE NEUTRAL CONDUCTORS. FOR EXISTING CIRCUITS, WHERE REQUIRED BY NEC, PROVIDE AND INSTALL HANDLE TIES ON EXISTING CIRCUIT BREAKERS.

F. REUSE EXISTING JUNCTION BOXES, CONDUITS AND WIRING TO FEED RECEPTACLES AND LIGHTING FIXTURES WHERE APPLICABLE. REMOVE AND DISPOSE OF ALL UNUSED CONDUIT AND WIRING BACK TO LAST ACTIVE DEVICE OR PANEL.

GROUNDING:

A. THE ELECTRICAL SYSTEMS SHALL BE COMPLETELY AND EFFECTIVELY GROUNDED AS REQUIRED BY THE NEC AND AS SPECIFIED HEREINAFTER.

B. ALL METALLIC RACEWAYS SHALL BE MECHANICALLY AND ELECTRICALLY SECURE AT ALL JOINTS AND AT ALL BOXES, CABINETS, FITTINGS, AND EQUIPMENT. METALLIC RACEWAYS SHALL BE CONNECTED TO A DIRECT GROUND AT THE POINT OF ELECTRICAL SERVICE ENTRANCE AND SHALL BE ELECTRICALLY CONTINUOUS THROUGHOUT THE ENTIRE SYSTEM.

C. ALL GROUND CONDUCTORS SHALL BE INSULATED COPPER UON.

D. ALL RACEWAYS WITH NO. 10 OR 12 AWG PHASE CONDUCTORS FOR RECEPTACLES, LIGHTING FIXTURES AND SIMILAR CIRCUITS (NEW BRANCH CIRCUITS) SHALL BE PROVIDED WITH A PARITY SIZED GREEN EQUIPMENT GROUND CONDUCTOR. GROUND CONDUCTOR SHALL BE INSTALLED IN ENTIRE RACEWAY SYSTEM INCLUDING WALL SWITCHES AND FLEXIBLE CONDUIT TO LIGHT FIXTURES. EQUIPMENT GROUND CONDUCTOR SIZES FOR CIRCUITS WITH PHASE CONDUCTORS LARGER THAN NO. 12 AWG ARE INDICATED ON DRAWINGS. GROUND CONDUCTORS SHALL BE CONNECTED TO GROUND BUS IN PANELBOARDS.

E. TERMINATE FEEDER AND BRANCH CIRCUIT INSULATED EQUIPMENT GROUNDING CONDUCTORS WITH GROUNDING LUG, BUS, OR BUSHING. CONDUCTORS LOOPED UNDER SCREW OR BOLT HEADS WILL NOT BE PERMITTED.

F. INSTALL CLAMP-ON CONNECTORS ON CLEAN METAL CONTACT SURFACES TO ENSURE ELECTRICAL CONDUCTIVITY AND CIRCUIT INTEGRITY.

SWITCHES & RECEPTACLES:

A. ALL RECEPTACLES SHALL BE THE GROUNDING TYPE WITH GROUND CONNECTION MADE THROUGH AN EXTRA POLE WHICH SHALL BE PERMANENTLY CONNECTED TO GROUND CONDUCTOR.

B. GFCI RECEPTACLES SHALL MEET CURRENT UL 943 REQUIREMENTS WITH AUTO-MONITORING OR SELF-TEST FUNCTIONALITY; IF THE SELF-TEST FUNCTION DETECTS A PROBLEM, THE UNIT MUST DENY POWER OR PROVIDE VISUAL AND/OR AUDIBLE INDICATION.

C. RECEPTACLES FOR 20 AMPERE, 120 VOLT APPLICATION SHALL BE SPECIFICATION GRADE THREE-WIRE, TWO POLE, RATED 20 AMPERES AT 125 VOLTS, PASS & SEYMOUR OR APPROVED EQUAL.

D. LIGHT SWITCHES SHALL BE SPECIFICATION GRADE, 120/277 VOLTS, PASS & SEYMOUR OR APPROVED EQUAL.

E. PROVIDE WALL PLATES FOR SINGLE AND COMBINATION DEVICES OF TYPES, SIZES, AND WITH GANGING AND CUTOUTS AS INDICATED. SELECT PLATES WHICH MATE AND MATCH WIRING DEVICES TO WHICH ATTACHED. CONSTRUCT WITH METAL SCREWS FOR SECURING PLATES TO DEVICES; SCREW HEADS COLOR TO MATCH FINISH OF PLATES, WALL PLATES COLOR TO MATCH DEVICES, COLOR BY ARCHITECT.

F. WHERE EXISTING DEVICES ARE SHOWN TO BE REMOVED, CONTRACTOR SHALL MAINTAIN SERVICE TO REMAINING DEVICES.

LIGHTING FIXTURES:

A. THE CONTRACTOR SHALL FURNISH AND INSTALL COMPLETE IN ALL RESPECTS ALL LIGHTING FIXTURES INDICATED ON THE PLANS.

B. FIXTURES SHALL BE SUPPORTED INDEPENDENTLY FROM CEILING AND SHALL BE PROPERLY AND CAREFULLY ALIGNED. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL NECESSARY HARDWARE, ETC, FOR SUPPORT OF FIXTURES AS REQUIRED.

C. RECESSED FIXTURES SHALL BE CONNECTED WITH A MAXIMUM 6 FOOT FLEXIBLE WHIP.

D. BALLASTS – FLUORESCENT:

   1. BALLASTS FOR FLUORESCENT LAMPS SHALL BE HIGH FREQUENCY ELECTRONIC TYPE FOR USE WITH OCTIC TYPE (265 MA) LAMPS. THE TOTAL HARMONIC DISTORTION (%THD) SHALL BE LESS THAN 10%. THE POWER FACTOR SHALL BE .95 OR HIGHER.
   2. BALLASTS SHALL BE INDIVIDUALLY FUSED ON THE LINE SIDE OF THE BALLAST.
   3. BALLASTS SHALL BEAR THE ETL/CBM AND UL LABELS.
   4. NON-DIMMING ELECTRONIC BALLASTS FOR FLUORESCENT LAMPS SHALL BE GENERAL ELECTRIC (MAGNETEK), OSRAM SYLVANIA QUICKTRONIC, OR ADVANCE.
   5. INSTANT START BALLASTS SHALL BE USED WITH NON-OCCUPANCY SENSOR CONTROLLED LUMINARIES.
   6. PROGRAMMED RAPID START BALLASTS SHALL BE USED FOR OCCUPANCY SENSOR CONTROLLED LUMINARIES.

E. LAMPS:

   1. LAMPS APPROVED MANUFACTURERS SHALL BE: SYLVANIA. PHILIPS OR GENERAL ELECTRIC, NO SUBSTITUTIONS PERMITTED.
   2. FLUORESCENT LAMPS SHALL HAVE A MINIMUM 85 CRI AND CCT SHALL MATCH BUILDING STANDARD. OTHERWISE, ALL LAMPS SHALL BE 'TCLP' COMPLIANT.

G. FIXTURES SHALL BE CLEAN AND LENSES SHALL BE CLEAR OF FINGERPRINTS.

H. REPLACE NON-OPERATING LAMPS WITH NEW AND REPLACE MISMATCHED COLOR LAMPS WITH SAME COLOR LAMPS (MATCH BUILDING STANDARD) PRIOR TO FINAL OBSERVATION BY ENGINEER.

FIRE ALARM:

A. SYSTEM:

   1. PROVIDE IN ALL RESPECTS A COMPLETE AND OPERATIONAL SYSTEM AS INDICATED AND REQUIRED BY NFPA AND THE AHJ. UPON PROJECT COMPLETION THE FIRE ALARM SYSTEM SHALL BE TESTED IN THE PRESENCE OF THE OWNER AND THE AHJ.
   2. FIRE ALARM VENDOR SHALL PROVIDE SIGNED AND SEALED SHOP DRAWINGS INCLUDING BATTERY BACKUP CALCULATIONS.
   3. REFER TO VENDOR SHOP DRAWINGS FOR EXACT SYSTEM REQUIREMENTS, DEVICES AND APPLIANCE LOCATIONS.
   4. COORDINATE WITH THE FIRE PROTECTION SYSTEM INSTALLER AND MAKE FINAL CONNECTIONS TO FIRE PROTECTION SYSTEM AS REQUIRED.
   5. VERIFY/ADJUST AUDIBLE APPLIANCES, AUDIBILITY LEVELS IN ACCORDANCE WITH NFPA 72.
   6. VERIFY THAT NEW VISUAL APPLIANCES ARE CAPABLE OF SYNCHRONIZING WITH EXISTING APPLIANCES. CONTRACTOR SHALL PERFORM INVESTIGATION AT TIME OF BID TO OBTAIN INFORMATION FOR ALL REQUIRED MODIFICATIONS.

B. FIRE ALARM BOXES AND CONDUIT SHALL BE SPOT PAINTED RED.

C. CEILING MOUNTED AND WALL MOUNTED NOTIFICATION APPLIANCES SHALL BE WHITE WITH RED LETTERING UNLESS OTHERWISE SPECIFIED BY THE ARCHITECT.

ELECTRICAL LEGEND

SYMBOL	DESCRIPTION	MOUNTING/REMARKS
	1 X 4 ENCLOSED LIGHTING FIXTURE	CEILING SURFACE MOUNTED
	2 X 4 RECESSED LIGHTING FIXTURE	CEILING RECESSED
	STRIP LIGHTING FIXTURE	CEILING SURFACE OR SUSPENDED

FIXTURE STATE:

NORMAL POWER: SWITCHED	EMERGENCY POWER: SWITCHED

SYMBOL	DESCRIPTION	MOUNTING/REMARKS
?	OCCUPANCY SENSOR: DENOTED BY SUBSCRIPT	CEILING FLUSH
?	OCCUPANCY SENSOR: DENOTED BY SUBSCRIPT	TOP 48" AFF
?	LOW VOLTAGE SWITCH: DENOTED BY SUBSCRIPT	TOP 48" AFF

SWITCH/SENSOR SUBSCRIPTS:

a,b	RESPECTIVE FIXTURE/LAMP CONTROL	DM	DIMMER	MR	MOTOR/HP RATED
2	DOUBLE POLE	DT	DUAL TECHNOLOGY	OR	OVERRIDE
3	THREE WAY	IR	PASSIVE INFRARED	PL	PILOT LIGHT
4	FOUR WAY	K	KEY OPERATED	TD	TIME DELAY (10 MIN)
		MC	MOMENTARY CONTACT	UT	ULTRASONIC

SYMBOL	DESCRIPTION	MOUNTING/REMARKS
	DUPLEX RECEPTACLE: 20 A, 125 VAC	TOP 20" AFF
	DUPLEX RECEPTACLE: 20 A, 125 VAC	ABOVE COUNTER
?	FIRE ALARM STROBE: SUBSCRIPT = CANDELA	LENS 80" MIN – 96" MAX AFF, 6" MAX BELOW CEILING
?	FIRE ALARM HORN/STROBE: SUBSCRIPT = CANDELA	LENS 80" MIN – 96" MAX AFF, 6" MAX BELOW CEILING
	BRANCH CIRCUIT PANELBOARD: 240 VAC	TOP 78" AFF
	ELECTRICAL EQUIPMENT: DENOTED BY LABEL	AS NOTED
'EQUIP'	EQUIPMENT LABEL	REFER TO RESPECTIVE SCHEDULE
PNL-CIR	PANELBOARD-CIRCUIT DESIGNATION	REFER TO PANEL SCHEDULE
# #	KEYED NOTES	REFER TO LIKE-NUMBERED NOTES
	CIRCUIT/CONDUIT OR CABLE TURNING UP/RISER	WIRES INDICATED AS FOLLOWS:
	CIRCUIT/CONDUIT OR CABLE TURNING DOWN/DROP	TWO WIRES: *
	CIRCUIT HOME RUN TO PANELBOARD INDICATED	NEUTRAL WIRE (TYP) PHASE WIRE (TYP) THREE WIRES, ETC.
	CIRCUIT/CONDUIT FLEXIBLE CONNECTION	EQUIPMENT GROUND WIRE
	CIRCUIT/CONDUIT OR CABLE CONCEALED IN CEILING OR WALL	
	CIRCUIT/CONDUIT OR CABLE EXPOSED	*MIN 2 #12 + #12 EG – 1/2" C FOR ALL POWER AND LIGHTING RACEWAYS UON OR SPECIFIED
?	LIGHTING FIXTURE TAG	REFER TO SCHEDULE
#	EQUIPMENT TAG: EQUIPMENT BY OTHERS, COORDINATE DESIGNATION WITH RESPECTIVE DISCIPLINE	REFER TO RESPECTIVE DRAWINGS

ABBREVIATIONS:

A	AMPS OR AMPERE	FC	FOOTCANDLE	NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
A/C	AIR CONDITIONING	FLA	FULL LOAD AMPS	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
A/E	ARCHITECT/ENGINEER	FT	FOOT (FEET)	NO	NORMALLY OPEN
AF	AMPERE FRAME	GC	GENERAL CONTRACTOR	NTS	NOT TO SCALE
AFCI	ARC-FAULT CIRCUIT INTERRUPTER	GEN	GENERATOR	OB	OUTLET BOX
AFF	ABOVE FINISHED FLOOR	GFCI	GROUND-FAULT CIRCUIT INTERRUPTER	P	POLE
AFG	ABOVE FINISHED GRADE	GND	GROUND	PA	PUBLIC ADDRESS
AHJ	AUTHORITY HAVING JURISDICTION	HOA	HAND-OFF-AUTO	PB	PULL BOX
AIC	AMPERE INTERRUPTING CAPACITY	HP	HORSEPOWER	PH/ϕ	PHASE
AL	ALUMINUM	HPS	HIGH PRESSURE SODIUM	PNL	PANELBOARD (PANEL)
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	HV	HIGH VOLTAGE	RECPT	RECEPTACLE
ASD	ADJUSTABLE SPEED DRIVE	HZ	HERTZ	SCC	SHORT CIRCUIT CAPACITY
AT	AMPERE TRIP	IG	ISOLATED GROUND	SF	SQUARE FOOT (FEET)
ATS	AUTOMATIC TRANSFER SWITCH	IN	INCH (INCHES)	SPEC	SPECIFICATION
AUTO	AUTOMATIC	JB	JUNCTION BOX	SPD	SURGE PROTECTIVE DEVICE
AWG	AMERICAN WIRE GAUGE	kcmil	THOUSAND CIRCULAR MIL	SS	STAINLESS STEEL
BLDG	BUILDING	kV	KILOVOLT	SWBD	SWITCHBOARD
BFG	BELOW FINISHED GRADE	kVA	KILOVOLT AMPERE	SWGR	SWITCHGEAR
BRKR	BREAKER	kW	KILOWATT	TELECOM	TELECOMMUNICATIONS
C	CONDUIT	kWh	KILOWATT HOUR	TR	TAMPER RESISTANT
CB	CIRCUIT BREAKER	LED	LIGHT EMITTING DIODE	TYP	TYPICAL
CKT	CIRCUIT	LPW	LOW PRESSURE SODIUM	U	UNKNOWN CIRCUIT
CT	CURRENT TRANSFORMER	LTG	LIGHTING	UL	UNDERWRITERS LABORATORY
CU	COPPER	LTNG	LIGHTNING	UON	UNLESS OTHERWISE NOTED
°C	DEGREES CELSIUS	LV	LOW VOLTAGE	UPS	UNINTERRUPTIBLE POWER SUPPLY
°F	DEGREES FAHRENHEIT	MAX	MAXIMUM	UTIL	UTILITY
DISC	DISCONNECT	MCA	MINIMUM CIRCUIT AMPACITY	V	VOLT OR VOLTAGE
DP	DISTRIBUTION PANELBOARD	MCB	MAIN CIRCUIT BREAKER	VA	VOLT AMPERE
DS	DISCONNECT SWITCH	MCC	MOTOR CONTROL CENTER	VD	VOLTAGE DROP
DWG	DRAWING	MDP	MAIN DISTRIBUTION PANELBOARD	VFD	VARIABLE FREQUENCY DRIVE
EC	ELECTRICAL CONTRACTOR	MH	METAL HALIDE	W	WATT OR WIRE
EG	EQUIPMENT GROUND	MHz	MEGAHERTZ	WP	WEATHERPROOF
ELEC	ELECTRIC OR ELECTRICAL	MIN	MINIMUM	WR	WEATHER RESISTANT
ELEV	ELEVATOR	MLO	MAIN LUGS ONLY	WT	WATERTIGHT
EMER	EMERGENCY	MOCP	MAXIMUM OVERCURRENT PROTECTION	XFER	TRANSFER
EPO	EMERGENCY POWER OFF	MTS	MANUAL TRANSFER SWITCH	XFMR	TRANSFORMER
EPS	EMERGENCY POWER SUPPLY	N	NEUTRAL	XP	EXPLOSION RATED
EXIST	EXISTING	NA	NOT APPLICABLE		
		NC	NORMALLY CLOSED		
		NEC	NATIONAL ELECTRICAL CODE		

NOTES:

A. MOUNTING HEIGHTS INDICATE NOMINAL MOUNTING HEIGHTS UON.

B. COUNTER HEIGHT MOUNTING SHALL BE TOP 10" ABOVE FINISHED COUNTER, MAX 48" AFF UON.

C. NUMBER PRECEDED BY PLUS (+) SIGN DENOTES VARIANT MOUNTING HEIGHT (i.e. +96).

OBJECT STATE LINETYPES:

EXISTING OBJECT OR CONSTRUCTION:

EXISTING OBJECT OR CONSTRUCTION TO BE DEMOLISHED:

NEW OBJECT OR CONSTRUCTION TO BE PROVIDED:

OBJECT STATE SUBSCRIPTS:

D	EXISTING OBJECT TO BE DEMOLISHED	M	EXISTING OBJECT TO BE REMOVED & RELOCATED
E	EXISTING OBJECT TO REMAIN	R	RELOCATED EXISTING OBJECT

100% DOCUMENTS

NOVEMBER 25, 2015

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION

306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 – f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER
ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
NB/JD

REVISIONS

PROFESSIONAL SEAL

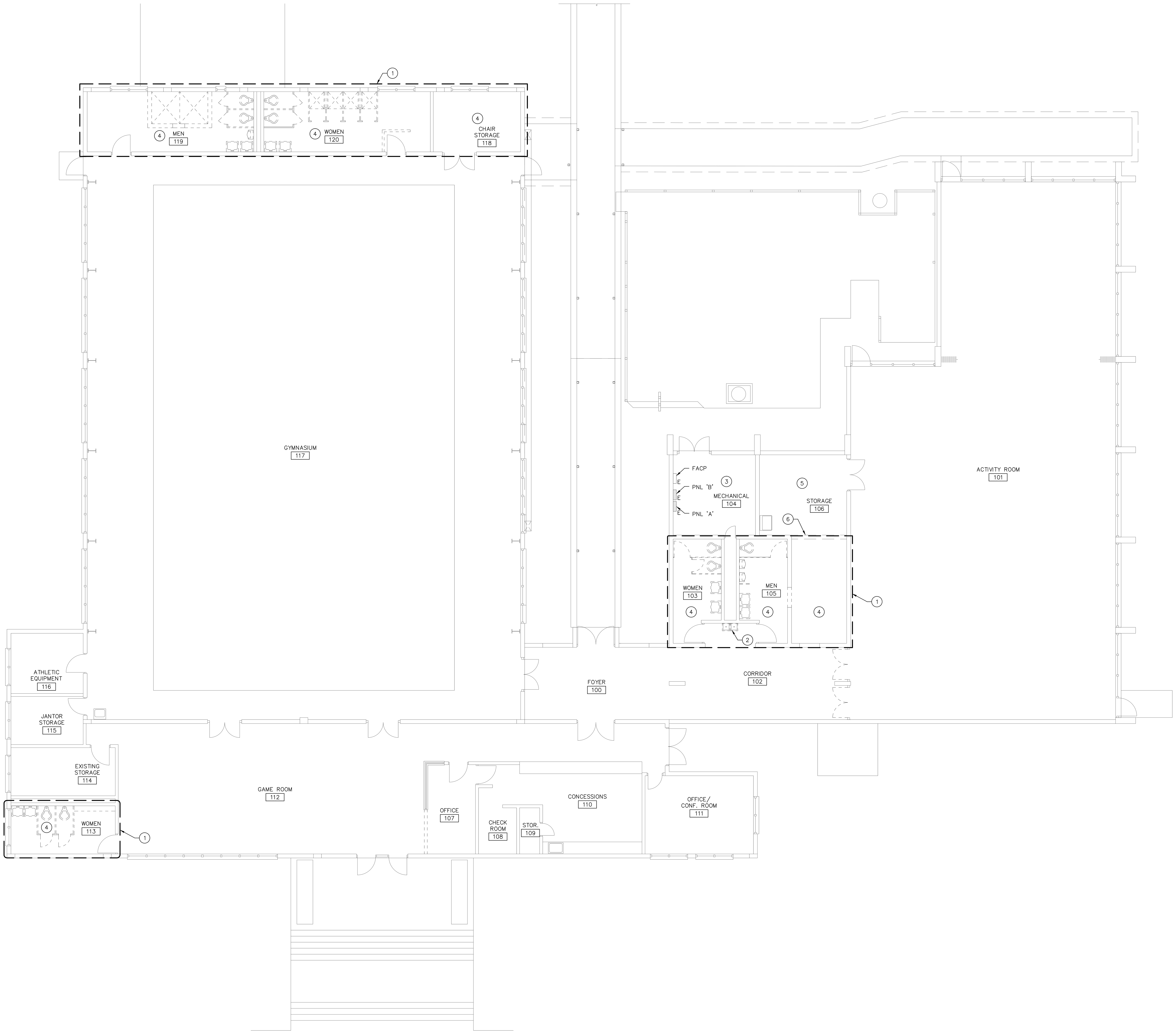
KEITH W. HALL, P.E.; FL. REG. #: 55024

SCALE: AS NOTED

ELECTRICAL LEGEND AND SPECIFICATIONS

SHEET NUMBER
E1.0

Z:\2014 Projects\0414B Wayne C Papy Athletic Center-Lobby Exp\Drawings\MEP\Sheet Set\0414B_E1.0 Electrical Legend and Specifications.dwg Nov.24.2015 8:31 pm



01 DEMOLITION PLAN

SCALE:1/8" = 1'-0"

0 4' 8' 16'

DRAWING GENERAL NOTES

A. FULLY FIELD INVESTIGATE PRIOR TO DEMOLITION OF CONDUIT AND WIRE. CONDUIT AND WIRE SHALL REMAIN IN PLACE AS REQUIRED FOR SERVING DOWN STREAM LIGHTS AND DEVICES.

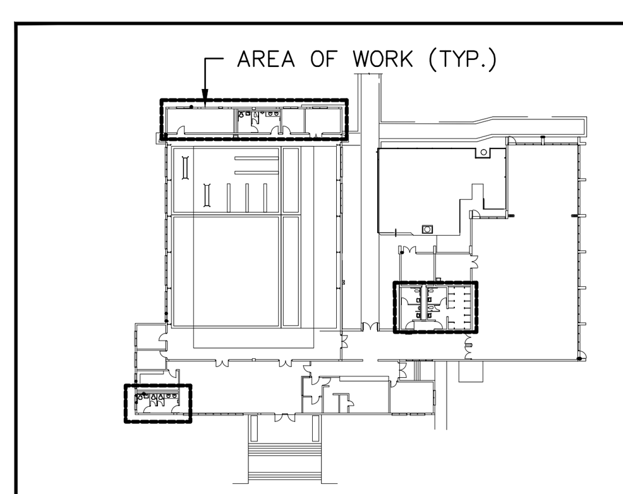
B. DEVICES ON EXISTING WALL TO REMAIN SHALL BE REPLACED WITH NEW DEVICES AND COVER PLATES IN KIND AND TYPE WITH SPECIFIED NEW.

DRAWING NOTES

1. PROJECT AREA OF WORK; UNLESS OTHERWISE NOTED, NO WORK SHALL BE PERFORMED OUTSIDE THIS AREA.
2. REMOVE RECEPTACLE AND COVER. PREPARE EXISTING BOX AND WIRE FOR RE-USE.
3. THIS SPACE IS EXISTING TO REMAIN.
4. REMOVE LIGHTING, LIGHTING CONTROLS, DEVICES, EQUIPMENT POWER AND ASSOCIATED CONDUIT AND WIRE BACK TO NEAREST JUNCTION BOX ABOVE THE CEILING SERVING THIS SPACE. PREPARE CIRCUITS FOR RE-USE DURING NEW CONSTRUCTION.
5. LIGHTING AND POWER FOR THIS AREA OF ROOM 106 SHALL BE EXISTING TO REMAIN. EXTEND CIRCUITS AS REQUIRED TO MAINTAIN CONTINUOUS OPERATION OF LIGHTING AND DEVICES.
6. NEW WALL TO BE INSTALLED DURING NEW CONSTRUCTION. SHOWN FOR REFERENCE TO IDENTIFY DELINEATION OF DEMOLITION SCOPE.

100% DOCUMENTS

NOVEMBER 25, 2015



00 KEY PLAN

SCALE:N.T.S

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION

306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 – f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER
ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
NB/JD

REVISIONS

PROFESSIONAL SEAL

KEITH W. HALL, P.E.; FL. REG. #: 55024

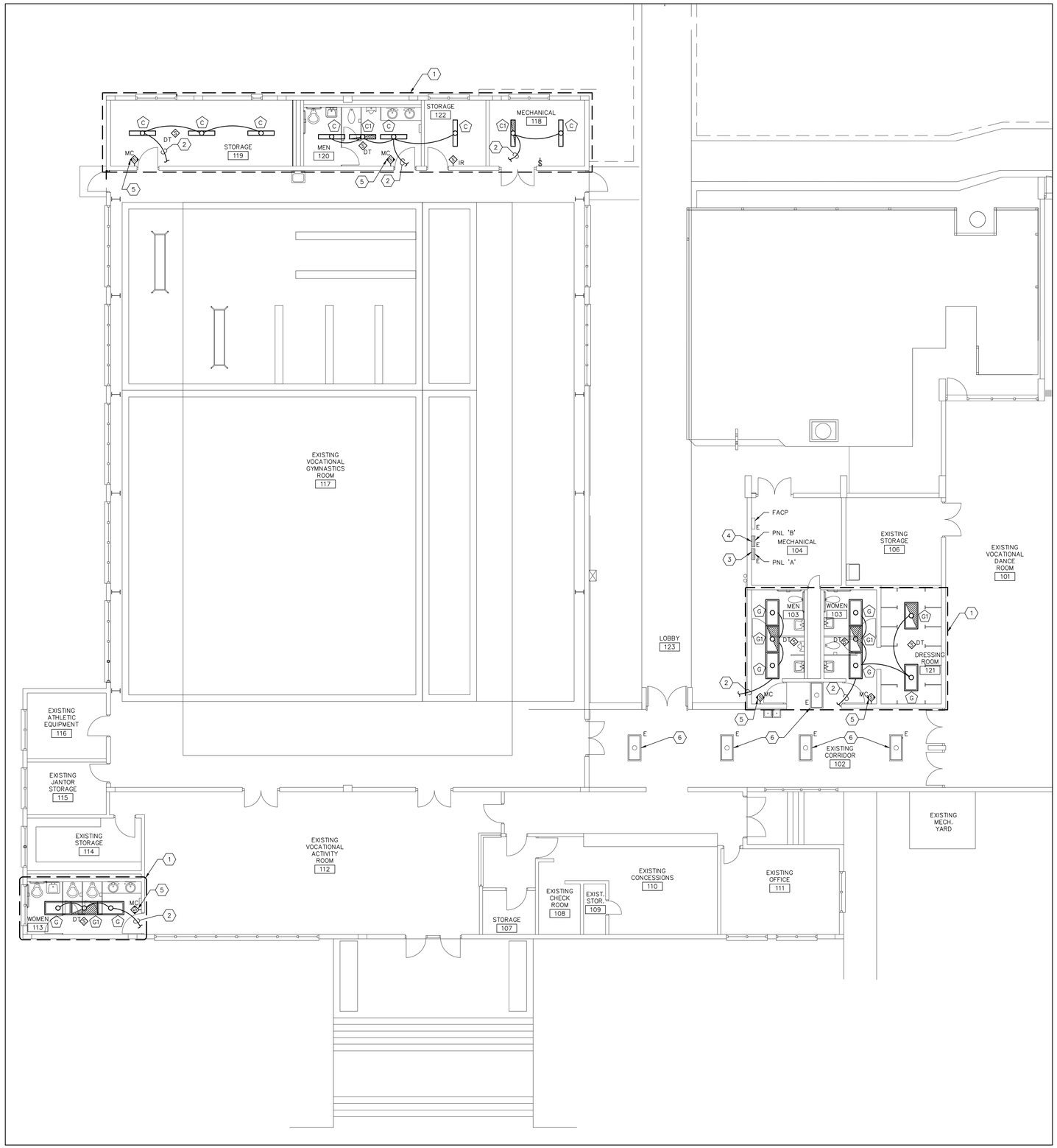
SCALE: AS NOTED

DEMOLITION PLAN

SHEET NUMBER
E2.1

X OF X

Z:\2014 Projects\0414B Wayne C Papy Athletic Center-Lobby Exp\Drawings\MEP\Sheet Set\0414B_E2.1 Demolition Plan.dwg Nov.24.2015 8:03 pm



01 LIGHTING PLAN
SCALE:1/8" = 1'-0"

DRAWING GENERAL NOTES

A. CIRCUIT ALL EXIT SIGNS AND EMERGENCY BALLASTS WITH AN UNSWITCHED "HOT" CONDUCTOR.
B. EXTEND CONDUITS AND CONDUCTORS AS REQUIRED.
C. REFER ALSO TO ARCHITECTURAL DRAWINGS.

(#) DRAWING NOTES

1. PROJECT AREA OF WORK.
2. CONNECT TO EXISTING LIGHTING CIRCUIT SERVING THIS SPACE.
3. EXISTING PANEL "A", GOULD, I-T-E PANELBOARD; 150 A MCB, 42 POLE, 240/120 V, 3ϕ, 4W, NEMA 1.
4. EXISTING PANEL "B", GOULD, I-T-E PANELBOARD; 150 A MCB, 18 POLE, 240/120 V, 3ϕ, 4W, NEMA 1.
5. LOW-VOLTAGE MOMENTARY SWITCH FOR MANUAL "ON" CONTROL OF OCCUPANCY SENSOR CONTROLLED LIGHTING; HUBBELL BUILDING AUTOMATION, MODEL # LVS-M-1-NP-XX OR ENGINEER APPROVED EQUAL. CONNECT TO OCCUPANCY SENSOR POWER PACK WITH MANUFACTURER RECOMMENDED CONDUCTORS; PROVIDE 1/2" C IN WALL, STUBBED OUT 2" ABOVE ACCESSIBLE CEILING, WITH PLASTIC INSULATING BUSHINGS.
6. EXISTING LIGHT FIXTURE TO REMAIN.

LIGHTING FIXTURE SCHEDULE

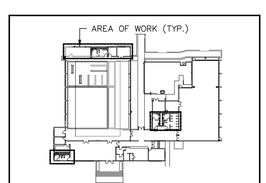
TAG	MANUFACTURER/ CATALOG NUMBER	LAMP DATA		VOLTAGE	MOUNTING	DESCRIPTION
		TYPE	WATTS			
C	DAY-O-LITE : GENERATION GB-D-2-T8-S-4-W-UNV-PRGS	(2) T8	32	120	SURFACE	4' WRAP AROUND FIXTURE WITH BLADE LOUVERS
C1	DAY-O-LITE : GENERATION GB-D-2-T8-S-4-W-UNV-EPC-PGRS	(2) T8	32	120	SURFACE	4' WRAP AROUND FIXTURE WITH BLADE LOUVERS WITH EMERGENCY BALLAST.
G	COLUMBIA : SERRANO SER-24-2-32-G-C-F-EP104-U-GLR	(2) T8	32	120	RECESSED	2' X 4' ARCHITECTURAL HIGH EFFICIENCY
G1	COLUMBIA : SERRANO SER-24-2-32-G-C-F-EP104-U-EL-GLR	(2) T8	32	120	RECESSED	2' X 4' ARCHITECTURAL HIGH EFFICIENCY WITH EMERGENCY BALLAST

NOTES:
1. REFER TO SPECIFICATIONS FOR LAMP CORRELATED COLOR TEMPERATURE (CCT) .
2. FINAL MATERIAL COLORS/FINISHES TO BE DETERMINED BY ARCHITECT.
3. FIXTURES OTHER THAN THOSE LISTED ON THE LIGHTING FIXTURE SCHEDULE BY MANUFACTURER AND CATALOG NUMBER SUBMITTED FOR SUBSTITUTION WILL REQUIRE THE SUBMITTAL TO INCLUDE THE FOLLOWING IN ORDER TO BE CONSIDERED. SUBMIT AFTER CONTRACT AWARD, NO PRE-CONTRACT SUBMITTAL WILL BE ACCEPTED.
   A. FIVE (5) SETS OF ORIGINAL COLOR FACTORY CATALOG SUBMITTALS.
   B. FIVE (5) SETS OF COMPLETE POINT TO POINT PHOTOMETRIC CALCULATIONS FOR NORMAL AND EMERGENCY POWER AS REQUIRED.
   C. A DISC CONTAINING THE IES PHOTOMETRY FILE FOR EACH FIXTURE TYPE.
   D. IF FIXTURES ARE SUBMITTED FOR REVIEW FOR "VALUE ENGINEERING", THE SUBMITTING ELECTRICAL CONTRACTOR SHALL PAY (IN ADVANCE) THE ENGINEER'S HOURLY FEES FOR SUBMITTAL REVIEW.
4. SUBJECT TO COMPLIANCE WITH THE ABOVE REQUIREMENTS, THE FOLLOWING MANUFACTURERS, IN ADDITION TO THOSE LISTED IN THE LIGHTING FIXTURE SCHEDULE, MAY BE INCORPORATED INTO THE PROJECT.
   A. LITHONIA LIGHTING
   B. COOPER

OCCUPANCY SENSOR SCHEDULE

TAG	MANUFACTURER/ MODEL NUMBER	SENSING TECHNOLOGY	COVERAGE ANGLE (DEG)	COVERAGE AREA (SF)	DESCRIPTION
DT	HUBBELL: OMNI-DT-2000 POWER PACK: UVPPM	DUAL TECHNOLOGY	360	2000	CEILING MOUNT SENSOR; POWER PACK WITH MANUAL ON/OFF CONTROL.
IR	HUBBELL: LHIRS-1-G-xx	PASSIVE INFRARED	180	1000	WALL SWITCH SENSOR. SET TO VACANCY MODE (MANUAL-ON)

NOTES:
1. OCCUPANCY SENSORS SHALL BE INSTALLED AND AIMED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
2. PROVIDE 120V AC RATED CONTACTS FOR CONTROL OF LIGHTING CIRCUITS INDICATED ON PLANS.
3. PROVIDE A SEPARATE POWER PACK FOR EACH LIGHTING CIRCUIT CONTROLLED FOR LOW VOLTAGE CEILING AND WALL MOUNTED SENSORS AS REQUIRED BY MANUFACTURER (LINE VOLTAGE SENSORS DO NOT REQUIRE POWER PACKS). POWER PACKS SHALL CONTAIN POWER SUPPLY FOR SENSOR AND RELAY FOR LINE VOLTAGE LIGHTING CIRCUIT. POWER PACKS SHALL BE INSTALLED IN A JUNCTION BOX LOCATED NEAR ASSOCIATED SENSOR. POWER PACKS SHALL BE CAPABLE OF MANUAL ON/OFF CONTROL.
4. SET OCCUPANCY SENSOR ADJUSTABLE SETTINGS TO THE SATISFACTION OF ARCHITECT/OWNER.
5. SHOP DRAWINGS SHALL BE SUBMITTED FOR EACH OCCUPANCY SENSOR TYPE TO BE INSTALLED, IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS. PROVIDE DESCRIPTIVE LITERATURE FOR ALL SENSORS AND COMPONENTS (SUCH AS POWER PACKS) REQUIRED FOR A COMPLETE INSTALLATION. LITERATURE SHALL BE MARKED TO SPECIFICALLY IDENTIFY THE MODEL NUMBERS, OPTIONS, SELECTIONS, COLORS, ETC.



00 KEY PLAN
SCALE:N.T.S

100% DOCUMENTS
NOVEMBER 25, 2015

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 - f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
NB/JD

REVISIONS

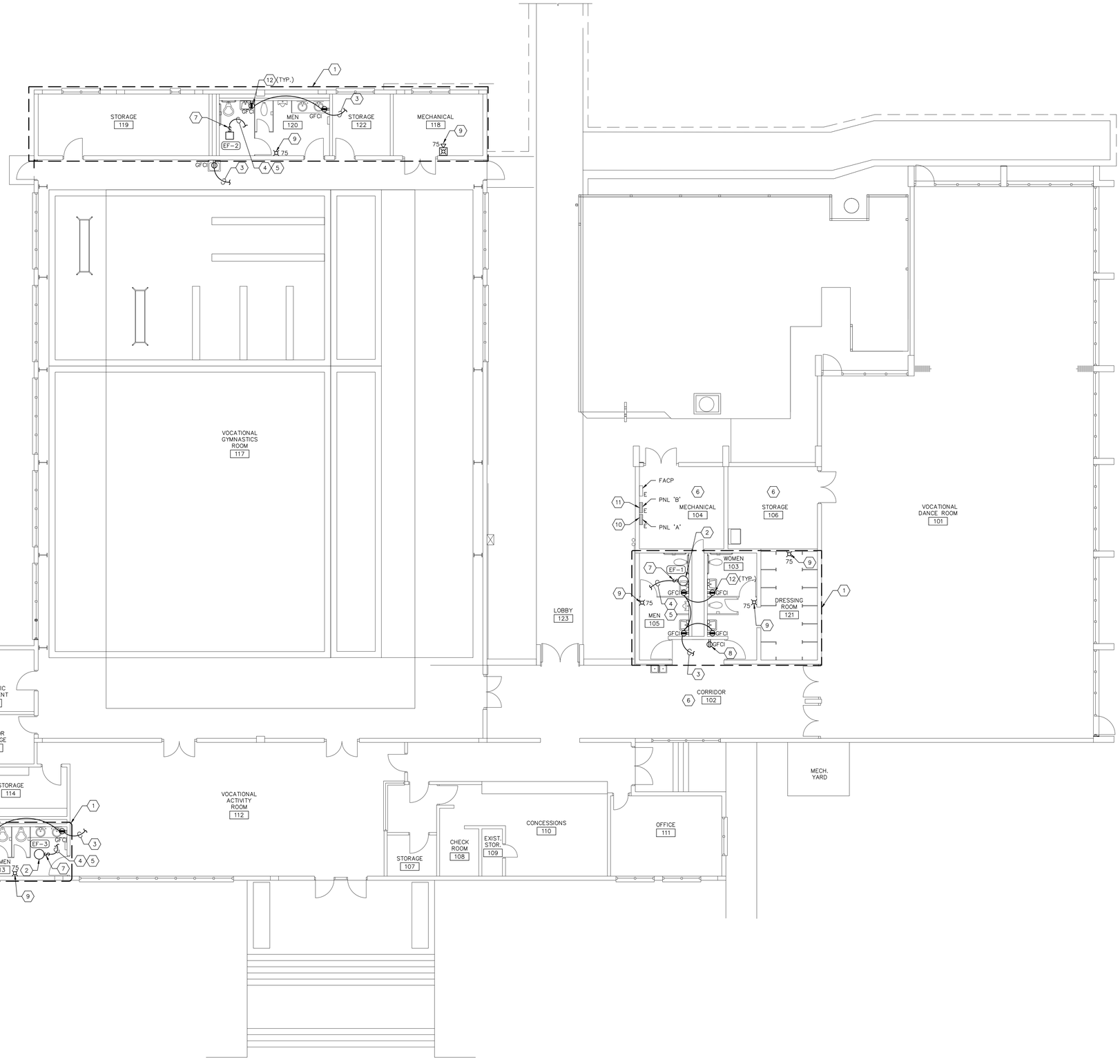
PROFESSIONAL SEAL

KEITH W. HALL, P.E.; FL. REG. #: 55024

SCALE: AS NOTED

LIGHTING PLAN

SHEET NUMBER
E3.1
X OF X



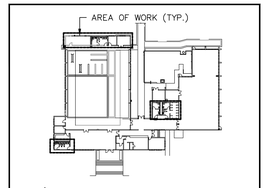
01 POWER AND SYSTEMS PLAN
SCALE: 1/8" = 1'-0"

DRAWING GENERAL NOTES

A. ALL NEW FIRE ALARM DEVICES SHOWN SHALL BE CONNECTED TO EXISTING FIRE ALARM SYSTEM. MATCH EXISTING MFG AND DEVICES.
B. EXTEND CONDUITS AND CONDUCTORS AS REQUIRED.
C. REFER ALSO TO ARCHITECTURAL DRAWINGS.

(#) DRAWING NOTES

1. PROJECT AREA OF WORK.
2. EXHAUST FAN LOCATED ON ROOF. COORDINATE EXACT LOCATION WITH DIV 15.
3. CONNECT TO EXISTING RECEPTACLE CIRCUIT SERVING THIS SPACE. VERIFY LOAD DOES NOT EXCEED 1500 VA.
4. RE-USE EXISTING WIRING TO CONNECT TO EXISTING CIRCUIT.
5. REFER TO MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION ON EXHAUST FAN SEQUENCE OF OPERATIONS.
6. NO ADDITIONAL ELECTRICAL DEVICES ADDED IN THIS SPACE. EXISTING DEVICES SHALL REMAIN FOR RE-USE FROM PREVIOUS SPACE.
7. INTEGRAL DISCONNECT PROVIDED WITH UNIT BY DIV 15.
8. PROVIDE NEW RECEPTACLE DEVICE AND COVER PLATE AT EXISTING OUTLET BOX. RE-USE EXISTING WIRING TO CONNECT TO EXISTING CIRCUIT.
9. PROVIDE AND INSTALL A NEW FIRE ALARM NOTIFICATION DEVICE. CONNECT TO EXISTING FACP WITH 3/4" C. (CONDUCTORS BY FIRE ALARM VENDOR).
10. EXISTING PANEL "A", GOULD, I-T-E PANELBOARD; 150 A MCB, 42 POLE, 240/120 V, 3ϕ, 4W, NEMA 1.
11. EXISTING PANEL "B", GOULD, I-T-E PANELBOARD; 150 A MCB, 18 POLE, 240/120 V, 3ϕ, 4W, NEMA 1.
12. COORDINATE EXACT RECEPTACLE LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.



00 KEY PLAN
SCALE: N.T.S

100% DOCUMENTS
NOVEMBER 25, 2015

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 - f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
NB/JD

REVISIONS

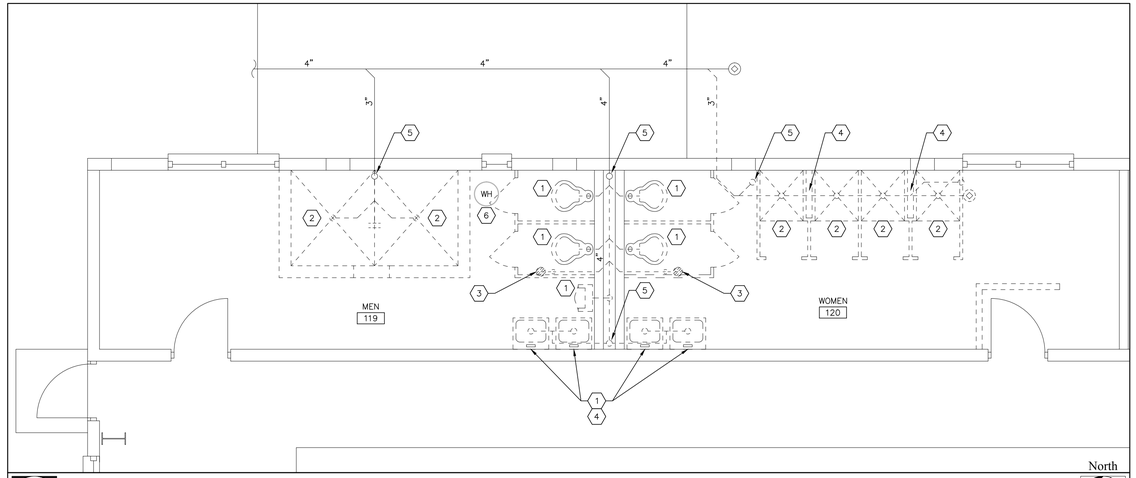
PROFESSIONAL SEAL

KEITH W. HALL, P.E., FL. REG. # 55024

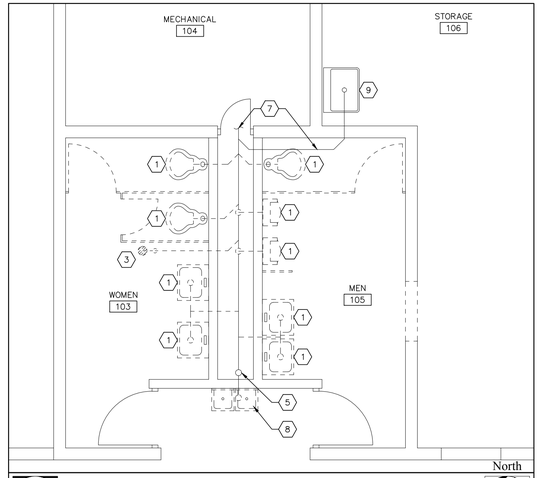
SCALE: AS NOTED

POWER PLAN

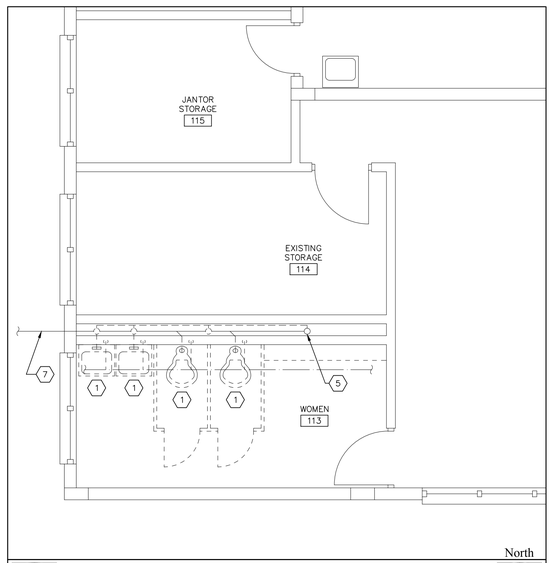
SHEET NUMBER
E3.2
X OF X



01 P1.0 MEN 119 & WOMEN 120 RESTROOM - PLUMBING DEMOLITION PLAN 1/4" = 1'-0"



02 P1.0 WOMEN 103 & MEN 105 - PLUMBING DEMOLITION PLAN 1/4" = 1'-0"



03 P1.0 WOMEN 113 RESTROOM - PLUMBING DEMOLITION PLAN 1/4" = 1'-0"

PLUMBING FIXTURE SCHEDULE

FIXTURE MARK	FIXTURE DESCRIPTION	ROUGH-IN PIPE SIZES: COLD WATER SUPPLY	HOT WATER SUPPLY	FIXTURE TRAP	FIXTURE DRAIN	MANUFACTURER AND MODEL NUMBER	ACCESSORIES	HEIGHT (A.F.F.)
WC-1	A.D.A. HEIGHT, FLOOR MOUNT, 1.28 GPF MANUAL FLUSH VALVE WATER CLOSET, VITREOUS CHINA, SIPHON JET FLUSHING ACTION, ELONGATED RIM, 1½" TOP SPUD, 2⅜" TRAPWAY.	1"	N/A	4"	4"	AMERICAN STANDARD 2854.128 KOHLER K-4406	• MANUAL 1.28 GPM FLUSHOMETER • HEAVY DUTY, OPEN FRONT, SOLID PLASTIC, ELONGATED SEAT WITH SELF-SUSTAINING CHECK HINGE	RIM: 16½"
WC-2	FLOOR MOUNT, 1.28 GPF MANUAL FLUSH VALVE WATER CLOSET, VITREOUS CHINA, SIPHON JET FLUSHING ACTION, ELONGATED RIM, 1½" TOP SPUD, 2⅜" TRAPWAY.	1"	N/A	4"	4"	AMERICAN STANDARD 2855.128 KOHLER K-4405	• MANUAL 1.28 GPM FLUSHOMETER • HEAVY DUTY, OPEN FRONT, SOLID PLASTIC, ELONGATED SEAT WITH SELF-SUSTAINING CHECK HINGE	RIM: 15"
WC-3	A.D.A. HEIGHT, WALL MOUNT, 1.1-1.6 GPF MANUAL FLUSH VALVE WATER CLOSET, VITREOUS CHINA, SIPHON JET FLUSHING ACTION, ELONGATED RIM, 1½" TOP SPUD, MIN. 2" TRAPWAY.	1"	N/A	4"	4"	AMERICAN STANDARD 2856.111 KOHLER K-4325 (OR EQUAL)	• MANUAL 1.28 GPF FLUSHOMETER VALVE • HEAVY DUTY, OPEN FRONT, SOLID PLASTIC, ELONGATED SEAT WITH SELF-SUSTAINING CHECK HINGE	RIM: 17"
WC-4	WALL MOUNT, 1.1-1.6 GPF MANUAL FLUSH VALVE WATER CLOSET, VITREOUS CHINA, SIPHON JET FLUSHING ACTION, ELONGATED RIM, 1½" TOP SPUD, MIN. 2" TRAPWAY.	1"	N/A	4"	4"	AMERICAN STANDARD 2856.111 KOHLER K-4325 (OR EQUAL)	• MANUAL 1.28 GPF FLUSHOMETER VALVE • HEAVY DUTY, OPEN FRONT, SOLID PLASTIC, ELONGATED SEAT WITH SELF-SUSTAINING CHECK HINGE	RIM: 15"
UR-1	WALL MOUNT, 0.125-1.0 GPF MANUAL FLUSH VALVE TOP SPUD URINAL, WHITE, WASHOUT FLUSH ACTION, 14" RIM, 3/4" TOP SPUD, MIN. 2" TRAPWAY.	3/4"	N/A	2"	2"	AMERICAN STANDARD 6501.511 KOHLER 33056837924 (OR EQUAL)	• COMMERCIAL URINAL AND FLUSH VALVE COMBINATION • MANUAL 1.0 GPF EXPOSED MANUAL FLUSHOMETER	RIM: 14"
LAV-1	A.D.A. HEIGHT, WALL MOUNT LAVATORY, 20¾"x18¾", VITREOUS CHINA, FAUCET HOLES ON 4" CENTERS, FRONT OVERFLOW DECK. COLOR: WHITE. INCLUDE WALL HANGER, CONCEALED ARM CARRIER.	½"	---	1¼"	2"	KOHLER K-2032 OR EQUAL, WITH SLOAN ETF-600 AMERICAN STANDARD 0356.028	• POLISHED CHROME PLATED BRASS, SINGLE INLET PEDESTAL FAUCET; SENSOR ACTIVATED, 0.5 GPM VANDAL RESISTANT SPRAY HEAD, WITH 4" CENTER-SET COVER PLATE. • 1¾" CHROME PLATED BRASS OFFSET DRAIN WITH TAIL PIECE AND PERFORATED STRAINER. • CHROME PLATED BRASS P-TRAP; 1¾" SLIP-JOINT INLET x 1½" ADJUSTABLE OUTLET, WITH CLEANOUT PLUG.	RIM: 34"
LAV-2	WALL MOUNT LAVATORY, 20¾"x18¾", VITREOUS CHINA, FAUCET HOLES ON 4" CENTERS, FRONT OVERFLOW DECK. COLOR: WHITE. INCLUDE WALL HANGER, CONCEALED ARM CARRIER.	½"	---	1¼"	2"	KOHLER K-2032 OR EQUAL, WITH SLOAN ETF-600	• POLISHED CHROME PLATED BRASS, SINGLE INLET PEDESTAL FAUCET; SENSOR ACTIVATED, 0.5 GPM VANDAL RESISTANT SPRAY HEAD, WITH 4" CENTER-SET COVER PLATE. • 1¾" CHROME PLATED BRASS DRAIN WITH TAIL PIECE AND PERFORATED STRAINER. • CHROME PLATED BRASS P-TRAP; 1¾" SLIP-JOINT INLET x 1½" ADJUSTABLE OUTLET, WITH CLEANOUT PLUG.	RIM: 31"
LAV-3	A.D.A. COMPLIANT, COUNTERTOP LAVATORY, SELF-RIMMING, 20"x17" OVAL BASIN, VITREOUS CHINA, WITH OVERFLOW DRAIN, 4" CENTER FAUCET HOLES. COLOR: WHITE.	½"	---	1¼"	2"	KOHLER K-2196-4 OR EQUAL, WITH SLOAN ETF-600	• POLISHED CHROME PLATED BRASS, SINGLE INLET PEDESTAL FAUCET; SENSOR ACTIVATED, 0.5 GPM VANDAL RESISTANT SPRAY HEAD, WITH 4" CENTER-SET COVER PLATE. • 1¾" CHROME PLATED BRASS DRAIN WITH TAIL PIECE AND PERFORATED STRAINER. • CHROME PLATED BRASS P-TRAP; 1¾" SLIP-JOINT INLET x 1½" ADJUSTABLE OUTLET, WITH CLEANOUT PLUG.	PER ARCH.
EWC-1	BI-LEVEL, GREENSPEC LISTED, HIGH-EFFICIENCY ELECTRIC, REFRIGERATED WATER COOLER; WALL-MOUNTED, BARRIER-FREE ACCESS, STAINLESS STEEL BASIN, LEAD-FREE DESIGN, DELIVERING 8 GPH OF 50°F WATER @ 80°F INLET WATER & 90°F AMBIENT AIR TEMPERATURES.	½"	N/A	1¼"	2"	ELKAY EZSTLG8	N/A	MINIMUM SPOUT HEIGHT: 36"/30"

PROJECT NOTES

GENERAL:

A. EXISTING PIPING AND EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE AND ARE PROVIDED FOR REFERENCE USE ONLY. FIELD VERIFY AND COORDINATE WITH EXACT LOCATIONS OF EXISTING PIPING, EQUIPMENT, ETC.

B. COORDINATE WITH OWNER FOR BUILDING WATER SHUT OFF. AFTER RESTORING WATER TO BUILDING, ASSURE NO LEAKS ARE EVIDENT.

DEMOLITION KEY NOTES

1. REMOVE EXISTING PLUMBING FIXTURE AND ALL ASSOCIATED SANITARY, VENT, AND SUPPLY PIPING BACK TO MAIN PIPING IN CHASE, BEHIND WALL, ABOVE CEILING, OR BELOW FLOOR, AND CAP. COORDINATE WITH NEW FIXTURE LAYOUT FOR EXTENT OF REMOVAL.
2. REMOVE EXISTING SHOWER DRAIN, SHOWER VALVE, SHOWER HEAD, AND ALL ASSOCIATED SANITARY AND SUPPLY PIPING BELOW FLOOR OR BEHIND EXISTING WALL SURFACE.
3. REMOVE EXISTING FLOOR DRAIN AND ASSOCIATED PIPING BACK TO MAIN PIPE RUN AND CAP. TRENCH CONCRETE FLOOR AROUND SANITARY DRAINS AS NECESSARY FOR REMOVAL; PATCH TO MATCH ADJACENT SURFACES. COORDINATE WITH NEW LAYOUT TO DETERMINE EXTENT OF REMOVAL.
4. REMOVE FIXTURE VENT PIPING BACK TO VENT STACK/VENT THRU ROOF. PROVIDE SUPPORTS AS NECESSARY FOR PIPING TO REMAIN.
5. EXISTING VENT STACK TO REMAIN.
6. EXISTING WATER HEATER IN MEZZANINE TO REMAIN.
7. EXISTING SANITARY MAIN PIPE TO REMAIN.
8. REMOVE EWC AND RETURN TO OWNER.
9. EXISTING SERVICE SINK TO REMAIN. KEEP IN SERVICE DURING CONSTRUCTION.

DRAIN & CLEANOUT FIXTURE SCHEDULE

FIXTURE	DESCRIPTION	MANUFACTURER AND MODEL NUMBER
FLOOR DRAIN (FD)	6" ROUND NICKEL BRONZE ADJUSTABLE STRAINER HEAD, CAST-IRON FLOOR DRAIN BODY AND COLLAR, 3" DRAIN OUTLET WITH 3" DEEP SEAL P-TRAP, 1/2" TRAP-SEAL PRIMER CONNECTION WITH PRESSURE ACTIVATED TRAP PRIMER VALVE.	ZURN Z415B WATTS FD-100-A
WALL CLEAN OUT (WCO)	CAST-IRON CLEANOUT TEE; RECESSED, TAPERED THREAD BRONZE PLUG; STAINLESS STEEL OR CHROME-PLATED BRASS WALL ACCESS COVER PLATE; SAME SIZE AS CONNECTED DRAINAGE PIPING; ASME A112.36.2M.	ZURN Z1446 WATTS CO-460-RD J.R. SMITH 4532S
FLOOR CLEAN OUT (FCO)	CAST-IRON ADJUSTABLE HOUSING FLOOR CLEANOUT; RAISED, TAPERED THREAD BRONZE CLOSURE PLUG; NEOPRENE RUBBER GASKET; NICKEL-BRONZE ROUND SCORIATED TOP COVER; SAME SIZE AS CONNECTED DRAINAGE PIPING; ASME A112.36.2M.	ZURN Z1400-K WATTS CO-200-RX (OR EQUAL)
EXTERIOR CLEAN OUT (ECO)	CAST-IRON ADJUSTABLE HOUSING CLEANOUT FERRULE; RECESSED, TAPERED THREAD, BRONZE CLOSURE PLUG; NEOPRENE RUBBER GASKET; SAME SIZE AS CONNECTED DRAINAGE PIPING; INSTALL IN 24" X 24" X 12" DEEP CONCRETE PAD FLUSH WITH GRADE; ASME A112.36.2M. INSTALL END-OF-LINE CLEANOUT WITH LONG SWEEP ELBOW; INSTALL 2-WAY CLEANOUT WITH 2-WAY CLEANOUT FITTING.	ZURN ZN1400-HD (OR EQUAL)

DRAINAGE PIPE SLOPE REQUIRED

PIPE SIZE (IN.)	MINIMUM SLOPE PER FOOT (IN.)
2"	1/4"
3"	1/8"
4"	1/8"
6"	1/8"
8"	1/16"
10"	1/16"

GENERAL PLUMBING NOTES

GENERAL:

A. INSTALL ALL EQUIPMENT AND PIPING WITH SUFFICIENT ACCESS FOR MAINTENANCE.

B. PROVIDE AN ACCESS PANEL AT ALL LOCATIONS WHERE A VALVE OR OTHER DEVICE REQUIRING SERVICE IS INSTALLED BEHIND INACCESSIBLE CEILING OR WALL.

C. ALL FLOOR DRAINS ARE TO BE INSTALLED WITH AUTOMATIC TRAP PRIMERS AND DEEP SEAL P-TRAPS.

D. PROVIDE AND INSTALL A CLEANOUT AT THE BASE OF EACH WASTE SOIL STACK.

E. INSTALL ALL PLUMBING VENTS WITH MINIMUM 2" PIPE, UNLESS OTHERWISE NOTED, AND A MINIMUM OF 10'-0" AWAY FROM HVAC/BUILDING OUTSIDE AIR INTAKES. COORDINATE WITH MECHANICAL CONTRACTOR AND OFFSET VENT PIPING AS REQUIRED.

F. PROVIDE WATER HAMMER ARRESTORS IN ACCORDANCE WITH PDI-WH201 STANDARD GUIDELINES.

G. ALL COPPER PIPE IS TO BE SOLDERED WITH LEAD-FREE SOLDER.

H. PROVIDE A PIPE SLEEVE AT ALL PIPE PENETRATIONS THROUGH FOUNDATION WALLS AND FLOORS.

PLUMBING LEGEND

SYMBOL	DESCRIPTION
'EQUIP'	EQUIPMENT MARK
(#)	KEYED NOTES
	CONNECTION DATUM: NEW TO EXISTING

ABBREVIATIONS:

A/E	ARCHITECT/ENGINEER	LAV	LAVATORY
AAV	AUTOMATIC AIR VENT	MAX	MAXIMUM
ADA	AMERICANS WITH DISABILITIES ACT	MCA	MINIMUM CIRCUIT AMPACITY
AFF	ABOVE FINISHED FLOOR	MIN	MINIMUM
AHJ	AUTHORITY HAVING JURISDICTION	MOCP	MAXIMUM OVERCURRENT PROTECTION
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	MSB	MOP SERVICE BASIN
		NA	NOT APPLICABLE
AP	ACCESS PANEL	NIC	NOT IN CONTRACT
BFG	BELOW FINISHED GRADE	NTS	NOT TO SCALE
BFP	BACKFLOW PREVENTER	P	PUMP
BHP	BRAKE HORSEPOWER	PDI	PLUMBING DRAINAGE INSTITUTE
CO	CLEANOUT	RD	ROOF DRAIN
DS	DOWNSPOUT	RPM	REVOLUTIONS PER MINUTE
DCW	DOMESTIC COLD WATER	SAN	SANITARY
DHW	DOMESTIC HOT WATER	SHR	SHOWER
ECO	EXTERIOR CLEANOUT	SS	SANITARY SEWER
EL	ELEVATION	TEMP	TEMPERATURE / TEMPORARY
EXIST	EXISTING	TYP	TYPICAL
EWC	ELECTRIC WATER COOLER	TMV	THERMOSTATIC MIXING VALVE
FD	FLOOR DRAIN	UL	UNDERWRITERS LABORATORY
FT	FOOT (FEET)	UON	UNLESS OTHERWISE NOTED
GPM	GALLONS PER MINUTE	VTR	VENT THROUGH ROOF
HB	HOSE BIB	WC	WATER CLOSET
HP	HORSEPOWER	WCO	WALL CLEANOUT
IN	INCHES	WH	WATER HEATER / WALL HYDRANT
INV	INVERT	WHA	WATER HAMMER ARRESTER

———	SANITARY SOIL WASTE PIPING
- - - - - - -	SANITARY VENT PIPING
—— - ——	DOMESTIC COLD WATER SUPPLY PIPING
—— - - ——	DOMESTIC HOT WATER SUPPLY PIPING
——→	DIRECTION OF FLOW
———⫤	CAPPED PIPE
———○	PIPING UP
———⊙	PIPING DOWN
———○	TOP BRANCH CONNECTION
———⊙	BOTTOM BRANCH CONNECTION
———◎	FLOOR DRAIN WITH AUTOMATIC TRAP PRIMER AND DEEP SEAL P-TRAP - SEE DETAIL
———⊗	CLEAN OUT

OBJECT STATE LINETYPES:

EXISTING OBJECT OR CONSTRUCTION: ———

EXISTING OBJECT OR CONSTRUCTION TO BE DEMOLISHED: - - - - - -

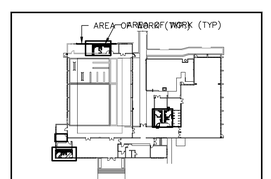
NEW OBJECT OR CONSTRUCTION TO BE PROVIDED: ———

OBJECT STATE SUBSCRIPTS:

D EXISTING OBJECT TO BE DEMOLISHED
E EXISTING OBJECT TO REMAIN
M EXISTING OBJECT TO BE REMOVED & RELOCATED
R RELOCATED EXISTING OBJECT

WATER HAMMER ARRESTER SCHEDULE

TABLE V, PDI-WH 201 (FOR GROUPED FIXTURES)		TABLE VI, PDI-WH 201 (FOR LONG RUNS OF PIPING; WATER PRESSURES UP TO 65 PSIG)						
FIXTURE UNITS	P.D.I. UNIT SIZE	P.D.I. UNIT SIZE						
		LENGTH OF PIPE (FT.)	PIPE DIAMETER					
			1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
1-3	AA	25	A	A	B	C	D	E
1-11	A	50	A	B	C	D	E	F
12-32	B	75	B	C	D	AE	F	EF
33-60	C	100	C	D	E	F	CF	FF
61-113	D	125	C	D	F	AF	EF	EFF
114-154	E	150	D	E	F	DF	FF	FFF
155-330	F							



100% DOCUMENTS
NOVEMBER 25, 2015

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 - f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy, Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2125
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX: (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
RM

REVISIONS

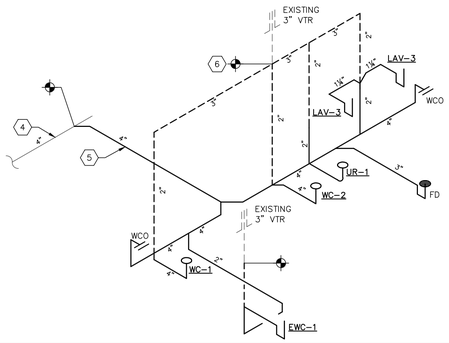
PROFESSIONAL SEAL

JOHN M. SPIERTO, P.E.; FL REG. #: 58182

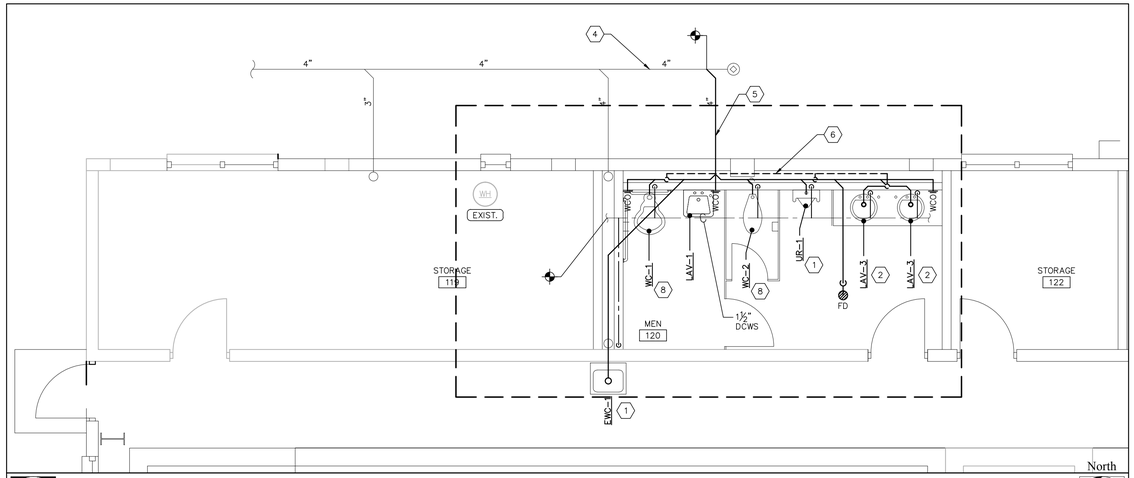
SCALE: AS NOTED

PLUMBING NOTES, LEGEND, SCHEDULES, & DEMOLITION PLANS

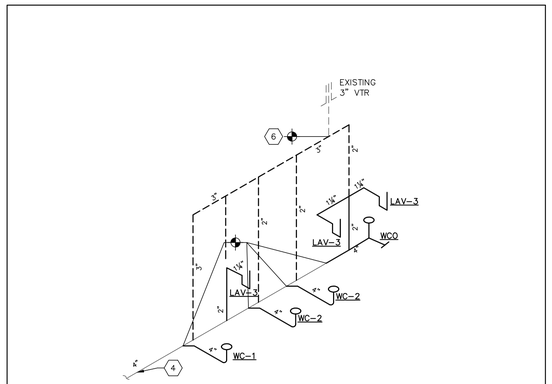
SHEET NUMBER
P1.0
---- OF X



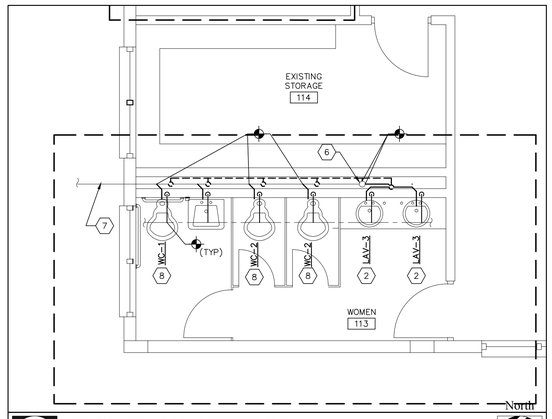
A P1.1 MEN 120 RESTROOM - SANITARY RISER DIAGRAM NTS



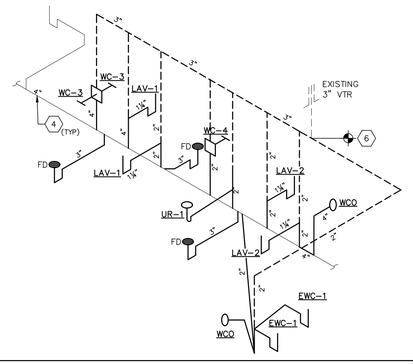
01 P1.1 MEN RESTROOM RENOVATION PLAN - PLUMBING 1/4" = 1'-0"



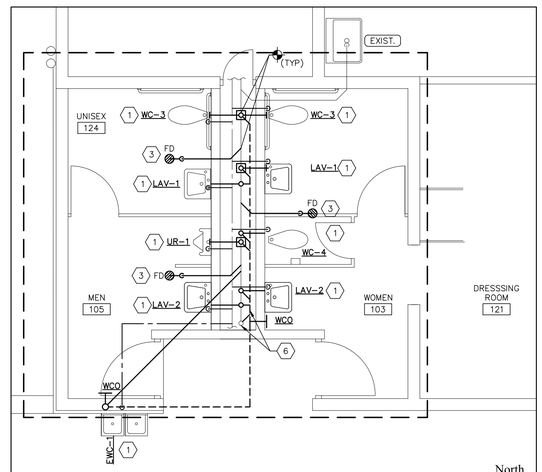
C P1.1 WOMEN 113 RESTROOM - SANITARY RISER DIAGRAM NTS



03 P1.1 WOMEN 113 RESTROOM RENOVATION PLAN - PLUMBING 1/4" = 1'-0"



B P1.1 WOMEN 103 & MEN 105 - SANITARY RISER DIAGRAM NTS



02 P1.1 WOMEN 103 & MEN 105 RESTROOM PLUMBING 1/4" = 1'-0"

PROJECT NOTES

GENERAL:

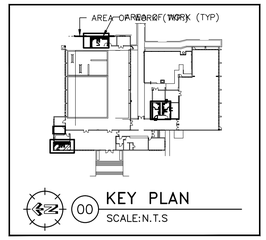
A. EXISTING PIPING AND EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE AND ARE PROVIDED FOR REFERENCE USE ONLY. FIELD VERIFY AND COORDINATE WITH EXACT LOCATIONS OF EXISTING PIPING, EQUIPMENT, ETC.

B. COORDINATE WITH OWNER FOR BUILDING WATER SHUT OFF. AFTER RESTORING WATER TO BUILDING, ASSURE NO LEAKS ARE EVIDENT.

(#) RENOVATION KEY NOTES

1. PROVIDE NEW WALL MOUNTED PLUMBING FIXTURE. PROVIDE NEW FIXTURE CARRIER IN WALL. EXTEND AND CONNECT TO DOMESTIC WATER SUPPLY PIPING IN CHASE. EXTENDED WATER LINE PIPING SHALL MEET LINE SIZES CALLED OUT IN SCHEDULE OR PER FIXTURE MANUFACTURER SPECIFICATION. EXTEND AND CONNECT TO EXISTING WASTE AND VENT PIPING MAINS. CONTRACTOR FIELD VERIFY EXACT LOCATION OF EXISTING PIPING.
2. PROVIDE NEW COUNTERTOP LAVATORY FIXTURE. EXTEND AND CONNECT TO DOMESTIC WATER SUPPLY PIPING IN CHASE. EXTEND AND CONNECT TO EXISTING WASTE AND VENT PIPING MAINS. CONTRACTOR FIELD VERIFY EXACT LOCATION OF EXISTING PIPING.
3. PROVIDE NEW FLOOR DRAIN WITH TRAP PRIMER TAPPING; EXTEND DOMESTIC WATER SUPPLY FROM NEAREST FIXTURE. SAW CUT AND TRENCH FLOOR AS REQUIRED; PATCH FLOOR TO MATCH ADJACENT SURFACES.
4. EXISTING 4" SANITARY WASTE PIPING. CONTRACTOR VERIFY SIZE & NOTIFY ENGINEER IF SIZE IS DIFFERENT FROM DRAWINGS.
5. PROVIDE 4" SANITARY PIPING IN LOCATION OF PREVIOUSLY REMOVED 3" SANITARY LINE.
6. COLLECT VENTS TOGETHER AND ROUTE TO EXISTING VTR.
7. EXISTING SANITARY MAIN PIPE TO REMAIN.
8. PROVIDE NEW FLOOR MOUNTED PLUMBING FIXTURE. SAW CUT AND TRENCH FLOOR AS REQUIRED. EXTEND AND CONNECT TO EXISTING SANITARY, VENT, AND SUPPLY PIPING. PATCH FLOOR AND WALL TO MATCH ADJACENT SURFACES.

100% DOCUMENTS
NOVEMBER 25, 2015



00 KEY PLAN
SCALE: N.T.S

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 – f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5868

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
RM

REVISIONS

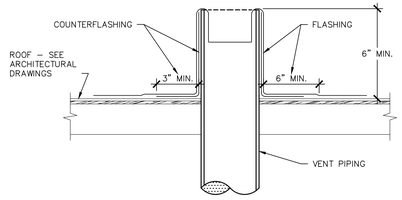
PROFESSIONAL SEAL

JOHN M. SPIERTO, P.E.; FL. REG. # 58182

SCALE: AS NOTED

PLUMBING PLANS & RISER DIAGRAMS

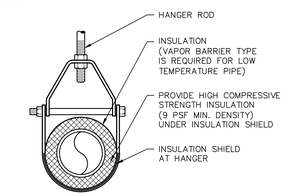
SHEET NUMBER
P1.1
---- OF X



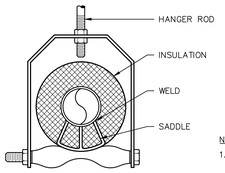
NOTES:

1. PAINT VENT TO MATCH ROOF.
2. FLASHING AND COUNTERFLASHING TO BE PROVIDED BY PLUMBING CONTRACTOR AND INSTALLED BY ROOFING CONTRACTOR.

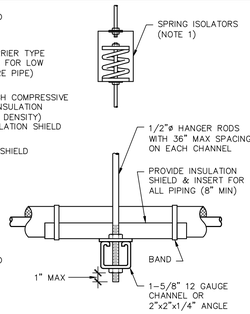
E VENT THRU ROOF DETAIL
SCALE:NTS



ADJUSTABLE CLEVIS HANGER
(FOR STATIONARY PIPES)



ADJUSTABLE ROLLER HANGER
(USE WHEN HORIZONTAL MOVEMENT CAUSED BY PIPE EXPANSION AND CONTRACTION MIGHT OCCUR)



TRAPEZE HANGER
(UP TO 1000 LB. UNIFORM LOAD)

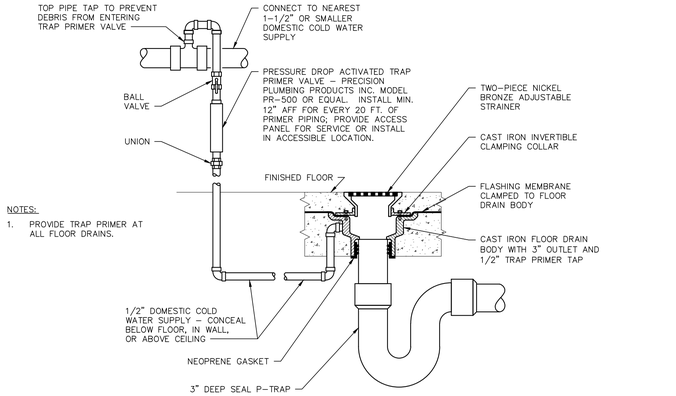
PIPE SUPPORT MAX. SPACING	
NOMINAL PIPE SIZE	PIPE RUN
IN.	LINEAR FT.
≤ 3/4"	7
1	7
1 1/4	7
1 1/2	9
2	10
2 1/2	11
3	12
4	14
5	16
6	17
8	19
10	22
12	23
14	25
16	27
18	28
20	30
24	32

NOTE: FOR TRAPEZE HANGERS USE SPACING OF SMALLEST SIZE ON TRAPEZE.

NOTES:

1. PROVIDE SPRING ISOLATORS IN MECHANICAL ROOMS, AND ON FIRST THREE (3) HANGERS BEFORE AND AFTER EQUIPMENT CONNECTIONS.

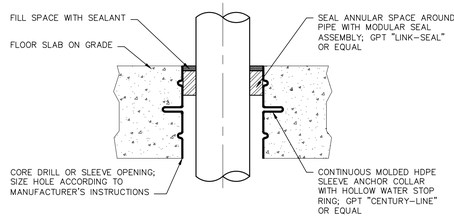
C TYPICAL PIPE HANGERS
SCALE:NTS



NOTES:

1. PROVIDE TRAP PRIMER AT ALL FLOOR DRAINS.

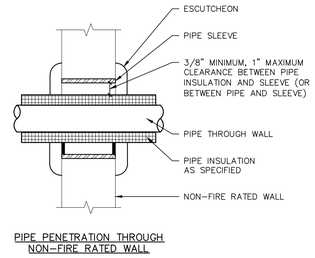
A FLOOR DRAIN
SCALE:NTS



NOTES:

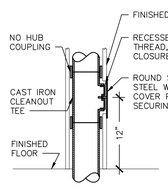
1. SLEEVE NOT REQUIRED FOR CORE–DRILLED HOLES.
2. INSTALL SLEEVE–SEAL SYSTEM ACCORDING TO MANUFACTURER'S INSTRUCTIONS. USE APPROPRIATE LINK–SEAL MODEL FOR THE INSTALLATION CONDITIONS.

A PIPE PENETRATION THROUGH SLAB ON GRADE
SCALE:NTS

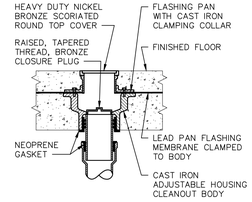


PIPE PENETRATION THROUGH NON–FIRE RATED WALL

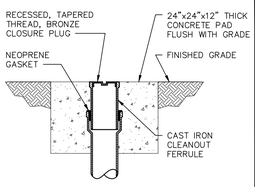
D PIPE PENETRATION THROUGH NON–FIRE RATED WALL
SCALE:NTS



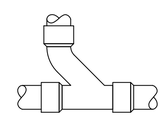
WALL CLEANOUT



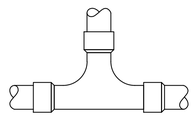
FLOOR CLEANOUT



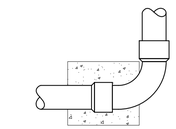
EXTERIOR CLEANOUT



CLEANOUT FITTING IN MAIN

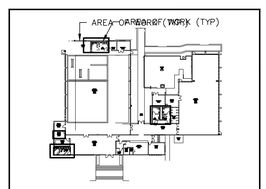


TWO–WAY CLEANOUT FITTING



END OF MAIN CLEANOUT FITTING

B CLEANOUT DETAILS
SCALE:NTS



00 KEY PLAN
SCALE:N.T.S

100% DOCUMENTS
NOVEMBER 25, 2015

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
PLANNING AND DESIGN DIVISION
306 E. JACKSON STREET 4 NORTH
TAMPA, FLORIDA 33602
p: 813. 274. 8456 – f: 813. 274. 8080
url: www.tampagov.net

James E. Jackson, Jr. AIA, NOMA
City Architect
Edward D. Rice, AIA
Project Architect
Kevin L. Henika, AIA
Project Architect
Thomas A. Hester, Sr., AIA, NOMA
Project Architect
Kinsey C. Tillman
Drafting Technician
Jerry P. Sanders
Drafting Technician
Byron K. Thomas, LEED GA
Drafting Technician

MEP CONSULTANT
HALL ENGINEERING GROUP
14499 N. Dale Mabry Hwy.
Suite 179
Tampa, FL, USA 33618-2042
Tel: 813.374.2121
FL. C.O.A. #: 27620

STRUCTURAL CONSULTANT
BROADWAY ENGINEERING
1335 W. CASS ST.
TAMPA, FLORIDA 33606
(813) 251-9244
FAX. (813) 251-9330

CIVIL CONSULTANT
MILLS AND ASSOCIATES, INC.
3242 HENDERSON BOULEVARD
SUITE 300
TAMPA, FLORIDA 33609
(813) 876-5869

LANDSCAPE CONSULTANT

WAYNE C. PAPY CENTER ADDITION AND RENOVATION
6925 N. FLORIDA AVENUE
TAMPA, FLORIDA 33604

FILE NUMBER

PROJECT NUMBER

ISSUE DATE
NOVEMBER 25, 2015

DRAWN BY
RM

REVISIONS

PROFESSIONAL SEAL

JOHN M. SPIERTO, P.E.; FL. REG. #: 58182

SCALE: AS NOTED

PLUMBING DETAILS

SHEET NUMBER
P5.1
---- OF X