University of Maryland Baltimore County
Demolition and Electrical Work for
Renovations to Patapsco Hall
UMBC CS2003-1736-E

Specifications

2 February 2003

JPA Commission No. 4938-01 (41A)

James Posey Associates, Inc.
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SECTION 01100

SUMMARY OF WORK

PART 1 GENERAL

1.01 ENGINEER

A. Throughout the Bidding and Contract Documents, General Requirements (Division 1), and technical sections, all references to the Engineer or to the Architect shall mean James Posey Associates, Inc.

1.11 SECTION INCLUDES

A. Brief project description.

B. Owner furnished products.

C. Contractor use of site and premises.

1.21 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

1.22 BRIEF PROJECT DESCRIPTION

A. All demolition and electrical work for the following.

B. Building type: Dormitory

C. Major materials and systems: Vertical, high-rise fan-coil units; tertiary piping and pumping for chilled water and heating water systems originating in a local SCUB.

D. Special features: New direct digital controls and domestic hot water generation.

E. Size, sq ft: 80,000

1.25 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow:

1. Work by others.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION
SECTION 01120
ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Coordinate work of trades and schedule elements of alterations and renovation work by procedures and methods to expedite completion of the work.

B. In addition to demolition specified in other sections and that specifically shown, cut, move or remove items as necessary to provide access or to allow alterations and new work to proceed. Include such items as:

   1. Repair or removal of hazardous or unsanitary conditions.

   2. Removal of abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring.

   3. Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete.

   4. Cleaning of surfaces and removal of surface finishes as needed to install new work and finishes.

C. Patch, repair and refinish existing items to remain, to the specified condition for each material, with a workmanlike transition to adjacent new items of construction.

1.14 RELATED SECTIONS

A. Cutting and patching: Section 01731.

B. Cleaning during construction: Section 01770.

1.40 ALTERATIONS, CUTTING AND PROTECTION

A. Assign the work of moving, removal, cutting and patching, to trades qualified to perform the work in a manner to cause least damage to each type of work, and provide means of returning surfaces to appearance of new work.

B. Perform cutting and removal work to remove minimum necessary, and in a manner to avoid damage to adjacent work.

   1. Cut finish surfaces such as masonry, tile, plaster or metals, by methods to terminate surfaces in a straight line at a natural point of division.

C. Perform cutting and patching as specified in Section 01731.

D. Protect existing finishes, equipment, and adjacent work which is scheduled to remain, from damage.

   1. Protect existing and new work from weather and extremes of temperature.

       a. Maintain existing interior work above 60 degrees F.
b. Provide weather protection, waterproofing, heat and humidity control as needed to prevent damage to remaining existing work and to new work.

E. Provide temporary enclosures to separate work areas from existing building and from areas occupied by Owner, and to provide weather protection.

1.70 SEQUENCE AND SCHEDULES

A. Schedule work in the sequences and within times specified in Section 01100.

B. Submit separate detailed sub-schedule for alterations work, coordinated with the Construction Schedules. Show:

1. Each stage of work, and dates of occupancy of areas.

2. Date of Substantial Completion for each area of alterations work, as appropriate.

3. Trades and subcontractors employed in each stage.

PART 2 - PRODUCTS

2.12 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

A. Provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing work.

1. Generally Contract Documents will not define products or standards of workmanship present in existing construction; determine products by inspection and any necessary testing and workmanship by use of the existing as a sample of comparison.

B. Presence of a product, finish, or type of construction, requires that patching, extending or matching shall be performed as necessary to make Work complete and consistent to identical standards of quality.

PART 3 - EXECUTION

3.21 SPECIAL TECHNIQUES

A. Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship. Quality of patches or extended work shall be not less than that specified for new work.

3.22 ADJUSTMENTS

A. Where partitions are removed, patch floors, walls, and ceilings, with finish materials to match existing.

1. Where removal of partitions results in adjacent spaces becoming one, rework walls, floors and ceiling to provide smooth planes without breaks, steps, or bulkheads.

2. Where planes change, request instructions from Engineer as to method of making transition.

B. Trim and refinish existing doors as necessary to clear new floors. Notify Engineer if trimming will violate requirements for fire-rated doors.
3.23 DAMAGED SURFACES

A. Patch and replace any portion of an existing finished surface which is found to be damaged, lifted, or discolored, or shows other imperfections, with matching material.

1. Provide adequate support of substrate prior to patching the finish.

2. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over entire surface.

3. When existing surface finish cannot be matched, refinish entire surface to nearest intersections, using the same finish used in comparable new work. Obtain approval before beginning the work.

3.04 TRANSITION FROM EXISTING TO NEW WORK

A. When new work abuts or finishes flush with existing work, make a smooth transition. Patched work shall match existing adjacent work in texture and appearance so that the patch or transition is invisible at a distance of five feet.

1. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface. Obtain approval of proposed trim before beginning the work.

3.75 CLEANING

A. Perform periodic and final cleaning as specified in Section 01770.

B. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.

C. At completion of alterations work in each area, provide final cleaning and return space to a condition suitable for use by Owner.

END OF SECTION
SECTION 01310

COORDINATION

PART 1 - GENERAL

1.11  SECTION INCLUDES

   A. Administrative and supervisory requirements for coordinating construction.
   
   B. Procedures for review of documents and coordination of construction activity, including
      preparation of coordination drawings.
   
   C. Coordination with Owner's requirements.
   
   D. Coordination of work of various trades, suppliers, and subcontractors.

1.18  COORDINATION PROCEDURES

   A. In accordance with requirements of the General Conditions, before starting each portion of the
      work, study and compare the various drawings and other contract documents relative to that
      portion of the work, as well as other information and field measurements and drawings.
   
   B. Examples of items which may require particular field adjustment and coordination include, but
      are not limited to:
      
      1. Specifications and drawings for equipment and furnishings which require connections to
         and coordination with associated mechanical and electrical systems and devices.
      
      2. Installation of systems typically shown on contract drawings as diagrams and therefore
         subject to field adjustment.
         
         a. Areas where two or more such systems are required to be installed in limited space.
      
      3. Areas subject to several simultaneously applied requirements of mechanical, electrical,
         and building codes.
   
   C. Immediately report as required by the General Conditions and by procedural and administrative
      specifications:
      
      1. If, during the coordination review or later during the progress of the work, errors,
         inconsistencies, or omissions are discovered.
      
      2. If a situation should develop which prevents the proper installation of any equipment or
         item, or compliance with the contract documents.
   
   D. Coordinate scheduling, submittals and work of the various sections of Specifications to assure
      efficient, timely, and orderly sequence of installation of construction elements. Provide for
      accommodating items to be installed later. Coordinate work so that each trade will have
      completed installations prior to construction which could obstruct their work.
   
   E. Dimensions: Coordinate sizing of various components to assure proper fit and location. Verify
      dimensions of existing work and of new construction and equipment.
F. Drawings: Various products and systems have been indicated schematically or diagrammatically. Coordinate actual layout and dimensions, and prevent interference between components or trades.

G. Substitution or change: Determine and coordinate the effects. Upon approval of substitution or change in the work, accommodate all the consequent ramifications and costs.

H. Sequence: Coordinate to provide normal progression of the work in a timely manner without delays. Determine long-lead items and the requirements for items on which each sequence is dependent.

I. Individual Inspection: Every subcontractor or trade is responsible for reviewing contract documents, and inspecting surfaces, substrates and areas related to the execution of their work.

J. Coordinate trades to insure that proper clearances and access are provided for items which require operation and maintenance.

1.21 COORDINATION MEETINGS

A. In addition to progress meetings specified in Section 01312, hold coordination meetings and preinstallation conferences with personnel and subcontractors to assure coordination of work.

1.30 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals. See requirements of the section specifying submittal procedures.

B. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, equipment.

C. Coordinate requests for substitutions to assure compatibility of space, of operating elements and effect on work of other sections.

1.31 COORDINATION SUBMITTALS

A. Coordination drawings: Prepare coordination drawings where careful and detailed coordination is needed, as required for situations described in “Coordination Procedures” above, and where required in other sections of specifications.

   1. Show relationships of components shown on separate shop drawings.

   2. Show proposed field coordination of systems shown schematically or diagrammatically on contract drawings.

   3. Indicate installation sequences.

1.60 COORDINATION OF SPACE

A. Coordinate use of project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on drawings. Follow route shown for pipes, ducts and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Use space efficiently to provide access for other installations, for maintenance, and for repairs.
B. In finished areas conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Review of work: Prior to the commencement of work of each section of the specifications, carefully examine previously executed work performed under other sections or by other trades, which might affect execution of work of a section.

B. Acceptance: Commencement of work of a section will indicate acceptance by the Contractor of previously executed surfaces, substrates and areas of work. The commencement indicates that previous work has been inspected and meets the Contractor's requirements for warranty.

3.60 FIELD QUALITY CONTROL

A. A competent superintendent shall be on the premises at all times to check, lay out, coordinate, and superintend the installation of work. Superintendent shall establish grades and lines relative to the work before starting, and be responsible for their accuracy.

B. Coordinate completion and clean-up of work of separate sections in preparation for Substantial Completion.

C. Coordinate access to site by various trades and subcontractors for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

D. Assemble and coordinate closeout submittals specified in Section 01770.

END OF SECTION
SECTION 01312
PROJECT MEETINGS

PART 1 - GENERAL

1.11 SECTION INCLUDES
   A. Preconstruction conference
   B. Progress meetings.

1.14 RELATED SECTIONS
   A. Section 01310 Coordination

PART 2 - PRODUCTS

   Not used

PART 3 - EXECUTION

3.03 PRECONSTRUCTION CONFERENCE
   A. Owner will conduct conference for execution of Owner - Contractor Agreement.
   
   B. Owner will conduct conference for clarification of Owner and Contractor responsibilities in use of site and review of administration procedures.

3.04 PROGRESS MEETINGS
   A. Progress meetings shall be held at the job site no less than two weeks apart, and also when and if the Contractor or Engineer finds them necessary or advantageous to progress of work.
   
   B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Engineer and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.
   
   C. Contractor shall conduct each progress meetings and prepare agenda of meeting with a copy for each attendee. Contractor shall keep accurate minutes of Progress Meetings, wording of which shall be approved by Engineer and shall promptly within two days distribute a sufficient number of copies to all parties.
   
   D. Contractor shall provide tables and chairs for meetings and a set of drawings and specifications shall be available for use.

END OF SECTION
SECTION 01330
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.11 SUMMARY
A. Submittal procedures.
B. Manufacturer and subcontractor list.
C. Product data, shop drawings, and samples.
D. Manufacturers' instructions.
E. Schedule of values.
F. Manufacturers' certificates.
G. Project schedules.

1.14 RELATED SECTIONS
A. Section 01450 - Quality Control: Manufacturers' field services and reports.
B. Section 01770 - Contract Closeout: Operation and maintenance manuals; certificates and special warranties; closeout submittals.

1.21 DEFINITIONS
A. Coordination drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

1. Preparation of coordination drawings is specified in Division 1 Section “Coordination” and may include components previously shown in detail on Shop Drawings or Product Data.

1.25 SUBMITTAL PROCEDURES
A. Transmit each submittal with a form or letter of transmittal acceptable to the Engineer.
B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix.
C. Identify project, contractor, subcontractor or supplier, pertinent Drawing sheet and detail number(s), and specification section number, and paragraph, as appropriate. Identify specific service or location for which the item is to be used.
D. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the work and contract documents.
E. Schedule submittals to expedite the project, and deliver to Engineer at business address. Coordinate submission of related items.
F. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed work.

G. Provide space for Contractor and Engineer review stamps.

H. Revise and resubmit submittals as required, identify all changes made since previous submittal.

I. Contractor’s failure to make submittals in time for review and resubmittals shall not be allowed as a reason for extending contract time.

J. Product data and shop drawings will not be reviewed until the manufacturer and subcontractor list has been accepted. Do not order, fabricate, or install any item until it has been reviewed and accepted.

K. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.30 MANUFACTURER AND SUBCONTRACTOR LIST

A. Within 7 days after date of Owner-Contractor Agreement, submit complete list of manufacturers and subcontractors proposed for use, with name of manufacturer, trade name, and model number of each product. A partial or incomplete list will not be accepted.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.31 PRODUCT DATA

A. Submit the number of copies which the Contractor requires, plus two copies which will be retained by the Engineer.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers’ standard data to provide information unique to this project.

C. The approval of a Shop Drawing or Product Data does not guarantee the measurements or the building conditions or that the Shop Drawings or Product Data have been checked to see that item submitted properly fits the building conditions. Approval shall not relieve the Contractor of the responsibility for furnishing material and performing work as required by the specifications and contract drawings; or the responsibility for verifying correctness of dimensions and quantities, and proper coordination of details and interface among trades.

D. All exclusively electrical items furnished as associated items with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate Shop Drawing but shall be clearly marked as associated with the mechanical item by specification paragraph.

E. After review, distribute in accordance with article on Procedures above and provide copies for Record Documents described in Section 01770 - Closeout Procedures.

1.32 SHOP DRAWINGS

A. Submit in the form of one reproducible transparency and one opaque reproduction.

B. Available space for equipment is indicated by the size of equipment shown on the drawings. Suppliers shall ascertain that their equipment will fit the available space. Include with shop
drawings of equipment, drawings showing necessary deviations and changes required in materials and appurtenances made necessary by the units proposed to be furnished. Contractor shall be responsible for required changes without any additional cost.

C. After review, reproduce and distribute in accordance with article on Procedures above and for Record Documents described in Section 01770 - Closeout Procedures.

1.33 SAMPLES

A. Submit samples, where required, to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

B. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Engineer's selection.

C. Include identification on each sample, with full project information.

D. Submit the number of samples specified in individual specification sections, or two if not specified; one of which will be retained by Engineer.

E. Reviewed samples which may be used in the work are indicated in individual specification sections.

1.34 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.35 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

   a. Contractor's Construction Schedule.
   b. Application for Payment forms, including Continuation Sheets.
   c. List of subcontractors.
   d. Schedule of alternates.
   e. List of products.
   f. List of principal suppliers and fabricators.
   g. Schedule of submittals.

2. Submit the Schedule of Values at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.

B. Format and content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each specification section.

   1. Identification: Include the following project identification on the Schedule of Values:
a. Project name and location.
b. Name of the Engineer.
c. Project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

   a. Related specification section or division.
   b. Description of work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.
   h. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.

4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.

6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the work.

7. Margins of cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor’s option.

C. Schedule updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.43 MANUFACTURER’S CERTIFICATES

A. When specified in individual specification sections, submit manufacturers’ certificate to Engineer for review, in quantities specified for Product Data.

B. Indicate whether material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
C. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

1.70 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule in duplicate within 15 days after date of Owner-Contractor Agreement for Engineer review.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.

D. Submit computer generated network analysis diagram using the PERT method, generally as outlined in Associated General Contractors of America (AGC) publication "The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry".

D. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

E. Indicate estimated percentage of completion for each item of work at each submission.

F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and under Allowances.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION
SECTION 01410

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. As a convenience to users of the contract documents, listings of organizations and their common acronyms or abbreviations which are referred to in the documents or which are among the authorities having jurisdiction.

B. Description of submittals required for conformance to regulatory requirements.

1.30 SUBMITTALS

A. Secure certificates of approval from specified or other approved testing agencies, inspection agencies, and authorities having jurisdiction. Certificates shall cover all work, including, but not limited to, plumbing, ductwork, fire protection, and electrical. Submit certificates of approval prior to final acceptance of the work.

B. Obtain, including the expediting of all necessary signatures and paperwork, permits, fees, and inspections required by city, county, state, or federal authorities having jurisdiction. Owner will pay directly for the costs of these certificates, permits, fees, inspections, and connections.

1.40 QUALITY ASSURANCE

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the codes and standards of the regulatory authorities or industry organizations, the provisions of the specifications shall take precedence.

B. Provide without extra charge, additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Materials, equipment or workmanship specified by reference to number, symbol, or title of any industry or government agency standard shall comply with the applicable provisions of such standard, except as limited to type, class, or grade, or modified in contract specifications. Standards referred to in the specifications, except as modified, shall have full force and effect as though printed in detail in specifications.

D. Regulatory authorities: The work covered under these specifications shall be performed in accordance with the applicable requirements of the authorities having jurisdiction. The applicable edition of a regulatory code is as defined by the authority. Where code standards are referred to, comply with standards and revisions in effect as of the date of the contract documents. The applicable regulatory authorities include, but are not limited to:

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.

2. The state department of health.


5. Insurance Service Office of Maryland.
E.  Trade associations and standards: The following abbreviations and acronyms, when referred to in the contract documents, mean the organizations identified below. Names and addresses are subject to change and are believed, but not assured, to be correct at the date of the contract documents.

AA  Aluminum Association
    900 19th St., NW, Suite 300
    Washington, DC 20006
    www.aluminum.org

(202) 862-5100

AABC  Associated Air Balance Council
      1518 K St., NW, Suite 503
      Washington, DC 20005
      www.aabchq.com

(202) 737-0202

AAMA  American Architectural Manufacturers
      Association
      1827 Walden Office Sq., Suite 104
      Schaumburg, IL 60173-4268
      www.aamanet.org

(847) 303-5664

ACI  American Concrete Institute
     P.O. Box 9094
     Farmington Hills, MI 48333-9094
     www.aci-int.org

(248) 848-3700

ACIL:  The Association of Independent
       Scientific, Engineering, and Testing
       Firms
       1629 K St., NW, Suite 400
       Washington, DC 20006
       www.acil.org

(202) 887-5872

ADC  Air Diffusion Council
     11 South LaSalle St., Suite 1400
     Chicago, IL 60603

(312) 201-0101

AEIC  Association of Edison Illuminating
      Companies
      600 N. 18th St.
      P.O. Box 2641
      Birmingham, AL 35291-0992

(205) 250-2530

AFPA  American Forest and Paper
      Association
      (Formerly: National Forest Products
      Association)
      1111 19th St., NW, Suite 800
      Washington, DC 20036

(800) 878-8878
(202) 463-2700

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P.O. Box 5010
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Hartford, CT 06102-5010
(860) 520-7300

ITS
Intertek Testing Services
(Formerly: Inchcape Testing
Services)
P.O. Box 2040
3933 US Route 11
Cortland, NY 13045-7902
www.itsglobal.com
(800) 345-3851
(607) 753-6711

MSS
Manufacturers Standardization Society
of the Valve and Fittings Industry
127 Park St., NE
Vienna, VA 22180-4602
(703) 281-6613

NAAMM
National Association of Architectural
Metal Manufacturers
8 South Michigan Ave., Suite 1000
Chicago, IL 60603
www.gss.net/naamm
(312) 456-5590

NAIMA
North American Insulation
Manufacturers Association
(Formerly: Thermal Insulation
Manufacturers Association)
44 Canal Center Plaza, Suite 310
Alexandria, VA 22314
www.naima.org
(703) 684-0084

NEBB
Natural Environmental Balancing
Bureau
8575 Grovemont Circle
Gaithersburg, MD 20877-4121
(301) 977-3698

NEMA
National Electrical Manufacturers
Association
1300 N 17th St., Suite 1847
Rosslyn, VA 22209
www.nema.org
(703) 841-3200

NETA
InterNational Electrical Testing
Association
P.O. Box 687
(303) 697-8441
106 Stone St.
Morrison, CO 80465-1526
www.electricnet.com/neta

NFPA  National Fire Protection Association
One Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
www.nfpa.org

(800) 344-3555
(617) 770-3000

NSF  NSF International
(Formerly: National Sanitation Foundation)
P.O. Box 130140
Ann Arbor, MI 48113-0140
www.nsf.org

(313) 769-8010

PDI  Plumbing and Drainage Institute
45 Bristol Dr., Suite 101
South Easton, MA 02375

(800) 589-8956
(508) 230-3516

PPI  Plastic Pipe Institute
(The Society of the Plastics Industry, Inc.)
1801 K St., NW, Suite 600L
Washington, DC 20006
www.plasticpipe.org

(202) 974-5306

SMACNA  Sheet Metal and Air Conditioning Contractors’ National Association, Inc.
4201 Lafayette Center Dr.
P.O. Box 221230
Chantilly, VA 20151-1209
www.smacna.org

(703) 803-2980

SSPC  Steel Structures Painting Council
40 24th St., 6th Floor
Pittsburgh, PA 15222-4643

(412) 281-2331

TIMA  Thermal Insulation Manufacturers Association
(See NAIMA)

UL  Underwriters Laboratories Inc.
333 Pfingsten Rd
Northbrook, IL 60062
www.ul.com

(800) 704-4050
(847) 272-8800

F. Federal government agencies: Names and titles of federal government standards- or specification-producing agencies are often abbreviated. The following abbreviations and acronyms referred to in the Contract Documents indicate names of standards- or specification-producing agencies of the federal government. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.
1.41 OTHER REFERENCES

A. Maryland Occupational Safety and Health Act (MOSHA)
State of Maryland Department of Health and Mental Hygiene
201 W. Preston Street, Baltimore, MD 21201

B. Standardized Plant Names, Published by J. Horace McFarland, Harrisburg, PA, for the
American Joint Committee on Horticultural Nomenclature.

C. Applicable state, city and county standard details and design manuals for water mains, sanitary
standards, and storm details.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION
PART 1 GENERAL

1.11 SECTION INCLUDES

A. Quality assurance and control of installation.
B. References.
C. Inspection and testing laboratory services.
D. Tests of mechanical and electrical systems and equipment.
E. Manufacturers’ field services and reports.

1.14 RELATED SECTIONS

A. Submittals: Section 01300.
B. Requirements for material and product quality: Section 01600.
C. Testing, adjusting, and balancing of mechanical equipment: Section 15950.

1.19 REFERENCES

A. Conform to reference standard by date of issue current on date of Contract Documents.
B. Obtain copies of standards when required by Contract Documents.
C. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.40 QUALITY ASSURANCE

A. The Specifications and Drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.
B. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the Engineer will determine sizes to be used.
C. In all cases of doubt, uncertainty or conflict as to the true meaning of the specifications or drawings it is the responsibility of the Contractor to notify the Engineer and obtain a decision as to the intent, before initiating any work which may be affected by this decision.

1.47 SPECIALIST

A. The term "specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in
the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the Contract. Where the contract specification requires installation by a specialist, the term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

B. Specialist shall submit a list of a minimum of three projects of similar type, size and duty, which have been performed for not less than five years.

C. List shall include project name, address, name and phone number of Owner's Representative, project size and type.

1.48 CONTROL OF INSTALLATION

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

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

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

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

E. Perform work by persons qualified to produce workmanship of specified quality.

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

PART 2 - PRODUCTS  (Not used)

PART 3 - EXECUTION

3.61 TESTS

A. Furnish all labor, specialties, equipment, services, and appurtenances required for the tests, and pay any other expenses incurred, including necessary changes to the systems as required to produce the specified results.

B. Conduct all tests before any equipment is connected that would be subject to damage from the test pressure, and voltage.

C. Notify all parties whose presence is necessary for the test. Notify Engineer at least two days prior to the actual test.

D. Perform specific tests on the systems and equipment installed as work of Division 15, Mechanical, and Division 16, Electrical, and specified in technical sections.

E. Tests shall be performed in accordance with the requirements of the applicable codes and as herein specified. The entire installation shall be proven complete and in readiness for regular and satisfactory use.
F. Equipment, materials and workmanship found at fault during tests shall be replaced, repaired or made good to satisfaction of the Engineer, and test repeated.

3.62 INSPECTION AND TESTING LABORATORY SERVICES

A. Contractor shall employ and pay for services of an independent testing laboratory to perform specified inspection and testing.

B. The independent firm will perform inspections, tests, and other services specified in individual specification sections and as required by the Engineer.

C. Reports will be submitted by the independent firm to the Engineer, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

D. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.

1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.

2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

E. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Engineer. Payment for retesting will be charged to the Contractor by the testing laboratory.

3.63 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Engineer.

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

C. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Submit report in duplicate within 30 days of observation to Engineer for review.

END OF SECTION
SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1  GENERAL

1.11   SECTION INCLUDES

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

B.   Temporary controls:  Barriers, enclosures and fencing, protection of the work, and water control.

C.   Construction facilities:  Access roads, parking, progress cleaning, project signage, and temporary buildings.

1.14   RELATED SECTIONS

A.   Project meetings:  Section 01312.

B.   Erosion and sediment controls:  Section 01570.

C.   Project closeout:  Section 01770.

PART 2  - PRODUCTS

2.01   Products shall comply with applicable sections of Division 2 through 16 and shall be commercial grade.

PART 3  - EXECUTION

3.30   APPLICATION

3.31   TEMPORARY ELECTRICITY

A.   Connect to existing power service.  Power consumption for construction shall not disrupt Owner's continuous service.

B.   Owner will pay cost of energy used.  Exercise measures to conserve energy.

C.   Temporary power service:  Of sufficient size, capacity, and characteristics to accommodate performance of the work.

D.   Provide power outlets for construction operations, with branch wiring and distribution boxes located within 100 ft of each work area.  Provide flexible power cords as required.

E.   Permanent convenience receptacles may be utilized during construction.

F.   Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

   1.   Provide 20 ampere duplex outlets, single phase circuits for power tools.

   2.   Provide 20 ampere, single phase branch circuits for lighting.
3.32 TEMPORARY LIGHTING

A. Provide and maintain lighting for construction operations.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

E. Maintain lighting and provide routine repairs.

F. Use permanent building lighting during construction as needed.

3.33 TEMPORARY HEAT

A. Provide and pay for heat devices and heat as required to maintain specified conditions for construction operations.

B. Owner will pay cost of energy used. Exercise measures to conserve energy. Enclose building prior to activating temporary heat in accordance with Article "Exterior Enclosures" in this section.

C. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

D. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

3.34 TEMPORARY VENTILATION

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

B. Use existing ventilation equipment. Extend and supplement equipment with temporary fans units as required to maintain clean air for construction operations.

C. Prevent dust or fumes from construction work from entering building ventilation systems.

3.35 TELEPHONE SERVICE

A. Provide, maintain and pay for telephone service to field office at time of project mobilization.

3.36 TEMPORARY WATER SERVICE

A. Connect to existing water source for construction operations.

B. Owner will pay cost of water used. Exercise measures to conserve water.

C. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.
3.37 TEMPORARY SANITARY FACILITIES

A. Existing permanent designated facilities may be used during construction operations. Maintain daily in clean and sanitary condition.

B. At end of construction, return facilities to same or better condition than originally found.

3.38 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades, temporary stairs, rails, screens, and covered walkways required by governing authorities for public rights-of-way. Provide access, staging, and protection as necessary for proper handling of work.

C. Provide protection for plant life not designated to be removed. Replace damaged plant life.

D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

3.39 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

3.41 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

3.42 INTERIOR ENCLOSURES

A. Provide temporary partitions as required to prevent damage to existing materials and equipment.

B. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces.

3.43 PROTECTION OF INSTALLED WORK

A. Protect installed work and provide special protection where specified in individual specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

G. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, dippings, adhesives, bitumens, mortars, paints, plasters, welding or burning.

2. Protect finished work from damage, defacement, staining, or scratching.

3. Protect finish work from cleaning agents, or grinding and finishing equipment.

4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.

5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

H. Repair damage and soiling to the complete satisfaction of the Engineer; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, at no addition to the Contract Sum.

3.45 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

3.46 SCAFFOLDING, TARPALINS

A. Wood Scaffolding: Do not use wood scaffolding, except for deck planking. All supporting members shall be of metal.

B. Tarpaulins: Certified flame retardant in accordance with NFPA 701.

3.47 SAFETY

A. Safety requirements of the Maryland Occupational Safety Authority supercede the following safety suggestions and shall govern all work on this project.

1. Contact Owner’s representative before starting any work.

2. Make sure all objects attached to walls or ceilings are securely fastened.

3. Do not work overhead of Owner’s personnel.

4. When cutting or chipping concrete, protect against spalling below and against flying chips.
5. Do not block doors with ladders; if blocking is necessary, place a "Caution" sign on other side of door.

6. Keep the work area clear of debris or other items over which people might trip.

3.48 HEAVY EQUIPMENT

A. Provide, either through own organization or through subcontractors, all construction cranes, and other rigging, concrete lifts, chutes, and the like required for completion of work.

B. All such construction shall be carried out in conformance with local codes and subject to the approval of Engineer. Do not locate or move cranes, chutes or other heavy equipment in such a manner as to damage or strain the framework of any building. Contractor shall be responsible for the integrity of the site and shall replace any and all construction damaged by the use of equipment.

C. Contractor and its subcontractors shall be entirely responsible for the proper handling and safety of all equipment used.

3.49 SECURITY

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

B. Coordinate with Owner's security program.

3.50 ACCESS ROADS

A. Designated existing on-site roads may be used for construction traffic.

B. Use of sidewalks or roads outside the property lines shall be with permission and approval of the authorities having jurisdiction.

3.52 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Remove waste materials, debris, and rubbish from site daily and dispose off-site.

3.54 FIELD OFFICES AND SHEDS

A. Office: Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture.

B. Provide space for project meetings, with table and chairs to accommodate 10 persons.

3.55 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

END OF SECTION
SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.11 SECTION INCLUDES

A. Products.
B. Product options.
C. Substitutions.
D. Delivery, storage, and handling.

1.14 RELATED SECTIONS

A. Section 01450 - Quality Control: Product quality monitoring.

1.20 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the work. Products may also include existing materials or components required for reuse.

B. Labeling and testing electrical components and equipment: As specified in Mechanical and Electrical Basic Materials and Methods.

C. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

D. Provide interchangeable components of the same manufacturer, for similar components.

E. All products and materials shall be of the specified level of quality, suitable for the conditions and expected performance of the project, and of standard manufacture.

F. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

G. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

1.21 PRODUCT OPTIONS

A. General: Where Contractor is permitted to use a product other than the specific item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in article 1.22 for substitutions.

B. Products specified by reference standards or by description only: Any product meeting those standards or description.
C. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

1. Where other acceptable manufacturers are named, Contractor may provide products only of those manufacturers, which meet the specifications.

2. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

C. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance, and shall not be construed as limiting competition. Contractor may use products of any manufacturer, which meet the specifications.

D. Products specified by naming one manufacturer or particular product, with no provision for other options: No options or substitutions allowed.

1.22 SUBSTITUTIONS

A. Engineer will consider requests for Substitutions only as permitted in Instructions to Bidders and General Conditions.

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

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

D. A request constitutes a representation that the Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty for the Substitution as for the specified product.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure:

1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed
   product equivalence.

3. The Engineer will notify Contractor, in writing, of decision to accept or reject request.

1.50 DELIVERY, STORAGE AND HANDLING

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

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

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

D. Store and protect products in accordance with manufacturer's instructions, with seals and labels
   intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

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

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to
   avoid condensation.

H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with
   foreign matter.

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

J. Arrange storage of products to permit access for inspection. Periodically inspect to assure
   products are undamaged and are maintained under specified conditions.

K. Ship equipment in sections of suitable size for entering the building. Make all necessary
   arrangements for bringing equipment into the building and installing it in its ultimate location.

L. Deliver all package products to the job site in manufacturer's unopened, original, standard
   containers with grade seals unbroken and labels intact.

M. All materials received on the site shall be clean or be cleaned upon arrival.

N. Laterally brace stacks and piles of materials.

O. Metals shall be free of mud, ice, frost, rust or foreign materials which will damage the finish.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.60 FIELD QUALITY CONTROL

A. All materials and equipment shall be installed and completed in a first class and workmanlike
   manner and in accordance with the best modern methods, practice and manufacturer's
instructions. Any work which does not present an orderly and neat or workmanlike appearance shall be removed and replaced when so directed in writing by the Engineer.

END OF SECTION
SECTION 01731
CUTTING AND PATCHING

PART 1 GENERAL

1.11 SECTION INCLUDES

A. Requirements and limitations for cutting and patching of work.

1.14 RELATED SECTIONS

A. Section 01100 - Summary of work: Work by Owner or by separate contractors.

B. Section 01330 - Submittal Procedures.

C. Section 01600 - Product Requirements: Product options and substitutions.

D. Individual product specification sections:
   1. Cutting and patching incidental to work of the Section.
   2. Advance notification to other sections of openings required in work of those sections.
   3. Limitations on cutting structural members.

1.30 SUBMITTALS

A. Submit written request in advance of cutting or alteration which affects:
   1. Structural integrity of any element of project.
   2. Integrity of fire rating of any fire-rated assembly.
   3. Integrity of weather-exposed or moisture-resistant element.
   4. Efficiency, maintenance, or safety of any operational element.
   5. Visual qualities of sight exposed elements.
   6. Work of Owner or separate contractor.

B. Include in request:
   1. Identification of project.
   2. Location and description of affected work.
   3. Necessity for cutting or alteration.
   4. Description of proposed work, and products to be used.
   5. Alternatives to cutting and patching.
   6. Effect on work of Owner or separate contractor.
7. Written permission of affected separate contractor.

8. Date and time work will be executed.

C. Submit evidence of Specialist’s experience.

1.60 PROJECT CONDITIONS

A. If, in the course of the work, workers encounter a material they suspect to be asbestos, to contain lead or PCBs, or to present some other hazard:

1. Promptly notify the Owner and Engineer in writing.

2. Do not perform any work which would disturb the suspected material until written instructions have been received.

B. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field.

PART 2 PRODUCTS

2.10 MATERIALS

A. Primary products: Those required for original installation. Comply with contract requirements.

B. Product substitution: For any proposed change in materials, submit request for substitution as required in Section 01600.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing work, inspect conditions affecting performance of work.

C. Report unsatisfactory or questionable conditions to Engineer in writing; do not proceed with work until Engineer has provided further instructions.

D. Beginning of cutting or patching means acceptance of existing conditions.

3.05 PREPARATION

A. Provide temporary supports to ensure structural integrity of the work. Provide devices and methods to protect other portions of project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering work.

C. Maintain excavations free of water.

3.08 CUTTING AND PATCHING

A. Execute cutting, fitting, and patching including excavation and fill to complete work.
B. Fit products together, to integrate with other work.
C. Uncover work to install ill-timed work.
D. Remove and replace defective or non-conforming work.
E. Remove samples of installed work for testing when requested.
F. Provide openings in the work for penetration of mechanical and electrical work.

3.20 PERFORMANCE

A. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing.

B. Where possible, employ original installer to perform cutting and patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval. Neatly cut holes and slots to size required, with minimum disturbance to adjacent work; cut holes in concrete slabs for pipes and conduit with core drills of proper sizes. Openings shall be covered temporarily when not in use and patched as soon as work is installed.

1. Do not cut or core drill floor slab until reinforcing steel in the area to be cut has been located, and penetration has been designed so that it will not damage reinforcing.

2. Method for location: Non-destructive testing using a calibrated metal detector (R-meter type).

D. Restore work with new products in accordance with requirements of Contract Documents.

E. Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

F. Where patching fire-rated assemblies, restore each assembly with materials and methods to maintain its fire rating.

G. At penetrations of fire-rated walls, partitions, ceilings, or floors, completely seal voids with firestopping material in accordance with Section 07840, to full thickness of the penetrated element.

H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.21 WORK BY SPECIALIST

A. Cabinet work:

1. All work in connection with the cutting, drilling, removing, replacing and additions of wood work shall be done by a "Specialist" as specified in Section 01450.

2. Submit name and credentials of cabinetmaker along with subcontractors list as specified in Section 01330. Cabinetmaker shall present at least five installations of the same type and duty and have performed for not less than 10 years.

END OF SECTION
SECTION 01732

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.10 SUMMARY

A. This section includes the following:

1. Demolition and removal of selected portions of a building or structure.
2. Demolition and removal of selected site elements.
3. Repair procedures for selective demolition operations.

B. Related sections include the following:

1. Division 1 Section Cutting and Patching for cutting and patching procedures for selective demolition operations.
2. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
3. Division 16 Sections for demolishing, cutting, patching, or relocating electrical items.

1.20 REFERENCES

A. ANSI A10.6: Safety Requirements for Demolition.

1.21 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.22 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.30 SUBMITTALS

A. Qualification data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

C. Landfill records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous or regulated wastes.

1.40 QUALITY ASSURANCE

A. Demolition firm qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this project.

B. Regulatory requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.60 PROJECT CONDITIONS

A. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
   1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

B. Owner assumes no responsibility for condition of areas to be selectively demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Hazardous materials: It is not expected that hazardous materials will be encountered in the work.
   1. Hazardous materials will be removed by Owner before start of the work.
   2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site will not be permitted.

E. Utility service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

F. Maintain fire-protection facilities in service during selective demolition operations.

1.80 WARRANTY

A. Existing warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.10 REPAIR MATERIALS

A. Use repair materials identical to existing materials.
1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual specification sections.

PART 3 - EXECUTION

3.02 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

D. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

3.03 UTILITY SERVICES

A. Existing utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

C. Utility requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.05 PREPARATION

A. Dangerous materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Site access and temporary controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Maintain streets and walkways, erect temporary protection, and protect existing site improvements as required in Section 01500, Temporary Facilities and Controls.

2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
C. Temporary shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.40 POLLUTION CONTROLS

A. Dust control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.41 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.

6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove large objects and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly.

10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Existing Items to remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

D. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

E. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

F. Concrete slabs-on-grade: Saw-cut perimeter of area to be demolished, then break up and remove.

G. Air-conditioning equipment: Remove equipment as specified in Section 15055, Mechanical Demolition.

3.45 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Section 01731, Cutting and Patching.

3.49 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION
PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Closeout procedures.
B. Final cleaning.
C. Adjusting.
D. Project record documents.
E. Operation and maintenance data.
F. Warranties.
G. Spare parts and maintenance materials.

1.14 RELATED SECTIONS

A. Submittals: Section 01330.
B. Cleaning: Section 01500.
C. Testing, adjusting, and balancing: Section 15950.
D. Special project warranties: Individual technical sections, Divisions 2-16.

1.30 SUBMITTALS

A. Closeout procedures:
   1. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Engineer’s inspection.
   2. Provide submittals to Engineer that are required by governing or other authorities.
   3. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Project record documents:
   1. Maintain on site, one set of the following record documents; record actual revisions to the work:
      b. Specifications.
      c. Addenda.
d. Change Orders and other Modifications to the Contract.

e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.

3. Record information concurrent with construction progress.

4. Specifications: Legibly mark and record at each product section description of actual Products installed, including the following:
   a. Manufacturer's name and product model and number.
   b. Product substitutions or alternates utilized.
   c. Changes made by Addenda and Modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction including:
   b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   d. Field changes of dimension and detail.
   e. Details not on original Contract Drawings.

6. Delete Engineer title block and seal from all documents.

7. Submit documents to Engineer.

C. Operation and maintenance data:

1. Submit three sets.

2. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil, including the following:
   a. Types of lubricants required.
   b. Locations of lubrication points.
   c. Frequency of lubrication.
   d. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.

3. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
4. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", and title of project. Print on spine of binder "O & M INSTRUCTIONS". If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.

5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.

7. Part 1: Directory, listing names, addresses, and telephone numbers of civil, structural, mechanical, and electrical engineers; contractor; subcontractors; and major equipment suppliers.

8. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
   a. Significant design criteria, including pump and fan curves and similar performance charts.
   b. List of equipment, including operating weights.
   c. Parts list for each component, including recommended spare parts list.
   d. Operating instructions.
   e. Maintenance instructions for equipment and systems.
   f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
   g. Valve charts, including locations of flow fittings.

9. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Air and water balance reports.
   c. Photocopies of certificates.
   d. Photocopies of warranties and guarantees, and bonds.
   e. Test reports: Copies of the results of all tests required under all sections of specifications.

10. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.

11. Submit final volumes revised, within ten days after final inspection.

1.80 WARRANTIES
A. All work and equipment provided as work of the Contract shall be fully warranted under the general project warranty. In addition, provide added special warranties as specified in individual sections.

B. During the correction period, the Contractor shall promptly correct any work found to be defective, or otherwise not in accordance with the requirements of the Contract Documents, on receipt of written notice from the Owner. Except as otherwise required in general conditions, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

C. When use of the permanent equipment has been permitted for temporary heating or ventilation of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been on agreed to in writing by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide duplicate notarized copies.

F. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

G. Submit to Owner prior to final Application for Payment.

H. For items of work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.92 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.

B. Deliver to project site and place in location as directed; obtain receipt prior to final payment.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.70 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.71 LUBRICATION

A. Bearings of equipment shall be provided with adequate facilities for lubrication. Oiling devices, fittings, and appurtenances shall be accessible. Lubricate all bearings upon completion of work prior to start-up of the equipment. Lubricants shall be as specified by equipment manufacturers.

3.75 FINAL CLEANING

A. Execute final cleaning prior to final inspection.
B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

3.81 OPERATING INSTRUCTIONS

A. Provide operating instructions as specified in Sections 15050 and 16050.

END OF SECTION
SECTION 07840
FIRESTOPPING

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Through-penetration firestopping in fire-rated construction.
B. Through-penetration smoke-stopping in smoke partitions.

1.14 RELATED SECTIONS

A. Sleeves and plates: Section 15052.
B. Ductwork: Section 15810.
C. Conduit: Section 16131.

1.20 REFERENCES

A. Underwriters Laboratories
   1. UL Fire Resistance Directory
   2. UL 1479: Through Penetration Firestops.
B. American Society for Testing and Materials Standards:

1.21 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described in referenced documents.
B. Barriers: Time-rated fire walls, smoke barrier walls, time-rated ceiling/floor assemblies and structural floors.
C. Construction gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floor or roof decks; and gaps between adjacent sections of structural floors.
D. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.
E. Penetration: Opening or foreign materials passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
F. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.
G. System: Specific products and applications, classified and numbered by the rating agency to close specific barrier penetrations.
1.25  SYSTEM DESCRIPTION

A. Design requirements

1. Fire-rated construction: Maintain barrier and structural floor fire resistant ratings including resistance to cold smoke at all penetrations.

2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations.

1.30  SUBMITTALS

A. General: Comply with Division 1 and Section 01330.

B. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.

2. Manufacturer's installation instructions.

C. Shop drawings: Submit firestop assemblies and devices for all openings and through penetrations in fire-rated construction. Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable rating agency classification.

2. Manufacturer or manufacturer's representative shall provide qualified engineering judgements and drawings relating to conditions where rated assemblies do not exist.

D. Quality control submittals:


E. Applicators' qualifications statement:

1. List past projects indicating required experience.

F. Certifications: Letters or forms showing acceptance by local authorities for systems without acceptance by a rating agency.

1.40  QUALITY ASSURANCE

A. Products and assemblies shall be tested and labeled by an independent, nationally recognized testing and labeling authority.

B. Installer's qualification: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, state, or local authority where applicable.

2. At least 2 years experience with systems.

3. Successfully completed at least 5 projects of comparable scale, using these systems.
C. Local and state regulatory requirements: Obtain acceptance for proposed assemblies not conforming to specific rating agency classifications or rated assemblies.

D. Materials shall have been tested to provide fire rating at least equal to that of the construction in which they are to be installed.

1.50 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:
   1. Deliver products in original unopened packaging with legible manufacturer's identification.
   2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.60 PROJECT CONDITIONS

A. Existing conditions:
   1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
   2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:
   1. Furnish adequate ventilation if using solvent.
   2. Furnish forced-air ventilation during installation if required by manufacturer.
   3. Keep flammable materials away from sparks or flame.
   4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
   5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.80 WARRANTY

A. General project warranty and correction period, as required in general conditions and Division 1, requires repair or replacement of materials or systems which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Acceptable manufacturers and products: Those listed in the UL Fire Resistance Directory for
the UL System involved, or rated for the application by Warnock Hersey or by another
acceptable rating agency.

2.20 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Provide systems or devices listed and labeled by a rating agency, and conforming to the
construction type, penetrant type, annular space requirements and fire rating involved in each
separate instance. The system shall be symmetrical for wall applications. Systems or devices
shall be asbestos-free.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent
property of the system, or by the use of a separate product included as a part of the rated
system or device, and designed to perform this function.

2.22 SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for
through-penetration firestopping in fire-rated construction is acceptable, provided that the
system includes the specified smoke seal or will provide a smoke seal. The length of time of
the fire resistance may be disregarded.

2.70 ACCESSORIES

A. Fill, void or cavity materials and forming materials: Classified for firestopping use, or included
in a rated firestopping assembly, by a rating agency.

PART 3 - EXECUTION

3.02 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed
and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of
materials.

2. Do not proceed until unsatisfactory conditions have been corrected.

3.05 PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose
materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire
resistance.

3.20 INSTALLATION

A. Provide firestop devices or assemblies for every opening and penetration in floors or fire-rated
construction.

B. Install penetration seal materials in accordance with printed instructions of the rating agency
and in accordance with manufacturer’s instruction.

C. Ensure an effective smoke barrier in each sealed penetration. Install smoke stopping as
specified for firestopping.
D. Protect materials from damage on surfaces subject to traffic.

E. Where large openings are created in walls or floors to permit installation of pipes, conduits, cables, or other items, close unused portions of opening with firestopping material tested for the application.

3.60 FIELD QUALITY CONTROL

A. Examine penetration seals to ensure proper installation before concealing or enclosing them.

B. Keep areas of work accessible until inspection and acceptance by applicable authorities.

C. Before substantial completion, patch and repair firestopping cut or penetrated by other construction work.

3.70 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

END OF SECTION
SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Requirements applicable to work of more than one Section of Division 16.
B. Electrical identification.
C. Testing wiring systems.

1.14 RELATED SECTIONS

A. Cutting and patching: Section 01731.
B. Operation and Maintenance Manuals: Section 01770.
C. Painting: Division 9.

1.21 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Listing and labeling (third-party certification): Where products and assemblies are required to be listed or labeled, or both, by an independent, nationally recognized testing and labeling agency, such agencies, as defined in 29 CFR 1910, shall be recognized by the authority having jurisdiction and typically include ACIL, ITS, and UL.

1.26 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed on the basis of using the particular manufacturers' products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.

2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that make their use impractical or cause functional fit, access, or connection problems.

D. The contract drawings are generally diagrammatic, and do not indicate all fittings or offsets in conduit or all pull boxes, access panels, or other specialties required.
1. Install conduit exposed to view parallel with the lines of the building and as close to walls, columns, and ceilings as may be practical, maintaining adequate clearance for access at parts requiring servicing.

2. Install conduit a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.

3. No conduit shall be run below the head of a window or door.

4. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

1.30 SUBMITTALS

A. General: Comply with Section 01330.

B. Test reports: Show that tests specified in Part 3 below demonstrate the specified results.

1.40 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the electrical, building, fire, and safety codes and regulations of the state, county, or city in which the work is performed.

B. Electrical control panels, equipment, materials and devices provided or installed as work of Division 16 shall bear UL label, or, if UL label is not available, the item shall be tested and labeled by a nationally recognized testing agency, acceptable to authorities having jurisdiction, and in accordance with NEC. Provide testing, if required, without addition to the contract sum.

PART 2 - PRODUCTS

2.10 MATERIALS

A. Plywood: PS-1, fire-retardant treated, grade B-D with exterior glue and one finished side.

B. Nameplates: Laminated plastic, engraved, white letters on black background, except where other colors are noted or specified.

1. Size: Minimum 0.75 inch (19 mm) by 2.5 inches (64 mm).

2. Letter size: Minimum height 0.1875 inch (5 mm).

3. Fasteners: Vandalproof brass screws or rivets.

C. Aircraft cable: 0.25-inch (6-mm) steel wire rope, galvanized, construction 7 by 19 strands, minimum 7000 lbs (31138 N) breaking strength.

2.21 DATE-SENSITIVE EQUIPMENT

A. Date-sensitive equipment: Systems, equipment, or components which use or process date and time data in order to perform their functions.
B. Each item of date-sensitive equipment used in the project shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

PART 3 - EXECUTION

3.03 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Manufacturer's instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturer's instructions and recommendations applicable to the project conditions.

1. Immediately notify Engineer if a difference or discrepancy is found between manufacturer's instructions and the drawings or specifications.

3.59 IDENTIFICATION

A. Items to be identified include, but are not limited to:

1. Starters.
2. Panelboards.
3. Disconnects.
4. Other appurtenances including receptacles other than 120-V.

B. Identify function, equipment served, and area served.

3.61 TESTS

A. During the progress of the work and after completion, test the branch circuits and distribution system, and the low voltage alarm and signal systems.

B. Results of the tests shall show that the wiring meets the requirements of this specification. Should any test indicate defect in materials or workmanship, immediately repair, or replace with new, the faulty installation, and retest the affected portions of the work.

C. Furnish equipment and instruments necessary for testing.

D. Tests shall demonstrate the following:

1. Lighting, power, and control circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. The resistance to ground of each non-grounded circuit is not less than one megohm.
4. Circuits are properly connected in accordance with the applicable wiring diagrams.
5. Circuits are operable. Demonstration shall include functioning of each control not less than ten times, and continuous operation of each lighting and power circuit for not less than 0.5 hour.
E. Test circuit breakers larger than 100 amps at full voltage.
F. Make voltage built-up tests with a voltage sufficient to determine that no short circuits exist.
G. Immediately repair defects and retest until systems are operating correctly.
H. Submit test reports.

3.81 OPERATING INSTRUCTIONS

A. Furnish the necessary technicians, skilled workers, and helpers to operate the electrical systems and equipment of the entire project for one 8-hour days.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions for use by instructors and Owner personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Engineer.

END OF SECTION
SECTION 16055
ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Extent and location of demolition are shown on the drawings.

1.14 RELATED SECTIONS

A. Demolition: Section 01732.

1.30 SUBMITTALS

A. General: Comply with Section 01330.

B. Shop drawings: Demolition and removal procedures and schedules.

C. Project record documents:
   1. Record drawings.

1.40 QUALITY ASSURANCE

A. Demolition shall be carried out as expeditiously as possible, in accordance with accepted practice and applicable building code provisions.

1.60 PROJECT CONDITIONS

A. If, in the course of the work, workers unexpectedly encounter a material not identified for special removal but which they suspect to be asbestos, to contain lead or PCBs, or to present some other hazard:
   1. Promptly notify the Owner and Engineer in writing.
   2. Do not perform any work which would disturb the suspected material until written instructions have been received.

B. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.

C. Locate, identify, and protect mechanical and electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.05 PREPARATION
A. Protect existing building and equipment that is to remain, particularly to prevent entry of either dust or water. Assure weathertightness at all times. Keep materials on hand to patch and maintain protection.

3.20 DEMOLITION

A. Comply with demolition and disposal requirements of Division 1.

B. Perform removal work neatly with the least possible disturbance to the building.

C. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during removal operations.

D. Demolish, remove, demount, and disconnect inactive and obsolete conduit, fittings and specialties, equipment, and fixtures.

1. Conduit and ducts embedded in floors, walls, and ceilings may be abandoned in place if they do not interfere with new installations. Cut back to at least one inch below finished surface.

2. Remove materials above accessible ceilings.

3. Disconnect and cap items to remain behind finished surfaces.

4. Patch and repair surface materials as required in Section 01731, Cutting and Patching.

E. Remove the anchors, bolts, and fasteners associated with conduit and equipment to be removed.

3.24 DISPOSAL

A. Dispose of equipment and materials removed, and rubbish and waste material, as work progresses. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily.

END OF SECTION
PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Grounding electrical systems and equipment.
B. Ground system test.

1.30 SUBMITTALS

A. General: Comply with Section 01300.
B. Product data: Ground rods and connections.
C. Certifications: System test.

PART 2 - PRODUCTS

2.10 MATERIALS

A. Ground wire, unless specifically noted otherwise, shall be copper, 98 percent conductivity, solid for No. 10 and smaller and stranded for No. 8 and larger.
B. Ground rods: Copper bonded steel, 0.75 inch diameter by 10 feet long, one end pointed and the other end tinned, equal to the product of ITT Blackburn Co.
C. Mechanical type ground connectors: Equal to Burndy G Series, of a type to suit the condition.
D. Joint connectors: Equal to "Cadweld," manufactured by Erico Products Co.
E. Bolted connectors shall have a minimum of two bolts secured with "ENDURA" bolts and lockwashers.

PART 3 - EXECUTION

3.21 INSTALLATION, GENERAL

A. Provide the complete grounding of conduit systems, electrical equipment, conductor and equipment enclosures, motors, transformers, and neutral conductors in accordance with applicable codes. Grounded neutral conductors shall be continuously identified. Continuity of metal raceways shall be insured by double locknuts.
B. Furnish and install main grounds for secondary electrical service to cold water main in accordance with NEC requirement. In addition to the cold water ground, provide ground rods as indicated or as required by NEC and applicable codes.
C. Install copper grounding jumpers of 3/0 copper cable around each main water valve in the building. Install copper grounding jumpers around conduit expansion fittings. Jumpers shall be of adequate current carrying capacity corresponding to size of conduit.
D. Ground system connections which are beneath the floor and in a concealed or inaccessible location shall be brazed or welded. Brazing and welding shall be "CADWELD."

E. The secondary neutral of each load center transformer shall be grounded with a copper conductor in PVC conduit, to the nearest 1.5 inch or larger cold water pipe.

3.61 GROUNDING SYSTEM TEST

A. Ensure that grounding system is continuous and that resistance to ground is not more than 10 ohms.

B. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground.

C. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall.

D. Submit written results of each test including location of rods as well as resistance and soil conditions at time measurements were made.

END OF SECTION
SECTION 16120

WIRES AND CABLES

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Wire and cable.

1.14 RELATED SECTIONS

A. Supports: Section 16050.

B. Conduits: Section 16131.

C. Surface metal raceways: Section 16138.

1.30 SUBMITTALS

A. General: Comply with Section 01330.

B. Product data:

1. Each type of wire and cable, including accessories.

2. Include copies of UL certifications showing compliance with requirements in "Quality Assurance" below.

1.40 QUALITY ASSURANCE

A. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70 Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Products and installation shall comply with NFPA 70 and other applicable national, state, and local electrical codes.

PART 2 - PRODUCTS

2.20 LOW-VOLTAGE CONDUCTORS (600 V. MAX.)

A. Conductors: Copper, 98 percent conductivity, rated for 75 degrees C, suitable for 600 volt duty, Type THW, THWN, or THHN, solid for No. 10 and smaller and stranded for No. 8 and larger and when specifically noted.

B. Conductor identification: Markings along outer braid denoting conductor size, type of insulation, and manufacturer's trade name, and color code. Identification shall extend to branch circuits and outlets. Use the color coding system tabulated below throughout the building's network of feeders and circuits, and as a basis for balancing the load. Use color coding for emergency wiring as follows but clearly tagged in all outlets, fixtures, and as appropriate.

1. Colors on conductors No. 10 and smaller: Solid colored insulation.
2. Colors on conductors No. 8 and larger: Colored tape wrapped a minimum of 6 inches (150 mm) on either end of conductor.

<table>
<thead>
<tr>
<th>COLOR CODE</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>120-V, 2 wire</td>
<td>NEUTRAL</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>208Y-120-V, 3-phase, 4-wire</td>
<td>White</td>
<td>Black, Red or Blue depending on phase</td>
<td></td>
</tr>
<tr>
<td>480/277-V, 3-phase, 4-wire</td>
<td>Gray</td>
<td>Brown</td>
<td>Orange</td>
</tr>
</tbody>
</table>

C. Wires used solely for grounding purposes shall be green, if insulated. Isolated ground conductors shall be green with a yellow strip.

D. Control wiring shall be coded with colors different from those used to designate phase wires.

2.21 WIRING ACCESSORIES

A. Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service where installed.


C. Compression taps: Series CT-2 tap with CT-2C cover, or Series 54710 color-keyed compression taps, Burndy Corporation "Versitap" or equal by OZ/Gedney.

D. Make splices in underground junction boxes with waterproof splice kits.

E. Power distribution blocks: Equal to FC1 Burndy "U-Blok."

2.25 CABLE (MC)

A. Metal-clad cable: Type MC copper 600-V multiconductor with ground conductor. Solid copper No. 10 and smaller, stranded copper No. 8, conforming to ASTM B 3 or B 8.

B. Fittings: Steel or malleable iron.

PART 3 - EXECUTION

3.20 INSTALLATION, GENERAL

A. Provide wiring indicated in accordance with national, state, and local electric codes.

B. Wire and cable not installed in raceways:

1. Support from building structure; do not support from ceiling supports, ceilings, or other utilities.

2. Support no less than every 4 feet (1220 mm).
3.21 INSTALLING INTERIOR WIRING

A. Sizes and locations: Minimum sizes unless otherwise indicated on the drawings.
   1. 120-V branch circuits, except as specified below:
      a. Homerun from first outlet to panel: No. 12 when run is 50 feet (15000 mm) or less;
         No. 10 when run is more than 50 feet (15000 mm).
      b. First outlet to other outlets: No. 12.
   2. Any system: Minimum No. 12 unless specified or shown on drawings to be smaller.

B. Splicing shall be done in outlet boxes and junction boxes and not in conduit.
   1. Conductors No. 8 and larger: Terminated, spliced and taped, wherever practical, with
      compression connectors or solderless connectors. Use tools recommended by the
      manufacturer.
   2. Splices in conductors No. 10 and smaller, including lighting fixtures: Made with wire
      connectors.
   3. Taps in conductors No. 6 and larger: Made with compression taps.

C. Wiring over boilers and in other high ambient temperature areas shall be of types required by
   NEC.

D. Circuit numbers shown on drawings indicate quantity only. Connect loads to panels so that
   loads are evenly balanced on all phases equally. Wires shall be neatly shaped in panels,
   troughs, boxes, and appurtenances.

3.22 COORDINATION WITH DEVICES AND EQUIPMENT

A. Where conductor size or parallel conductors shown on drawings connect to terminals on
   devices or equipment which is not sized for the connection:
   1. Provide a junction box as near the equipment as possible but no more than 10 feet (3 m)
      away. Obtain approval of location before installing.
   2. Provide conductor(s) sized to the ampacity of the equipment, from equipment to junction
      box.
   3. In the junction box, splice the conductors from the equipment to the conductors of sizes, or
      parallel conductors, shown on the drawings.

3.23 INSTALLING EXTERIOR WIRING

A. Exterior 600 V circuits: Copper, No. 10 minimum, with an extra No. 10 (minimum) bare copper
   ground conductor.

3.25 INSTALLING CABLE (LOW VOLTAGE - BELOW 100 VOLTS)

A. Cable shall be installed in conduit raceways in walls, concrete floors, above inaccessible
   ceilings, where exposed and wherever it may not be accessible or may be subject to physical
damage. Otherwise, it shall be installed above accessible suspended ceilings and attached to building structure with approved standoff insulated clamps.

B. Cable routes shall avoid hot utilities which might adversely affect the system's performance or result in damage to the cable. If cable must be placed close to such utilities, keep it separate and protect with insulation.

C. Do not run cable in hangers used for pipes, electric conduits or ceiling hangers, nor support it in any way by attachments to pipes, conduits or ceiling hangers.

D. Separate conduit systems shall be used for each low-voltage system.

E. Each cable run shall contain an S loop or other means to accommodate expansion or contraction as required.

F. Cable bends shall have a radius not less than the value recommended by the cable manufacturer.

G. Tag cables connected to electronic equipment, to show function and the location of other end. Labels shall be securely fastened to the cable.

H. Where ceiling plenums are used for passage of air by heating and air conditioning system, install low voltage cables and wiring in conduit or use UL listed plenum cable.

3.26 INSTALLING MC CABLE

A. Install in compliance with the NEC.

B. Locations: In drywall partitions and above ceilings. Do not install in masonry partitions or walls.

C. Connect cable with wiring accessories specified above.

D. Cable larger than No. 8 shall not be permitted.

E. Homerun from panelboard to first junction box: Wire in EMT or IMC raceway.

END OF SECTION
SECTION 16131

CONDUITS

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Conduit and accessories, above ground.

1.14 RELATED SECTIONS

A. Firestopping: Section 07840.

B. Boxes: Section 16134.

1.22 REGULATORY REQUIREMENTS

A. Install conduits and raceways in hazardous areas in accordance with applicable requirements of NEC Article 500 through 516 for Commercial Garages, Gasoline Dispensing and Service Stations, Acetylene Bulk Storage, Paint Spray Finishing Processes.

1.30 SUBMITTALS

A. General: Comply with Section 01330.

B. Product data: Each type of conduit included in the work, and related fittings, accessory materials, hangers and fasteners.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

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

B. Steel conduit and tubing:

   Allied Steel Conduit
   Crouse-Hinds Distribution Equipment
   Pyle-National Company

C. Steel conduit fittings:

   Thomas & Betts Corporation.
   Efcor Family of Companies.
   American Electric Company; Construction Materials Group.
   Emerson Electric Co.; Appleton Electric Co.
   Hubbell, Inc.; Killark Electric Manufacturing Co.
   O-Z/Gedney; Unit of General Signal.
   Scott Fetzer Co.; Adalet-PLM.
   Spring City Electrical Manufacturing Co.

D. Nonmetallic conduit, tubing and fittings:

   Arnco Corp.
   Cantex Industries; Harsco Corp.
Certainteed Corp.; Pipe and Plastics Group
George-Ingraham Corp.
Lamson & Sessions; Carlon Electrical Products

E. Wiring troughs and fittings:

Hoffman Engineering Co.
Keystone/Rees, Inc.
Square D Company

F. Conduit hangers:

American Electrical "Kindorf"
Unistrut
Fee and Mason
Grinnell

G. Fasteners:

Caddy Fasteners by Erico Products Inc
ITT Phillips

2.20 CONDUIT AND FITTINGS

A. Galvanized steel conduit: Hot-dip galvanized with threads galvanized after cutting, one of the following:

1. Rigid full weight, heavy-wall steel conduit (RGS) conforming to UL 6 and ANSI C80.1.
2. Intermediate steel conduit (IMC) conforming to UL 1242 and ANSI C80.6.

B. Steel conduit fittings: Cast malleable iron fittings with smooth finish and full threaded hubs. Include steel or malleable iron locknuts, bushings, and other fittings.

1. Insulating bushings: Equal to Thomas and Betts Series 22.
2. Hub fittings with recessed sealing ring and nylon insulated throat equal to Thomas and Betts Series 370.
3. Fittings for exposed locations: Conduit outlet bodies, zinc or cadmium plated.

C. Electrical metallic tubing (EMT): Hot-dip galvanized or sherardized thin-wall steel conduit conforming to UL 797 and ANSI C80.3.

D. Connectors and couplings for EMT: Concrete- or rain-tight, compression or set screw type, made of cadmium plated steel with nylon insulating throat, equal to Thomas & Betts Series 5031, 5123 and 5120.

E. Flexible metal conduit: Made of sheet metal strip, interlocked construction, conforming to UL 1.

F. Liquidtight flexible metal conduit shall conform to UL 360.

G. Connectors for flexible metal conduit: Equal to angle wedge "Tite-Bite" with nylon insulated throat, Thomas & Betts Series 3110 and 3130.
H. Liquid tight type connectors: UL, File #14814A. Fittings: With nylon insulated throat, equal to Thomas & Betts Series 5331.

I. Plastic conduit: Polyvinyl chloride (PVC) Type 40, rated for use with 90-degree conductors, for exposed, underground, and encased applications, complying with NEMA Specification TC-2, UL 651, and ANSI C33.91.

J. Plastic conduit fittings and cement:
   1. Fittings: Complying with NEMA TC 3, UL 514, and ANSI C33.91.
   2. Cement: Solvent cement made by the manufacturer of the conduit and fittings.

K. Wiring troughs: Steel wiring trough with hinged cover, UL listed as wireways and auxiliary gutters, equal to Square D "Square-Duct."
   1. Cover: Opening complete width and length of trough;
   2. Finish: Baked enamel.

L. Fittings for wiring troughs: Made with removable covers and sides to permit installation of a complete system with access to wires throughout the system, UL listed with the troughs. Connections: Threaded screws at every connector.

M. Weatherproof expansion fittings: With bonding jumpers, equal to OZ/Gedney types AX and TX.

2.21 ACCESSORY MATERIALS

A. Pull rope: Equal to Graybar Electric Co., Inc., "Pro-Pull": Polypropylene, minimum 0.1875 inch (5 mm) thick, tensile strength 800 lbs (3559 N), work load 130 lbs (578 N).

B. Caps and plugs: Equal to Thomas & Betts Series 1470.

C. Lubricant: Equal to Ideal Industries, Inc. "Yellow 77". UL approved.

D. Bituminous protective coating: Coal tar based, self-priming on steel, applied in a wet film thickness at least 22.0 mils per coat; equal to 46H-413 "Hi-Build Tnemec-Tar" manufactured by Tnemec Company, Inc.

E. Rust inhibitive paint: Alkyd based, equal to Benjamin Moore "Retardo" 163, white or yellow, applied in a wet film thickness of at least 2.9 mils.

F. Conduit seals: Sealing fittings, meeting requirements of NFPA 70 and designed for their locations and classifications.
   1. Sealing compound: UL listed, supplied with the fitting or factory-sealed in the fitting, and specified by the manufacturer for the intended location.

2.23 CONDUIT HANGERS

A. Adjustable hangers: Equal to Kindorf C-149 lay-in hanger or C-150 Clevis hanger.

B. Trapeze hangers: Constructed of channels with Kindorf C-105 notched steel straps.

C. Channels: Steel, 1.5 inches (38 mm) wide with 7/8-inch (22-mm) continuous slot, gauges and weights equal to Kindorf 900 series.
D. Beam clamps: Equal to Kindorf E-160 or E-230 adjustable type, for connecting hanger rod to steel beam.

E. Hangers for conduit 1.0 inch (27 mm) and smaller, through or below bar joists: "Hang-on" hangers attached to joists with Minerallac scissor clips or two-piece stud clips.

F. Finish: All hangers, assemblies, plate washers, rods, locknuts, channels, bolts, and appurtenances shall be hot-dip galvanized.

2.24 FASTENERS

A. General: Select fasteners such that load applied does not exceed one-fourth of manufacturer's load capacity in 3500 psi. (24000 kPa) concrete.

B. Fasteners to concrete: Self-drilling type expansion anchors, or machine bolt drop in anchors for drilled holes, equal to ITT Phillips "Red Head". Fasteners to concrete ceilings shall be vibration- and shock-resistant.

C. Fasteners to drywall or cavity wall: Equal to ITT Phillips "Red Head" toggle bolts, hollow wall drive anchors, or nylon anchors as required.

PART 3 - EXECUTION

3.20 INSTALLATION, GENERAL

A. Provide complete, separate and independent raceway system for each of the various wiring systems including, but not limited to, the following:

   Power

B. Wire all raceway systems completely, except where otherwise indicated, as shown on drawings and as required for satisfactory operation of each system.

C. Where wiring troughs are required or used to facilitate the installation, amply size them to accommodate conductors, in accordance with the NEC.

D. Types and locations of conduits are scheduled at the end of the section.

E. Where conduit penetrates floors or fire-rated construction, penetrations shall be firestopped as specified in Section 07840, Firestopping.

F. Do not install conductors or pull rope during installation of conduit.

G. Where conduit is connected to a cabinet, junction box, pull box, or auxiliary gutter, protect the conductors with an insulating bushing. Provide locknuts both inside and outside the enclosure. Where conduit is stubbed up to above ceilings for future wiring, close ends with bushings.

H. Bituminous protective coating:

1. Coat exposed threads on steel conduits in concrete slabs at couplings and fittings, after joints are made up.

2. Coat metallic conduits below grade not in concrete, and where emerging from below grade or slabs, four inches above and below grade or slab.

I. Rust-inhibitive paint:
1. Exposed threads of exterior conduit.

2. All unfinished metal components.

J. Make turns in conduit runs with manufactured elbows or using machines or tools designed to bend conduit. Turns shall be not less than the various radii permitted by NEC.

K. Sizes:

1. Do not use conduit smaller than 0.75 inch (21 mm), except where otherwise indicated.

2. Feeder conduits shall be as large as indicated, or as required by NEC (whichever is larger). Do not install more than one feeder in a single conduit.

3. Conduit sizes shown on drawings are based on Type THW wire.

L. Make vertical runs plumb and horizontal runs level and parallel with building walls and partitions.

M. Ground conduits as required by the NEC.

N. Where conduits pass through building expansion joints, and wherever relative movement could occur between adjacent slabs, equip with weatherproof expansion fittings and bonding jumpers.

O. Where conduits through roof cannot be installed inside equipment or pipe curbs, flash them in accordance with the SMACNA Architectural Manual.

1. Coordinate flashing details and materials with manufacturer and installer of roofing system.

2. Pitch pockets are not permitted.

P. Run conduits concealed in new construction, except where connecting to surface-mounted cabinets and equipment in electrical distribution and mechanical equipment spaces. Install conduit above suspended ceiling, and within walls and partitions. In slab on grade, install conduit above vapor barrier. Slab shall be depressed for feeder conduits. Maintain at least two inches of concrete above conduits installed in slabs.

Q. Immediately after each run of conduit is completed, test it for clearance, smooth the joints, and close at each end with caps or plugs to prevent entrance of moisture or debris.

R. Conduit installed outdoors or at indoor locations exposed to continuous or intermittent moisture shall provide a liquidtight seal. Use steel or malleable iron hub fittings. Coat exposed threads with bituminous protective coating.

S. Install no conduit in these locations:

1. Setting beds for terrazzo or tile.

2. Concrete toppings, unless specifically approved by Structural Engineer.

3.21 INSTALLING PULL BOXES, JUNCTION BOXES, OUTLET BOXES

A. Install as specified in Section 16134, Boxes.
B. Install pull or junction boxes in long runs of conduits or where necessary to reduce the number of bends in a run.

1. Select inconspicuous locations. Do not install until locations have been approved by the Engineer.

2. Install boxes flush with wall or ceiling surfaces, with flat covers. Where removable ceiling units are used, locate boxes above ceilings.

C. Verify door swings before locating switch outlets.

3.22 INSTALLING FLEXIBLE CONDUIT

A. Installation shall comply with NEC Articles 350 and 351.

1. Minimum length: Two feet (610 mm).

2. Maximum length: Six feet (1830 mm).

B. Make immediate connections to equipment in suspended ceilings with flexible metal conduit. Include sufficient slack to permit removal of equipment.

C. Make immediate connections to motors and transformers with liquidtight flexible conduit. Include sufficient slack to reduce the effects of vibration.

D. In wet locations, install liquidtight type, in such a manner that liquids tend to run off the surface and not drain toward the fittings.

E. Where fittings are brought into an enclosure with a knockout, install a gasket assembly consisting of an O ring and retainer on the outside.

3.23 INSTALLING PULL ROPE AND CONDUCTORS

A. After conduit is installed, fish pull rope. After completion of the work of this project, pull rope shall remain in conduits identified as to be left empty.

B. Do not use a pull rope that has a tensile strength of more than one of the conductors of a two-wire circuit, more than two of the conductors of a three-wire circuit, or more than three of the conductors of a four-wire circuit.

C. Do not pull conductors into the conduits until the system is entirely completed and wet building materials are dry.

D. Use only an approved lubricant for pulling wires.

3.25 INSTALLING CONDUIT HANGERS

A. Single runs of overhead conduits 1.25-inch (35-mm) size and larger shall be supported by adjustable hangers, using 0.375-inch (10-mm) rods for conduits up to 2.0 inch (53-mm) size and 0.5-inch (13-mm) rods for conduits larger than 2.0 inches (53 mm).

B. Support groups of conduits run in parallel on trapeze hangers suspended from 0.5-inch (13-mm) hanger rods.

C. Space hangers not over 10 feet (3 m) apart.
D. Below bar joist construction, support hangers from a length of structural channel, welded to the top chords of at least two joists.

E. Where large numbers of conduits are grouped together, stagger individual hangers so as not to concentrate the load on a few joists.

F. Where hanger rods are attached to structural beams, use adjustable beam clamps.

G. Below precast plank construction, hanger rods shall pass through the precast planks and be secured on top side with nut, locknut and plate washer. Plate washers shall be at least 4 inches (102 mm) square and 0.125 inch (3.2 mm) thick. Top of hanger assembly shall be concealed in the concrete fill which will be placed over the planks.

H. Attach hanger rods to concrete with expansion bolts and anchors.

3.27 CONDUIT IN EXISTING BUILDING

A. Remove superfluous electrical equipment and cap outlets not being used, as specified in Section 16055, Electrical Demolition.

B. In existing areas that are being renovated it is the intent to show on the drawings what the finished areas will contain when completed. Except as specified otherwise, reuse existing conduit, and outlet boxes where they meet specifications and code requirements. Replace existing products or materials which are not suitable for reuse as determined by the Engineer.

C. Suitably cap superfluous concealed outlets, and remove unused wire. Remove superfluous raceways exposed in finished areas, and abandon superfluous raceways concealed in walls.

D. Install wiring in existing building concealed wherever possible above ceilings, in new walls, and in existing furred spaces. In secondary rooms, such as storerooms, install in EMT. Install exposed raceways on existing wall as specified in Section 16138, Surface Raceways.

3.90 SCHEDULE OF LOCATIONS

A. IMC with screw joint couplings:
   1. Conduits 2.0 inch (53-mm) size and larger except as noted above to be rigid steel.
   2. Wiring to exterior equipment.
   3. Conduits in electrical, mechanical, and boiler room.

B. Option RGS or IMC:
   1. In exterior walls.

C. EMT:
   1. Sizes 1.5 inch (41 mm) and smaller except as noted above.

END OF SECTION
SECTION 16132
CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.11 SECTION INCLUDES
   A. Indoor enclosures.
   B. Weatherproof enclosures.

1.14 RELATED SECTIONS
   A. Equipment foundations: Section 16072.

1.30 SUBMITTALS
   A. Comply with Section 01330.
   B. Product data: Each type of enclosure required for the project.

PART 2 - PRODUCTS

2.11 INDOOR ENCLOSURES
   A. Type 1 in accordance with NEMA 250 and conforming to UL 57, of size required by NEC to fit equipment or as shown on the drawings.
   B. Construction: Code grade galvanized steel.

2.12 WEATHERPROOF ENCLOSURES
   A. Type 3R in accordance with NEMA 250 and conforming to UL 57, of size required by NEC to fit equipment or as shown on the drawings.
   B. Construction: Fabricated of 14-gauge galvanized steel, with drip shield top and smooth, seam-free sides and back.
   C. Doors: Double doors fabricated from 12-gauge galvanized steel, overlap type without center post.
      1. Door gaskets: Neoprene, attached with oil-resistant adhesive and held in place with steel retaining strips.
      2. Full-length piano hinges.
      3. Locks: Keyed, with all keys alike. Provide two keys with each enclosure.
   D. Provide steel channels in rear of cabinet for mounting metering equipment.

2.13 FINISHES
   A. Satin gray enamel, inside and out.
PART 3 - EXECUTION

3.20 INSTALLATION

A. Securely attach enclosure to wall, set on housekeeping pad, or hang on frame, as indicated.

3.21 LOCATIONS

A. Provide indoor type inside building and weatherproof type in exterior locations.

END OF SECTION
SECTION 16134
BOXES

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Boxes with covers.

1.14 RELATED SECTIONS

A. Conduits: Section 16131.

B. Outlet boxes where required for special systems: Provided by the equipment manufacturers of the various systems.

1.30 SUBMITTALS

A. General: Comply with Section 01330.

B. Product data: Each type of box included in the project.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The listed manufacturers and particular products are intended to set a standard for materials, quality of construction, and performance. Other products may be proposed as permitted by the provisions of the article "Product Options" in Section 01600.

B. Boxes:

Steel City
Raco, Inc.
Appleton Electric Company

C. Boxes for hazardous locations:

Crouse-Hinds Distribution Equipment
Killark Electric Manufacturing Company

2.10 MATERIALS

A. Outlet, switch, and junction boxes: Sherardized or galvanized stamped, or cast-steel or cast-aluminum, where required for hazardous or weather-exposed locations.

2.20 MANUFACTURED UNITS

A. Outlet boxes in concrete construction: Octagonal, two-piece type, of sufficient depth to keep conduits not closer than 1 inch (25 mm) to surface.

B. Switch and receptacle boxes in masonry partitions and walls: Square cornered tile wall boxes 3.5 inches (90 mm) deep, or four-inch (100-mm) square boxes with raised tile wall device covers. The device covers shall be of extra depths required to suit the block or brick construction in which they are placed.
C. Switch and receptacle boxes in metal stud partitions: 4 inches (100 mm) square by 1.5 inches (38 mm) deep boxes with 0.75-inch (19-mm) raised tile wall device covers finishing flush with finished wall surface.

D. Wall- and partition-mounted outlets for low-voltage systems: Same as specified above for switches and receptacles.

E. Junction and pull boxes in feeder conduit runs: Galvanized, of size required for conduit arrangement and not less than the size required by NEC, and furnished with screwed covers.

PART 3 - EXECUTION

3.20 INSTALLATION

A. Provide box at each outlet, switch, and appurtenance. Each box shall be of a type suitable for the duty intended and shall be installed in accordance with the manufacturer's instructions.

1. In locations classified hazardous, provide cast-aluminum boxes UL listed for the service.

2. Where conduit is exposed, provide cast-steel or -aluminum boxes.

B. Coordinate locations of boxes with installation of conduit as specified in Section 16131.

C. "Through-wall" boxes: Not permitted in partitions.

D. Firmly secure the boxes in place, plumb, level and with front of device cover even with finished wall surface.

E. The boxes in metal wall stud partitions shall be securely supported by metal channels spanning between two studs and attached to same.

F. Provide a single cover plate where two or more devices are grouped together in one box.

END OF SECTION
SECTION 16138
SURFACE RACEWAYS

PART 1 - GENERAL

1.11 WORK INCLUDES
A. Surface raceway, metal.

1.14 RELATED SECTIONS
A. Conduits: Section 16131.

1.30 SUBMITTALS
A. General: Comply with Section 01330.
B. Product data:
   1. Surface raceway.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Specified manufacturers and models are the basis for design of the project. The following listed manufacturers may also provide units of acceptable quality. If units by any of these manufacturers should be proposed, verify that they meet requirements specified in the article "Product Options" in Section 01600, and submit product data as specified in the article "Submittals" above.

   Airey-Thompson Sentinel Lighting; Wiremold Company (Th).  
   Mono Systems, Inc.  
   Thomas & Betts Corp.  
   Walker Systems, Inc.; Wiremold Company (Th).  
   Wiremold Company (Th); Electrical Sales Division.

2.11 SURFACE METAL RACEWAYS
A. UL listed and meeting requirements of NFPA 70 (NEC).
B. One-piece type equal to Wiremold No. 700 as a minimum size, galvanized steel 0.04 inch (1 mm) thick, complete with fittings, connectors, and appurtenances.
C. Finish: Field paintable baked enamel, ivory.

PART 3 - EXECUTION

3.21 INSTALLING SURFACE METAL RACEWAYS
A. Install surface metal raceways in accordance with sizes as required by NFPA 70 (NEC).
B. Install each assembly as recommended by the manufacturer.
C. Attach raceway and boxes to walls and ceilings with fasteners as specified for conduits. Attach each outlet box with at least two screws. Secure one-piece raceways at no less than every four feet (1220 mm) with two-hole straps.

D. Raceway routes, mounting heights, and locations of types of outlets are shown on drawings.

E. Make raceway runs plumb and true and parallel with building and casework lines.

F. Except as otherwise shown on drawings, locate raceways in corners, adjacent to door trims, and in other ways to be inconspicuous, even when this requires additional lengths.

G. Paint raceway to match wall surface.

3.70 CLEANING AND ADJUSTING

A. Touch up surfaces damaged during installation with paint supplied by the manufacturer.

END OF SECTION
SECTION 16150

WIRING CONNECTIONS

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Power and control wiring for equipment.

1.14 RELATED SECTIONS

A. Equipment: Installed items requiring electricity, specified in other sections or shown on drawings.

B. Motors: Section 15053.

C. Control wiring: Section 15902.

PART 2 - PRODUCTS

2.10 MATERIALS

A. Conduits, wires and cables, devices, and accessories as specified in other sections.

PART 3 - EXECUTION

3.20 INSTALLATION

A. Provide power wiring from the motor starter panelboards and motor starters to each motor and its manual controlling device. Interlock and control wiring related to the automatic temperature control system shall be provided under Section 15902, Control Wiring.

1. Make flexible or liquid tight connections as specified in Section 16131, Conduits.

B. Except where provided with equipment, furnish and install manual pushbutton stations and pilot lights, with wiring. Where stations and pilot lights are grouped at central locations, mount them under a common faceplate.

C. Rough in and connect to equipment furnished under other sections. Make connections as indicated on drawings with exact locations and details determined by approved shop drawings of the equipment.

1. Under equipment sections, equipment will be set in position and the electrical devices and components furnished loose. Assemble, install, and wire under this section.

2. Accomplish rough-in from walls with flush outlet boxes and from floors by means of conduit couplings finishing flush with finished floor.

D. Certain equipment, as indicated, will be furnished with control panels and auxiliary control components. Mount the panels, furnish and install source wiring and disconnects, and completely connect controls and motors.

E. Provide source wiring, connections, and disconnects for mechanical heating, ventilating, and air-conditioning (HVAC) equipment specified in Division 15. Refer to sections of Division 15 for equipment and controls.
1. Provide weathertight enclosures for disconnects for outdoor equipment.

2. Mount starters where required, and provide proper size overload protection.

3. Where capacitors are required for power factor correction as specified in 15053, Motors, connect the capacitors.

F. Roof exhaust fans will be equipped with factory-wired disconnects located adjacent to the motor under the ventilator hoods as specified in Section 15830, Fans. Exhaust fans shall be controlled by various means as indicated on drawings.

1. For fans shown to be manually controlled, furnish and install a manual motor starting switch with pilot light, located where indicated.

2. Where necessary for larger and three-phase motors, provide magnetic starters.

3. Where fans are provided with electrically operated dampers, provide wiring and relays for single-phase damper operators on three-phase motors.

G. Cabinet unit heaters will be equipped with a manual motor starting switch with overload protection, located within the cabinet. Provide source wiring to line side of this switch. Automatic control of these units will be as described in Control Sequences.

H. Where a Division 15 section requires installation of equipment under supervision of equipment manufacturer’s representative, coordinate electrical installation to cooperate with representative’s requirements.

I. Provide power sources for Owner-furnished equipment.

END OF SECTION
SECTION 16441

PANELBOARDS

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Circuit breaker panelboards.

1.20 REFERENCES

A. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

B. NEMA PB 1, Panelboards.

C. NEMA PB 1.1, Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

D. UL 50, Enclosures for Electrical Equipment.

E. UL 67, Panelboards.

1.30 SUBMITTALS

A. General: Comply with Section 01330.

B. Shop drawings: Panelboards, with dimensioned plans, sections, and elevations. Show tabulations of installed devices, features, and voltage rating. Include:

1. Bus configuration and current ratings.

2. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

3. Wiring diagrams for power and control, differentiating between manufacturer-installed and field-installed wiring.

C. Product data: Each type of panelboard, accessory item, and component.

D. Test reports: As a minimum, date of completion of specified field quality control tests for each panelboard.

1.40 QUALITY ASSURANCE

A. UL label and local testing (if required): As specified in Section 16050, Basic Electrical Materials and Methods.

1.92 EXTRA MATERIALS

A. Furnish spare breakers for panelboards as indicated in schedule on drawings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Square D Company is the only acceptable manufacturer.

2.30 PANELBOARDS, GENERAL

A. UL listing: UL 67, listed and labeled. Panelboards for service entrance shall be listed and labeled for service entrance.

B. Integrated equipment short-circuit rating: Each panelboard, as a complete unit, shall have a short-circuit rating equal to or greater than the integrated equipment rating shown or scheduled on the drawings.

1. Rating shall be established by testing in accordance with UL 67, with the overcurrent devices mounted in the panelboard. Make short-circuit tests on the overcurrent devices and on the panelboard structure simultaneously, by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. The source shall be capable of supplying specified panelboard short-circuit current or greater.

2. Testing of overcurrent devices only while individually mounted is not acceptable. Testing the bus structure by applying a fixed fault to the bus structure alone is not acceptable.

3. Mark each panelboard with its maximum short-circuit current rating at the supply voltage.

C. Enclosures: Flush- or surface-mounted as indicated, NEMA PB 1, Type 1, UL 50, galvanized steel.

2.31 CIRCUIT-BREAKER PANELBOARDS

A. Factory-assembled complete with breakers.

B. Cabinets and fronts: Minimum 20 inches wide, wiring gutter space in accordance with UL 67, with minimum four-inch width on every side.

1. Door: Required for sizes up to and including 600 amps.

   a. Door-in-door construction, secured with a single latch, with outer door covering the gutter.

   b. Lock: Flush, cylinder tumbler type, with catch and spring-loaded stainless steel door pull. All panelboards shall be keyed alike. Provide two keys for each panelboard.

   c. Hinges: Steel, completely concealed.

   d. Provide a metal frame with clear plastic cover on the inside of the door, for the circuit directory.

C. Circuit breakers: UL 489; voltage, continuous-current rating, and interrupting rating as indicated on the drawings; bolt-on, thermal-magnetic, molded-case type with trip rating permanently indicated on the breaker.

1. Breakers shall be 1-, 2- or 3-pole, with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers.

2. Operating mechanism: Overcenter, trip-free, toggle-type with quick-make, quick-break action. Handles shall have on, off, and tripped positions.
3. Circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware or disturbing adjacent units, bars, or branch circuit connections.

4. Where indicated on the drawings, provide shunt-trip main breakers, standard main breakers, or lugs.

D. Bussing assembly and temperature rise: Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule, established by heat rise tests conducted in accordance with UL 67.

1. Conductor dimensions shall not be accepted in lieu of actual heat tests.

2. Current-carrying parts of the bus structure shall be plated copper.

3. Provide a separate ground bus with screw terminals for branch wiring and feed-through lugs.

4. Where indicated on the drawings, provide a neutral bus sized for 200 percent of the panelboard bus rating. Panels with 200 percent neutrals shall be designed for use with nonlinear loads.

E. Distribution panelboards: Distribution panelboard shall be capable of accepting up to 1200-A branch breakers. Current characteristics shall be as scheduled on the drawings.

F. Lighting and appliance panelboards: Maximum branch breaker amperage shall be 125 A.

1. Single-pole, 15 and 20 A circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

2. Branch breakers serving exit lights, fire alarm, clocks, and telephone equipment shall be provided with handle-blocking devices which shall prevent accidental operation but not prevent tripping.

PART 3 - EXECUTION

3.20 INSTALLATION

A. Securely attach panelboards to the wall where indicated on the drawings. Install in accordance with NEMA PB 1.1 and manufacturer's written installation instructions.

B. Frame and mount printed schedule of circuits indicating type and location of equipment outlets on each circuit.

C. Wiring in gutters: Arrange conductors into groups, and bundle and wrap with wire ties.

3.25 CONNECTIONS

A. Connect panelboards and components to wiring and to ground as indicated.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's values are not indicated, use those specified in
UL 486A and UL 486B.

3.59 IDENTIFICATION

A. Identify field-installed wiring and components as specified in Basic Electrical Materials and Methods.

B. Label each panelboard with engraved nameplate.

3.60 FIELD QUALITY CONTROL

A. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuit.

B. Make continuity tests of each circuit.

3.75 CLEANING

A. Clean interior and exterior of panelboards.

B. Refinish painted surfaces damaged during construction to match the rest of the panelboard.

END OF SECTION
SECTION 16460

TRANSFORMERS

PART 1 - GENERAL

1.11 SECTION INCLUDES

A. Transformers for electric power 600 V and below.
B. General-purpose transformer.

1.14 RELATED SECTIONS

A. Equipment foundations: Section 16072.

1.20 REFERENCES

A. NEMA ST 20: Dry-Type Transformers for General Applications.

1.30 SUBMITTALS

A. General: Comply with Section 01330.
B. Product data: Each transformer, complete with details.
C. Certifications: Specified sound levels of load center transformer.
D. Unit shown on drawings is based on the characteristics of the design basis unit specified in Part 2. If another acceptable manufacturer's unit should be proposed, ascertain that it will meet the required standards and performance. Include, with shop drawings of the unit, scale drawings similar to the contract drawings, showing any changes in wiring, arrangement or access made necessary to accommodate the unit proposed.

1.40 QUALITY ASSURANCE

A. UL label and local testing (if required): As specified in Section 16050, Basic Electrical Materials and Methods.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Square D/Groupe Schneider is the only acceptable manufacturer.

2.30 TRANSFORMERS, GENERAL

A. Factory-assembled and -tested, air-cooled units of types specified, of size, phase, and voltage ratings indicated on the drawings, designed for 60-Hz service.
B. Cores: Grain-oriented, nonaging silicon steel.
C. Coils: Continuous copper windings without splices except for taps.

2.31 GENERAL-PURPOSE TRANSFORMERS
A. Self-cooled, dry type of size, phase, and voltage rating indicated on the drawings, designed in accordance with NEMA ST-20.

B. Enclosure: Arranged for conduit entrance on the primary and secondary sides and provided with adequate louvered openings to allow suitable ventilation and cooling.

C. Insulation: The maximum hot spot temperature can be 30 degrees C higher than the specified average below.
   1. Transformers higher than 15 kVA: Class 220 degrees C having a maximum temperature rise under full load conditions not exceeding 115 degrees C when the transformer is operating in 40 degrees C ambient temperature.

D. Taps: Four, 2.5 percent rated kVA taps, two below and two above rated primary voltages.

E. Sound levels based on NEMA ST 20 test procedure:
   1. Transformers 150 kVA and smaller: Not more than 50 dB.
   2. Transformers of larger capacity: Not more than 55 dB.

PART 3 - EXECUTION

3.20 INSTALLATION, GENERAL

A. Mount on wall or floor as shown on the drawings.
   1. Wall mounting: Either suspended by adjustable steel hanger rods from ceiling and bolted at bottom, or fastened to the wall.
   2. Floor mounting: On equipment foundation (housekeeping pad).

B. Ground neutrals of dry type transformers as specified in Section 16060, Grounding and as required by NEC (NFPA 70).

3.22 INSTALLING GENERAL-PURPOSE TRANSFORMER

A. Protect against overload on the primary side by circuit breakers in the panels as indicated.

B. Install both wall- and floor-mounted transformers on Isomode vibration isolator pads.

C. Make immediate connections to and from transformers through flexible metal conduit

3.70 ADJUSTING AND CLEANING

A. Refinish painted surfaces damaged during construction to match the rest of the equipment.

B. Adjust taps to provide optimum voltage conditions at utilization equipment.

3.85 PROTECTION

A. Apply temporary heat within indoor transformer enclosures, in accordance with manufacturer's recommendations, until the space temperature and humidity are under normal control.