ADDENDUM NUMBER 3

CHILDREN'S COURT AND COUNTY FLEET/SHERIFF BUILDINGS
INDEPENDENT HEATING SYSTEMS
Milwaukee County Grounds
West Watertown Plank Road
Wauwatosa, WI

Project Number: O143-12436

Date of Addendum: January 28, 2013

This Addendum to the Contract Documents is issued to modify, explain or correct the original documents, dated December 21, 2012, and is hereby made part of the Contract Documents. Acknowledge receipt of this Addendum in the space provided on the Bid Form, or bid may be rejected.

BIDDING, CONTRACT DOCUMENTS, AND DRAWINGS

1. CHANGE Bid Due Date to February 1, 2013 at 2:00 P.M.

2. ADD the attached Division 26 specification sections to the project manual:
   26 05 00 Basic Electrical Requirements (7 pages)
   26 05 02 Electrical Demolition for Remodeling (3 pages)
   26 05 19 Wire and Cable (5 pages)
   26 05 26 Grounding and Bonding (5 pages)
   26 05 29 Supporting Devices (2 pages)
   26 05 33 Conduit (4 pages)
   26 05 34 Boxes (3 pages)
   26 28 16 Safety and Disconnect Switches/Enclosed Circuit Breakers (4 pages)
   26 29 00 Motor Controls (3 pages)
   Note – the added Division 26 specifications as noted above are available for viewing and/or downloading at the following Website address:
   http://county.milwaukee.gov/ConstructionBidsandR23075/Childrens-Court-and-County-Fle.htm

3. Clarification: Contractor shall be responsible for removal of all demolished equipment. The following equipment shall be turned over to the owner:
   a. Fleet Management: None
   b. Children's Court: Demolished pumps/motors P-1 and P-2, variable frequency drives.

4. Clarification: WE Energies actual charges for the gas service upgrades shall be taken out of the $60,000 allowance.

5. Sheet T001 – Project Phasing and Schedule.
   Clarification: Item 2.4: Coring of holes in lobby and roof shall be completed after 6:00 P.M. during weekdays.

6. Sheet A230 - Detail 2/A230 - Partial Roof Level, New Work Plan.
   Change new work key note #6 to #8. Cut patch & return new modified Bit roofing into existing.

7. Sheet M210 Children's Court Partial Basement Floor Plan – New Work: Contractor shall patch hole in OA intake grating (near column line 43) with a piece of 12 gauge galvanized steel. Weld to grating. Touch up welds and grating with galvanized sheet paint.

8. Sheet E150 – Electrical Schedules, Add: Motor Starter Schedule to sheet.

MOTOR STARTER SCHEDULE				
TAG	P-2 THRU P-3	P-4	P-5	P-6 THRU P-10
BUILDING	FLEET	FLEET	FLEET	FLEET
VOLTAGE	460	460	460	460
PHASE	3	3	3	3
FLA	40	3	1.6	4.8
HP	30	1.5	0.75	3
TYPE	VFD	COMB STARTER	COMB STARTER	COMB STARTER
FURNISHED BY	DIV 23	DIV 26	DIV 26	DIV 26
INSTALLED BY	DIV 26	DIV 26	DIV 26	DIV 26
SIZE	HP Rated	NEMA 0	NEMA 0	NEMA 0
ENCLOSURE	NEMA 1	NEMA 1	NEMA 1	NEMA 1
DISCONNECT	INTEGRAL/FUSED	30 A	30 A	30 A
FUSES	PER VFD SUPPLIER	INTEGRAL	INTEGRAL	INTEGRAL
ACCESSORIES	SEE SPEC	HOA	HOA	HOA

9. Sheet E210 – Children's Court Partial Basement Floor Plan - Electrical Demolition:
Add: Demo work general note #2 to demo work general notes.
#2. Electrical Contractor shall maintain temporary lighting in Mechanical Room.

10. Sheet E250 – Electrical Schedules, Add: Motor Starter Schedule to sheet.

MOTOR STARTER SCHEDULE			
TAG	P-1 THRU P-2	P-3 THRU P-4	P-5 THRU P-6
BUILDING	CHILDREN'S	CHILDREN'S	CHILDREN'S
VOLTAGE	460	460	460
PHASE	3	3	3
FLA	21	4.8	1.1
HP	15	3	0.5
TYPE	VFD	COMB STARTER	COMB STARTER
FURNISHED BY	DIV 23	DIV 26	DIV 26
INSTALLED BY	DIV 26	DIV 26	DIV 26
SIZE	HP RATED	NEMA 0	NEMA 0
ENCLOSURE	NEMA 1	NEMA 1	NEMA 1
DISCONNECT	INTEGRAL/FUSED	30 A	30 A
FUSES	PER VFD SUPPLIER	INTEGRAL	INTEGRAL
ACCESSORIES	SEE SPEC	HOA	HOA

End of Addendum No. 3

SECTION 26 05 00
BASIC ELECTRICAL REQUIREMENTS

1. PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Applicable provisions of Division 1 shall govern all work under this Section.

1.2. SCOPE

A. Basic Electrical Requirements, which are applicable to all Division 16 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1.3. SECTION INCLUDES

PART 1 – GENERAL
- Related Documents
- Scope
- Sections Includes
- Reference Standards
- Regulatory Requirements
- Quality Assurance
- Continuity of Existing Services and Systems
- Approved Electrical Testing Laboratories
- Sealing and Firestopping
- Intent
- Omissions
- Submittals
- Project/Site Conditions
- Work Sequence and Scheduling
- Work by Other Trades
- Salvage Materials
- Certificates and Inspections
- Operating and Maintenance Instructions
- Record Drawings

PART 2 – PRODUCTS
- Identification
- Sealing and Firestopping

PART 3 – EXECUTION
- Equipment Access
- Coordination
- Sleeves
- Sealing and Firestopping
- Housekeeping and Clean Up

1.4. REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

ANSI	American National Standards Institute
ETL	Electrical Testing Laboratories, Inc.
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
UL	Underwriters Laboratories Inc.

1.5. REGULATORY REQUIREMENTS

A. All work and materials are to conform in every detail to applicable rules and requirements of the Wisconsin State Electrical Code Volumes 1 and 2, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes and present manufacturing standards (including NEMA).

B. All Division 26 work shall be done under the direction of a currently certified State of Wisconsin Certified Master Electrician.

1.6. QUALITY ASSURANCE

A. All materials shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by OWNER, shall apply and such items shall bear those labels.

1.7. CONTINUITY OF EXISTING SERVICES AND SYSTEMS

A. No outages shall be permitted on existing systems except at the time and during the interval specified by the OWNER's project representative. Any outage must be scheduled when the interruption causes the least interference with normal business routines.

B. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.

1.8. APPROVED ELECTRICAL TESTING LABORATORIES

A. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:

Underwriters Laboratories Inc.
Electrical Testing Laboratories, Inc.

1.9. SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between conduits and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.10. INTENT

A. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.

B. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits the OWNER's intent (as determined by the OWNER Project Manager).

C. It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the OWNER's and/or Engineer's inspections, tests and approval from the commencement until the acceptance of the completed work.

1.11. OMISSIONS

A. No later than six (6) days before bid opening, the Contractor shall call the attention of the OWNER to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.12. SUBMITTALS

A. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Do not use highlighters for identification. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

B. On request from the OWNER, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

C. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

D. The submittals must be approved before fabrication is authorized.

E. Submit sufficient quantities of submittals to allow the following distribution:

Site Field Office	1 copy
Owner	2 copies

Engineer	1 copy
O&M Manuals	2 copies
Electrical Contractor	Remaining copies

1.13. PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Tools, materials and equipment shall be confined to areas designated by the OWNER.

1.14. WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate electrical schedule and operations with OWNER's Construction Representatives.

1.15. WORK BY OTHER TRADES

A. Electrical details on drawings for equipment to be provided by others is based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.16. SALVAGE MATERIALS

A. No materials removed from this project shall be reused except as specifically noted on the drawings. Materials demolished shall become the property of and shall be disposed of by the Contractor, except for items specifically requested by the Owner.

1.17. CERTIFICATES AND INSPECTIONS

A. Obtain and pay for all required inspections. Deliver originals of these certificates to the OWNER's Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

1.18. OPERATING AND MAINTENANCE INSTRUCTIONS

A. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:

Copies of all approved submittals.
Manufacturer's wiring diagrams for electrically powered equipment
Records of tests performed to certify compliance with system requirements
Certificates of inspection by regulatory agencies
Parts lists for manufactured equipment
Preventive maintenance recommendations
Warranties
Additional information as indicated in the technical specification sections

1.19. RECORD DRAWINGS

A. The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.

B. The OWNER will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all concealed conduit, or similar items.

C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.

D. At completion of the project, the Contractor shall submit the marked-up record drawings to the OWNER prior to final payment.

2. PART 2 PRODUCTS

2.1 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:

Manufacturers:
3M, STI/SpecSeal, Tremco, Hilti or approved equal.

All firestopping systems shall be by the same manufacturer.

Submittals:
Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

Product:
Firestop systems shall be UL listed or tested by an independent testing laboratory.

Use a product that has a rating not less than the rating of the wall or floor being penetrated.

Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

NON-RATED PENETRATIONS:

Conduit Penetrations:
At conduit penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

3. PART 3 EXECUTION

3.1. EQUIPMENT ACCESS

A. Install all conduit and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels with the General Contractor, making sure that access is available for all equipment and specialties.

3.2. COORDINATION

A. The Contractor shall cooperate with other trades and OWNER's personnel in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the OWNER, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

B. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

3.3. SLEEVES

A. In existing wet area floor penetrations, core drill sleeve openings large enough to insert schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, pumps, and similar waterside equipment.

B. Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.

3.4. SEALING AND FIRESTOPPING

A. Fire and/or Smoke Penetrations:
Install approved product in accordance with the manufacturer's instructions where conduit penetrates a fire rated barrier.

B. Non-Rated Surfaces:
When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.

1. Use galvanized sheet metal sleeves in hollow wall penetrations to provide a backing for the sealant. Grout area around sleeve in masonry construction.
2. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.

3.5. HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and

existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION

SECTION 26 05 02
ELECTRICAL DEMOLITION FOR REMODELING

1. PART 1 GENERAL

1.1. RELATED DOCUMENTS

1.2. SCOPE

A. Applicable provisions of Division 1 shall govern all work under this section.

1.3. SECTION INCLUDES

PART 1 - GENERAL
- Related Documents
- Scope
- Section Includes

PART 2 - PRODUCTS
- Material and Equipment

PART 3 - EXECUTION
- Examination
- Preparation
- Demolition and Extension of the Existing Electrical Work
- Cleaning and Repair
- Installation

2. PART 2 PRODUCTS

2.1. MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work as specified in the individual Sections.

3. PART 3 EXECUTION

3.1. EXAMINATION

A. Verify field measurements and circuiting arrangements as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and/or existing record documents. Report discrepancies to the Engineer and OWNER Field Representative before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2. PREPARATION

A. Disconnect electrical systems to equipment scheduled for removal.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations. In particular, all security

and safety systems must be maintained in operation at all times as required by the Owner. This includes security and safety lighting.

C. Existing Fire Alarm System: Disable system only when necessary. Obtain permission from the OWNER Field Representative and local Authority Having Jurisdiction at least 48 hours before partially or completely disabling system. Minimize outage duration. If required, make temporary connections to maintain service in areas adjacent to work area.

3.3. DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work to meet all requirements of these specifications and plan drawings.

B. If certain raceways and boxes are abandoned but not scheduled for removal, those items must be shown on the "As Built Drawings".

C. Remove, relocate, and extend existing installations to accommodate new construction.

D. Remove abandoned wiring to source of supply.

E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. This includes the extension of the circuit from the last active device to the next device in the system to be activated.

3.6 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts (if required) and broken electrical parts.

3.7 INSTALLATION

A. Install relocated materials and equipment under the provisions of other sections.

END OF SECTION

SECTION 26 05 19
WIRE AND CABLE
(Below 600 Volts)

1. PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Applicable provisions of Division 1 shall apply to all work under this Section.

1.2 SCOPE

A. Furnishing and installing required wiring including pulling, terminating and splicing.

B. Grounding and bonding conductors.

1.3. SECTION INCLUDES

PART 1 - GENERAL
- Related Documents
- Scope
- Section Includes
- Related Work
- Project Conditions

PART 2 – PRODUCTS
- General
- Building Wire
- Wiring Connectors

PART 3 - EXECUTION
- General Wiring Methods
- Wiring Installation In Raceways
- Wiring Connections and Terminations
- Wire Color
- Branch Circuits
- Emergency Circuits
- Equipment Grounds

1.4. RELATED WORK

A. Section 26 05 33 - Conduit.
B. Section 26 05 34 - Boxes.

1.5. PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire routing shown on Drawings is approximate unless dimensioned. Route wire as required to meet Project Conditions.

D. Where wire routing is not shown, and destination only is indicated, determine exact routing and lengths required.

2. PART 2 PRODUCTS

2.1. GENERAL

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

B. All conductors shall be copper.

C. Insulation shall have a 600 volt rating.

D. In mechanical rooms, light fixtures, and other high temperature applications, the insulation shall be rated 90 degrees C. Other areas shall use insulation rated 75 degrees C unless stated otherwise in other parts of these specifications and drawings.

E. All conductors must be suitable for the application intended. Conductors #10 and larger must be stranded. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:

F. All conductors terminated with crimp type devices must be stranded.

G. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.2. BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits.

2.3. WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.

B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.

C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

D. All wire connectors used in exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.

3. PART 3 EXECUTION

3.1. GENERAL WIRING METHODS

A. All wire and cable shall be installed in conduit.

B. Do not use wire smaller than 12 AWG for power and lighting circuits, 14 AWG for control wiring greater than 60 volts, or #18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.

C. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 208 volt branch circuit home runs longer than 200 feet (61 m).

D. Splice only in junction or outlet boxes.

E. Identify ALL low voltage, 600v and lower, wire per section 16195.

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

3.2. WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.

B. Place all conductors of a given circuit (this includes phase wires, neutral, and ground conductor) in the same raceway.

3.3. WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.

C. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

F. Thoroughly clean wires before installing lugs and connectors.

G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.4. WIRE COLOR

A. General:

1. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.

2. For wire sizes 8 AWG and larger - Identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.

3. In existing facilities, use existing color scheme.

B. Neutral Conductors: White for 120/208V and 120/240V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with the proper circuit.

C. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.

D. Feeder Circuit Conductors: Each phase shall be uniquely color coded.

E. Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes.

3.5. BRANCH CIRCUITS

A. The use of multi-wire branch circuits with a common neutral feeding loads is not permitted.

B. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductor.

3.6. EMERGENCY CIRCUITS

A. All emergency system wiring shall be installed in raceways separate from all other systems.

3.7. EQUIPMENT GROUNDS

A. The entire electrical system must be grounded.

B. Provide bonding conductors as required to ground electrical equipment enclosures.

C. Provide cable, bus bar, clamps and other miscellaneous equipment to properly ground the system and the equipment.

D. Grounding of the electrical system shall be provided first in accordance with the NEC by providing a continuous metallic raceway to every electrical device installed and solidly grounding the entire system to the building principal ground point.

E. Grounding of the electrical system shall be provided second by installing a separate ground wire with each feeder circuit or branch circuit whether or not shown on plans.

F. A separate green grounding conductor must be installed in flexible conduits regardless of circuit ampacity.

G. The grounding conductor shall be green insulated or in larger wire sizes where green insulation is not readily available, provide green tape for not less than 6" at every point of access to the wire.

H. Where grounding conductors are pulled, they shall be electrically bonded to the equipment enclosure at the source of power, to each enclosure through which it passes and to the apparatus being served by the electrical supply.

I. The minimum size for copper equipment grounding conductors shall be in accordance with 2005 NEC, Article 250-Table 250-122.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Scope: The work specified in this section includes providing labor, material, equipment, and services necessary for a complete grounding system as shown on the drawings and as herein specified.

B. Grounding Section Includes: The work specified in this section includes, but shall not be limited to, providing grounding of the following:

1. Metal building frames.
2. Electrical power systems.
3. Electrical metallic raceways.
4. Metal enclosures.
5. Lighting fixtures.
6. Equipment requiring power.

C. Bonding Section Includes: The work specified in this section includes, but shall not be limited to, providing bonding of the following:

1. Interior metal piping systems.
2. Metallic waste, vent, and drain piping.

1.2 DEFINITIONS

Not Applicable

1.3 CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. If the referenced publications have been revised prior to Contract award, the latest edition/revision shall be submitted for the referenced document.

C. ASTM International (ASTM)

1. ASTM B 8 – "Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft."
2. ASTM B 33 – (Revised 1985), "Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes."

D. Institute of Electrical and Electronics Engineers (IEEE)

1. ANSI/IEEE 80 – "Guide for Safety in AC Substation Grounding" (copyrighted by IEEE, ANSI approved).
2. ANSI/IEEE 81 – "Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System" (copyrighted by IEEE, ANSI approved).
3. ANSI/IEEE 142 – "Recommended Practice for Grounded of Industrial and Commercial Power Systems" (copyrighted by IEEE, ANSI approved).

E. Insulated Cable Engineers Association (ICEA)

1. ICEA 5-68-516 – "Ethylene Propylene Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy."

F. National Fire Protection Association (NFPA)

1. NFPA 70 – "National Electrical Code (hereinafter referred to as NEC).
2. NFPA 780 – "Installation of Lighting Systems."

G. Underwriters Laboratories, Inc. (UL)

1. UL ECMD – "Electrical Construction Materials Directory."
2. UL 467 – "Grounding and Bonding Equipment."
3. UL 486A – "Wire Connectors and Soldering Lugs for Use with Copper Conductors, Seventh Edition."

H. American National Standards Institute, Electronic Industries Alliance/Telecommunications Industry Alliance (ANSI/EIA/TIA), ANSI/EIA/TIA-607 Grounding and Bonding.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms shall be engaged in manufacture of grounding and bonding products, of types, sizes required, and ancillary grounding materials, including stranded cable, copper braid and bus, grounding electrodes, and bonding jumpers, and whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firms shall have at least five years of successful installation experience with projects utilizing grounding systems similar to that required for this Project.

C. Compliance: Comply with applicable local electrical code requirements, NEC, ANSI/IEEE 142, and applicable UL requirements.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data showing material proposed. Product data shall include, but shall not be limited to, the following:

1. Conductors.
2. Cables.
3. Insulators.
4. Connectors.

B. Shop Drawings: Submit complete shop drawings as required to determine acceptability. Shop drawings shall consist of a complete list of materials, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instruction. Shop drawings shall include, but shall not be limited to, the following:

1. Special fabricated components, which are not a manufactured standard product.

C. Proof of Compliance: Where materials or equipment are specified to comply with requirements of UL, proof of such compliance shall be submitted.

D. Test Reports: Submit ground testing test report as specified.

E. Operation and Maintenance Manuals: Prepare and deliver complete operating and maintenance manuals. Provide information pertinent to the equipment for preventive maintenance and for replacement of expendable components. Manuals shall include the items listed below and other information recommended by the manufacturer:

1. Cables.
2. Insulators.
3. Complete list of parts with reordering numbers.

4. Electrical characteristics of components.
5. Recommended spare parts list.
6. Complete set of shop drawings.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Materials and components shall be properly packaged, stored, and handled to prevent damage or breakage.

1.7 SPARE PARTS

Not Applicable

1.8 WARRANTY

A. The contractor shall warrant all materials, workmanship, and equipment against defects for a period of one year after the date of substantial completion. Certain equipment shall be warranted at the time of final acceptance, or for longer periods of time as specified in those sections of the project manual.

B. The contractor shall repair or replace, at no additional cost to Owner, any item that may become defective within the warranty period.

C. The repair of faulty workmanship shall be considered to be included in the contract.

1.9 MAINTENANCE

Not Applicable

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work, include, but shall not be limited to, the following:

1. Adalet-PLM Division; Scott Fetzer Co.
2. Burndy Corporation.
3. Cadweld Division; Erico Products, Inc.
4. Crouse-Hinds Division; Cooper Industries.
5. Joslyn Corporation.
6. OZ Gedney Division; General Signal Corp.
7. Thomas and Betts Corp.
8. Eritech; Erico Products, Inc.

2.2 CONDUCTORS

A. General: Grounding and bonding conductors shall be bare and insulated copper as shown on the drawings or required by other sections of this specification.

B. Conductivity: Copper conductors shall have a conductivity of not less than 98 percent at 75 degrees C. Conductor resistance values shall be in accordance with the value in ICEA S-68-516.

C. Cable Sizes: Cable sizes shall be as shown on the drawings or as required by this specification.

D. Insulation: Insulated grounding and bonding conductors shall have an insulation equal to the current carrying conductors.

2.3 CONNECTORS

A. Exothermic Welds: Exothermic welds shall be a thermite reaction system employing copper oxide and aluminum powder reaction to melt and fuse copper conductors into welded connections.

B. Ground Rod-to-Cable Connector: Connector shall be U-bold ground rod clamp. A ground rod clamp shall be bronze with stainless steel U-bolt. The connector shall have at least 1½" of contact with the ground rod and cables and accommodate at least two cables thru size No. 4/0.

C. Metal Pipe Connectors: Connectors shall be copper alloy, U-bold type.

D. Ground Bushings: Bushings shall be malleable iron, zinc plated, insulated throat with screw type wire connector.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which the work is to be installed, and notify the Architect/Engineer in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate with other work to ensure that installation is not vulnerable to physical damage.

3.3 APPLICATION

A. General: The entire electrical system and building structure shall be grounded. The following items of equipment, appurtenances, and as required by Article 250 of NEC, shall be grounded:

1. Electrical service, equipment, and enclosures.
2. Conduits and raceways.
3. Neutral and ground conductors.
4. Switches and panels.
5. Motor frames, control cabinets, and lighting fixtures.

B. All metallic conduits, supports, cabinets, and all the other electrical equipment shall be permanently and effectively grounded. All grounded shall be in accordance with the applicable code, and shall meet the approval of the local Inspection Department.

C. All metallic raceways shall be mechanically and electrically continuous. Where non-conductive raceways are installed, provided separated equipment grounding conductors bonded to pull and/or junction boxes at each end of each conduit run.

D. Furnish and install a separate equipment grounding wire with each branch circuit conduit, routed with the phase and neutral wires, NEVER in a separate conduit.

E. Equipment grounding wire to be routed in conduit along the phase and neutral wires (NEVER in separate conduit) per code and the Illinois Department of Public Health (IDPH) requirements.

F. Installation of the equipotential grounding system shall be as detailed in Article #18-27-517 (Chicago Electrical Code), in NFPA-70 Articles #517 and 660, and NFPA #99. The

required equipment and associated panels are indicated on the electrical design drawings.

G. Exothermic Welds

1. Provided exothermic welds for the following:

   a. Cable to cable (below grade).
   b. Cable to structural steel.

2. Comply with AWS Code for procedures, appearance, and quality of welds, and for methods used in correcting welding work. The manufacturer's specific instructions and molds shall be used for every weld.

H. Connectors: Provide mechanical connections for the following:

1. Cable-to-pipe
2. Cable-to-ground bus or as otherwise noted on the drawings

I. Bonding Jumpers: Bonding jumpers shall be installed where continuity of piping or metal must be maintained or as required by NEC.

3.4 INSTALLATION

A. Install grounding systems as indicated, in accordance with equipment manufacturer's written instructions and with recognized practices. Comply with applicable requirements of UL 467, UL 486A, NFPA 78 ANSI/IEEE 80, and applicable NEMA standards, to ensure that products fulfill requirements.

B. Connectors

1. Provide mechanicals connections as specified.
2. Remove non-conductive coatings such as paint, lacquer, and enamel on surfaces of equipment to be grounded.
3. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 468A to assure permanent and effective grounding.
4. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory-applied protective coatings have been destroyed, which are subjected to corrosive action.
5. No connections below grade shall be covered before inspection by the Architect/Engineer.

C. Bonding Jumpers: Install on water meters and where expansion joints or dielectric unions are used.

D. Ground Bushings: Where a conduit enters a metal enclosure without a ground bus, a ground bushing shall be provided to terminate ground conductor.

-- END OF SECTION --

SECTION 26 05 29
SUPPORTING DEVICES

1. PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Applicable provisions of Division 1 shall apply to all work under this section.

1.2. SCOPE

A. Conduit and equipment supports, straps, clamps, steel channel, etc, and fastening hardware for supporting electrical work. Included are the following:

1.3. SECTION INCLUDES

PART 1 - GENERAL
- Related Documents
- Scope
- Section Includes
- Quality Assurance

PART 2 - PRODUCTS
- Material

PART 3 - EXECUTION
- Installation

1.4. QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

2. PART 2 PRODUCTS

2.1. MATERIAL

A. Support Channel: Galvanized.

B. Hardware: Corrosion resistant.

C. Minimum sized threaded rod for supports shall be 3/8".

D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when conduit is installed on the interior or exterior surface of any exterior building wall.

3. PART 3 EXECUTION

3.1. INSTALLATION

A. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only).

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction.

C. Do not use powder-actuated or plastic anchors.

D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.

E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit.

F. Do not drill structural steel members unless approved by OWNER.

G. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. Install surface-mounted cabinets and panels with minimum of four anchors. Provide steel channel supports to stand cabinet one inch (25 mm) off wall.

I. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, walkways etc.

END OF SECTION

SECTION 26 05 33
CONDUIT

1. PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Applicable provisions of Division 1 shall govern all work under this Section.

1.2. SCOPE

A. Raceways shall be installed as a complete system continuous from service to outlet or equipment, mechanically and electrically connected, constituting a continuous ground system.

1.3. SECTION INCLUDES

PART 1 – GENERAL
- Related Documents
- Scope
- Section Includes
- Related Work

PART 2 - PRODUCTS
- Rigid Metal Conduit
- Electrical Metallic Tubing and Fittings
- Flexible Metal Conduit and Fittings
- Liquidtight Flexible Conduit and Fittings
- Conduit Supports
- General

PART 3 – EXECUTION
- Conduit Sizing, Arrangement and Support
- Conduit Installation
- Conduit Installation Schedule

1.4. RELATED WORK

A. Section 26 05 29 - Supporting Devices.
B. Section 26 05 34 - Boxes

2. PART 2 PRODUCTS

2.1. RIGID METAL CONDUIT AND FITTINGS

A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.

B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.2. ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Conduit: Steel, galvanized tubing.

B. Fittings: All steel, set screw, water tight, concrete tight. No push-on or indenter types permitted.

C. Conduit Bodies: All steel threaded conduit bodies.

2.3. FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: steel, galvanized, spiral strip.

B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 16500).

2.4. LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.5. CONDUIT SUPPORTS

See section 26 05 29.

2.6. GENERAL

A. All steel fittings and conduit bodies shall be galvanized.

B. No cast metal, split or gland type fittings permitted.

C. Condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.

D. All condulet covers must be fastened to the condulet body with screws and be of the same manufacture.

E. Wireways and gutters shall not be used in lieu of pull boxes and condulets.

3. PART 3 EXECUTION

3.1. CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. EMT is permitted to be used in sizes 4" (50 mm) and smaller. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.

B. Size power conductor raceways for conductor type installed. Conduit size shall be 3/4 inch (13 mm) minimum except as specified elsewhere.

C. Size conduit for all other wiring, including but not limited to control, fire alarm, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.

D. Arrange conduit to maintain headroom and present a neat appearance.

E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

F. Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

G. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.

H. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

I. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.

J. Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.

K. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, etc., unless so approved or detailed.

L. In general, all conduit shall be concealed except where noted on the drawings or approved by the Engineer. Contractor shall verify with Engineer all surface conduit installations except in mechanical rooms.

M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.

N. No continuous conduit run shall exceed 100 feet (30 meters) without a junction box.

3.2. CONDUIT INSTALLATION

A. Cut conduit square using a saw or pipecutter; de-burr cut ends.

B. Conduit shall not be fastened to the corrugated metal roof deck.

C. Bring conduit to the shoulder of fittings and couplings and fasten securely.

D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations (sheet metal boxes **4** & 11/16th" square and larger, shall contain NO pre-punched or concentric knockouts).

E. All conduit terminations (except for terminations into conduit bodies) shall use connectors or conduit hubs with one locknut or shall use double locknuts (one each side of box wall) and insulating bushing. Provide bushings for the ends of all conduit not terminated in box walls.

F. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.

G. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint.

H. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.

I. Where conduit passes between areas of differing temperatures such as into or out of unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.

J. Route conduit through roof openings for piping and ductwork where possible.

3.3. CONDUIT INSTALLATION SCHEDULE

A. Conduit other than that specified below for specific applications shall not be used.

B. Exposed Outdoor Locations: Rigid steel conduit.

C. Concealed Dry Interior Locations: Intermediate metal conduit. Electrical metallic tubing.

D. Exposed Dry Interior Locations: Intermediate metal conduit. Electrical metallic tubing.

E. Motor and equipment connections: Liquid-tight flexible PVC coated metal conduit (wet, damp, or dry locations). Flexible metal conduit (dry locations only). Minimum length shall be one foot (300 mm), maximum length shall be three feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

F. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Conduit size shall be 3/8" (10 mm) minimum diameter and six foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

END OF SECTION

SECTION 26 05 34
BOXES

1. PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Applicable provisions of Division 1 shall apply to all work under this Section.

1.2. SCOPE

A. Wall and ceiling outlet boxes, pull and junction boxes for power, low voltage, and fire alarm. Included are the following topics:

1.3. SECTION INCLUDES

PART 1 – GENERAL
- Related Documents
- Scope
- Section Includes
- Submittals
- Related Work

PART 2 - PRODUCTS
- General
- Outlet Boxes
- Pull and Junction Boxes

PART 3 - EXECUTION
- Coordination of Box Locations
- Outlet Box Installation
- Pull and Junction Box Installation

1.4. SUBMITTALS

A. Submit product data under provisions of Division 1 and Section 16010.

B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

1.5. RELATED WORK

A. Section 26 05 33 - Conduit
B. Section 26 05 19 – Wire and Cable

2. PART 2 PRODUCTS

2.1. GENERAL

A. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

2.2. OUTLET BOXES

A. Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.

B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.

C. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.

2.3. PULL AND JUNCTION BOXES

A. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8th inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).

B. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

C. Sheet Metal Boxes Larger Than 12 Inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover.

D. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

E. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.

F. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.

1. Wireways shall not be used in lieu of junction boxes.

G. Boxes installed inside air handling units shall be plenum rated withgasketed covers.

3. PART 3 EXECUTION

3.1. COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned.

C. No outlet shall be located where it will be obstructed by other equipment, piping, etc.

D. Boxes shall not be fastened to the metal roof deck.

E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.

F. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Engineer and install outlet as instructed by the Engineer.

G. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.

H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors.

I. Locate and install to maintain headroom and to present a neat appearance.

J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.2. OUTLET BOX INSTALLATION

A. Provide knockout closures for unused openings.

B. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.

C. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.

D. Ceiling outlets shall be 4 inch (100 mm) octagon or 4 inch square, minimum 2-1/8 inch (54 mm) deep.

G. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

H. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

I. Surface wall outlets shall be 4 inch (100 mm) square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.3. PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install OWNER approved access panels in non-accessible ceilings where boxes are installed.

B. Support pull and junction boxes independent of conduit.

END OF SECTION

SECTION 26 28 16
SAFETY AND DISCONNECT SWITCHES/ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes the following:

1. Equipment disconnects.
2. Motor-circuit disconnects.
3. Molded case circuit breaker in an individual enclosure.

1.2 DEFINITIONS

Not Applicable

1.3 CODES AND STANDARDS

A. NEMA KS-1 – Enclosed Switches

B. NFPA 70 (NEC)

1.4 QUALITY ASSURANCE

A. Comply with codes for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

C. Single-Source Responsibility: All enclosed switches and circuit breakers shall be the product of a single manufacturer.

1.5 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for switches and accessories specified in this Section.

C. Descriptive data and time-current curves for protective devices and let-through current curves for those devices with current-limiting characteristics. Include coordination charts and tables, and related data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Where recommended by the equipment supplier, deliver equipment in fully enclosed vans after specified environmental conditions have been permanently established in spaces where equipment is to be placed. The products accepted on the site shall be wrapped in factory packing and shall be inspected for damage prior to acceptance.

C. Store equipment in clean, dry with non-condensing environments that are controlled within manufacturer's ambient tolerances for non-operating equipment. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

D. Handle equipment carefully to prevent damage, breaking, and scoring. The contractor shall not install damaged units or components; replace with new.

E. Equipment furnished by others. The contractor shall be responsible for receiving, uncrating, inspecting, storing, and installing of Division 16 equipment listed as furnished by others.

1.7 SPARE PARTS

Not Applicable

1.8 WARRANTY

A. Motor and circuit disconnects and breakers shall be warranted for a minimum period of one year after project completion, or longer if manufacturer's warranty allows.

1.9 MAINTENANCE

Not Applicable

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide enclosed switches and circuit breakers by one of the following:

1. Safety Switches:
   a. General Electric
   b. Square D
   c. Cutler-Hammer
2. Circuit Breakers:
   a. General Electric
   b. Square D
   c. Cutler-Hammer

2.2 GENERAL

A. Disconnect and Safety Disconnect Switches:

1. General: Provide heavy duty surface-mounted safety switches for motors and equipment unless otherwise indicated, of types, sizes, and electrical characteristics as indicated on the electrical drawings and equipment schedules.
2. Switch Interiors: Switches shall have switch blades which shall be fully visible in the off position when the enclosure door is open. Current carrying parts shall be plated copper and switch contacts shall be silver-tungsten. Lugs shall be removable and shall be UL-listed for 75 degrees C, copper wire.
3. Switch Operator: Switches shall be quick-made, quick-break type. The operating handle shall be an integral part of the enclosure base and shall be padlockable in the off position. The handle position shall indicate whether the switch is in the on or off position.
4. Interlock Contacts: Provide two Form C auxiliary, 10 ampere, 300V rated contacts. The contacts shall provide for two normally open and two normally closed contacts for switch open or closed position.

B. Circuit Breakers:

1. All circuit breakers shall comply with NEMA ABI and FSW-C-375.

2. Circuit breakers shall be securely bolted to the enclosure and be flush with the box assembly.
3. Circuit breakers shall have over center toggle mechanism with quick-make, quick break action, common trip for all pole positions, and a handle position indicator with breaker rating imprinted in a location easily verified without removing the box cover.
4. Circuit breakers for heating, air conditioning, refrigeration and all motor loads shall be HCAR rated.
5. Circuit breaker size(s) shall be listed on the electrical plan drawings or equipment schedule.

2.3 ENCLOSURES

A. NEMA 1: Provide NEMA 1 general purpose enclosures for indoor installation unless otherwise indicated on the drawings. Enclosure covers shall be attached with pin type hinges. Enclosures shall have a gray baked enamel finish, electrodeposited on clean, phosphatized steel.

B. NEMA 3R: Provide NEMA 3R general purpose enclosures for outdoor installation unless otherwise indicated on the drawings. Enclosure cover shall be attached with pin type hinges and shall be securable in the open position. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatized steel. Provide rainproof bolt-on hubs.

2.4 RATINGS

A. General: Provide heavy duty safety switches and circuit breakers with required ampere rating.

B. Horsepower-Rated: Safety switches shall be horsepower-rated for 250, 480, and 600V, AC and DC, and shall be rated for the motor driven loads supplied by the switch.

C. Short Circuit Rating: Safety switches with Class RK1 or Class L fuses shall have a UL short circuit rating of 100,000 amperes RMS symmetrical minimum.

D. Circuit breakers shall have a UL short circuit rating of 65,000 amperes RMS symmetrical minimum.

2.5 FUSIBLE SWITCHES

A. Provide fusible disconnect switches as required.

B. Fusible disconnects rated 30 through 600 amperes shall have Class RK1 fuse clips. Refer to Division 16, Section 16491 for acceptable fuse manufacturers.

C. Disconnects rated 800 through 1200 amperes shall have Class L fuse clips. Refer to Division 16, Section 16491 for acceptable fuse manufacturers.

2.6 IDENTIFICATION

A. Each disconnect switch, circuit breaker, and shunt trip control panel shall have an engraved, laminated bakelite nameplate attached to the outside of the enclosure. The nameplate shall include the switch or breaker designation and the equipment it serves. Attach the nameplate by screws or rivets. See Division 16, Section 16050.

2.7 ELECTRICAL INTERLOCKS

A. Provide electrical interlock switches on disconnects as specified herein. The interlock switches shall open prior the opening of the power switch and close only after the power switch has been enclosed. Provide two sets normally open (NO) and normally closed (NC) switches for each disconnect.

B. Provide the necessary control wiring to the interlock switch to disconnect the control circuit from the motor controller.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches, breakers, and control panels in locations as indicated, according to manufacturer's written instructions. Comply with all applicable requirements of electrical installations and for the seismic zone of this project.

B. Install enclosures level and plumb.

C. Install wiring between enclosed switches and control/indication devices as required.

D. Connect switches, breakers, panels, enclosures, and components to wiring system and to equipment ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

E. Mounting: Mount enclosures on building structures adjacent to equipment unless otherwise noted. Enclosures shall not be mounted on equipment served, unless it is a part of a preassembled control panel. If building structure is not adjacent to the equipment, provide a separate unistrut rack with supports, clear of equipment, for mounting of switch and breaker enclosure. Conduits shall not be used for the support means.

F. Location:

1. Disconnects and breaker enclosures shall be readily accessible and shall not interfere with removal of equipment parts or with standard maintenance. Disconnects and breaker enclosures shall be installed with their top at 5½ feet above the floor unless otherwise noted on the drawings.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will employ and pay an independent testing agency to perform specified field quality-control testing.

3.3 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel on procedures and schedules for start-up and shutdown, troubleshooting, servicing, and preventive maintenance.

B. Review data in the "Operating and Maintenance Manual." Refer to Division 1 Section "Project Closeout."

C. Schedule training with Owner through the Architect with at least 7 days' advance notice.

-- END OF SECTION --

SECTION 26 29 00
MOTOR CONTROLS

1. PART 1 GENERAL

1.1. SECTION INCLUDES

A. Applicable provisions of Division 1 shall govern all work under this Section.

1.2. SCOPE

A. Combination magnetic motor starters. Included are the following topics:

PART 1 - GENERAL
- Section Includes
- Scope
- Related Work
- Coordination With Other Trades
- References
- Submittals
- Operation and Maintenance Data
- Spare Parts

PART 2 - PRODUCTS
- Magnetic Motor Starters
- Controller Overcurrent Protection and Disconnecting Means
- Fuses

PART 3 - EXECUTION
- Installation

1.3. COORDINATION WITH OTHER TRADES

A. Motors: In general, all electric motors required for this installation will be supplied with equipment, apparatus and/or appliances covered under other sections of the specifications.

B. Equipment:

1. All building utility motors such as fans, pumps, etc., together with certain "controlling equipment" for same, except motor starters and related apparatus, will be furnished under other sections of the specifications and delivered to the building site unless specifically noted otherwise.

2. The starters for these motors shall be furnished and installed by the Electrical Trade. (See Motor Schedule on Drawings.)

3. The Electrical Trade shall set and connect all specified starting equipment, install all power conduits and wiring and shall furnish and make all connections from starting equipment to motors as required to leave the apparatus in running condition.

C. Wiring Connections:

1. Furnish branch circuits for all motors to the starting equipment and then to the motors, complete with all control wiring for automatic and remote control where required or noted. Conduits to motors shall terminate in the conduit fittings on the motors, the final connection being made with flexible, liquid-tight conduit, seal-tight "UA", or as approved.

2. Provide all necessary labor and material to completely connect all electrical motors and controls (where required) in connection with the building utility equipment, including fans, pumps, etc.

3. All conduits and wiring required for control work from the holding coil circuit of the starter, including the furnishing and installation of control devices such as auxiliary contacts, control relays, pilot lights, selector switches, etc., shall be provided and installed by other trades unless otherwise indicated.

1.4. REFERENCES

ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
ANSI/UL 198E - Class R Fuses.
NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
NEMA KS 1 - Enclosed Switches.

1.5. SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 1 and Section 26 05 00.

A. Provide product data on combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

B. Submit manufacturers' instructions under provisions of Section 26 05 00 and Division 1.

1.6. OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 05 00 and Division 1.

B. Include spare parts data listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7. SPARE PARTS

A. Fuses: Furnish to Owner three (3) spare fuses of each type and rating installed.

B. Fuse Pullers: Furnish one fuse puller to Owner.

2. PART 2 PRODUCTS

2.1. MAGNETIC MOTOR STARTERS

A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower; size 0 minimum.

B. Full Voltage Starting: Non-reversing type.

C. Coil Operating Voltage: 120 volts, 60 Hz.

D. Overload Protection: bimetal or melting alloy.

E. Enclosure: NEMA Type: 1.

F. Provide manufacturer's equipment ground kit in all starter enclosures.

G. Auxiliary Contacts: NEMA ICS 2; one and normally open field convertible contacts in addition to seal-in contact.

H. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.

I. Indicating Lights: NEMA ICS 2; LED Push-to-test type. RUN: red in front cover.

J. Combination Motor Starters: Combine motor starters with fusible switch disconnect in common enclosure. Disconnect switch shall have permanent provisions for pad locking.

2.2. CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

A. Fusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class R fuses.

2.3. FUSES

A. Fuses 600 Amperes and Less: Dual element, time delay, UL Class RK 5.

3. PART 3 EXECUTION

3.1. INSTALLATION

A. Install motor control equipment in accordance with manufacturer's instructions.

B. Select and install heater elements in motor starters to match installed motor characteristics.

C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION