ELECTRICAL TABLE OF CONTENTS

SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Basic electrical Requirements specifically applicable to Division 26 & 28 Sections, in addition to Division 1 - General Requirements.

B. Information in this section is intended to clarify or make additions to the requirements set forth in the General Conditions, Supplementary Conditions and Division 1 of these specifications. Any conflict between Division 26 & 28 and those in the General Conditions or within the Division 26 drawings, Supplementary Conditions and Division 1 shall be brought to the attention of the Architect/Engineer in writing as a request for addendum prior to the bid opening.

C. Furnish all equipment, materials, articles, items, operations or methods listed, mentioned or scheduled on drawings, these specifications, manufacturer's installation instructions and include all labor materials, equipment and incidentals necessary for complete installation and operation.

D. All information contained in this section applies to all sections within Division 26 as it was part of each section.

E. Final walk-thru. Electrical Contractor shall submit in writing to the Architect's office advising that all of the Division 26 & 28 work has been completed in accordance with the plans and specifications. The intent is to acknowledge the Contractor is ready for a walk-thru. Open items that are part of the required construction work should be completed prior to the final walk-thru to avoid developing a so called construction completion list. The engineer reserves the right to reschedule the final walk-thru as determined accordingly.

F. Pre-bid questions. All pre-bid questions, clarifications, etc. must be submitted in writing to the Architect Office. All phone calls, faxes or e-mails from bidders and manufacturers, etc. directly received by the Engineers office during the bidding phase will be deferred back to the Architect Office.

G. Electrical Contractor shall review all of the project plans and specifications and not rely solely on the electrical drawings to establish a project bid. Refer to the structural and mechanical drawings for final mechanical equipment locations. Mechanical drawings shall govern over the electrical drawing locations.

1.2 LAYOUT OF THE WORK

A. Examine the site and all the drawings before proceeding with the layout and installation of this work. Verify all door swings and clearances to cabinets, etc., before locating switch and outlet boxes. Locate conduit, boxes, etc., essentially as shown on the drawings but in exact layout determined on the job to suit actual conditions. Confer and cooperate with the other trades on the job so all parts will be installed in proper

relationship. Precise locations of parts to coordinate with other work is the responsibility of the Contractor.

B. The Electrical Trades shall complete all cutting and patching for the electrical work, unless noted or specified otherwise. Division 26 & 28 Contractor shall be responsible to coordinate with the site Restoration Contractor for the new underground electrical work.

C. Arrange exposed work as closely as practicable to wall or ceiling surfaces in an accurate alignment. Locate concealed work so fittings, connectors and other projections will clear surfaces. Exposed work is defined as non-finished spaces, such as mechanical / electrical rooms or as indicated on architectural room schedules. All finished spaces, installation shall be concealed. Refer to Architectural drawing for room finish schedules.

D. During the bidding phase, if any design or discrepancy issues are discovered between the electrical drawings, specifications and other project plans, the contractor shall notify the Architect/Engineer. The intent is to resolve any issues during the bidding phase. For pertinent issues, addendums will be issued accordingly. After entering into a contract, it shall be considered there are no identified conflicts.

E. No drilling of existing laminated beams for new work is permitted without review with the project Structural Engineer

1.3 INTERFERENCES

A. The Electrical Contractor shall examine the plans of mechanical trades, the architectural and structural drawings and shall notify the Architect/ Engineer to resolve such interference or discrepancy. The Electrical Contractor bid shall not be based solely on the Electrical Plans and Specifications. Contractor shall obtain and review all project documents. The Contractor, when directed, shall make such changes or off-sets as required so that the work shall be properly located and coordinated with the other trades. Failure to comply with the foregoing will not relieve contractor's responsibilities of making such changes. Such changes shall be completed at no additional cost to the Owner.

B. All changes in location of equipment, fixtures, distribution equipment, receptacles, etc., from those shown on plans, shall be made without charge when directed by the Architect/Engineer before installation. At this time, an agreement shall be made if such a change is an additional cost to the owner.

C. The Electrical Contractor shall confer with other trades regarding location and size of pipes, equipment, fixtures, conduit, duct openings, switches, outlets, etc., in order that there may be no interference in the installation of the work of any trades or delay in the progress of any work.

D. The Electrical Contractor shall be responsible for confirming final heights with the architectural details. Architectural details shall govern final locations and mounting heights. Failure to coordinate will not relieve the contractor of making changes as required, at no cost to the owner.

E. Any changes made, necessary through failure to make proper arrangement to avoid interference, shall not be considered as extra.

F. The Electrical Contractor shall cooperate with those performing work under other divisions in his preparation of interference drawings, to the extent that the location of plumbing piping, heating piping, and/or ventilation ducts, with respect to the installation of other trades, shall be mutually agreed on by those performing work under other divisions.

G. In the event the described work on the drawings doesn't match requirements described in the specification, the more stringent shall be provided.

H. Contractor shall carefully review the code sections pertaining to safe working clearances to avoid piping, ducts interferences and other equipment. Install the electrical equipment to meet Code requirements. Adjust the locations shown as required.

1.4 MATERIALS AND WORKMANSHIP

A. All materials and equipment furnished for installation on this project shall be new and in strict accordance with this specification. All packaged materials shall be delivered in the original containers which show the manufacturer's name and the identifying designations as to size, quality, etc. Materials delivered to the job in unmarked or mutilated packages will be ordered to be removed from the site at once. Materials or equipment judged as "damaged" by the Architect or Engineer shall be removed from the job. All electrical equipment shall bear the Underwriter's Label.

B. All work shall be performed in a professional manner under the supervision of a Contractor's manager. The project manager shall be considered the main point of contact for the Architect/Owner's daily communication.

C. Should any dispute arise as to the quality or fitness of the materials or workmanship, Architect, Owner, Engineer and Electrical Contractor shall mutually agree work is non-acceptable and shall be reworked at no additional cost to the Owner.

D. Division 26 & 28 equipment schedule descriptions shall govern if it is found that the manufacturer's catalog numbering shown on the drawing is not current, or changed by the manufacturer without notification. Division 26 & 28 Contractor shall notify the Architect/Engineer with any conflicts during the bidding phase to get clarifications. After entering into a Contract, it shall be considered the equipment schedules provide the information to meet the intended specifications for quality and performance.

1.5 GUARANTEES

A. All equipment and work performed under Division 26 & 28 shall be guaranteed for one (1) year from time of substantial completion of project, unless directed otherwise in Division 1.

1.6 OWNERS ACCEPTANCE OF EQUIPMENT

A. Refer to Division 1.

B. Upon the Owner's written acceptance, the Electrical Contractor's guarantee period shall begin and the Owner shall accept the responsibility for operation and maintenance and the Contractor's liability shall be limited to the conditions covered in the guarantee as described in these specifications.

1.7 REFERENCES

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

1.8 SUBMITTALS

A. Submit 5 copies of shop drawings.

B. Proposed Products List: Include Products specified in the following Sections:

1. Section 260620 - Distribution Switchboards
2. Section 260621 - Panelboards
3. Section 260624 - Wiring Devices
4. Section 260926 - Occupancy Sensor Controls
5. Section 261839 - Enclosed Motor Controllers
6. Section 265100 - Interior Luminaires
7. Section 283100 - Fire Alarm

C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in single submittals.

D. Mark dimensions and values in units to match those specified.

E. Shop drawings shall be reviewed and checked by the Electrical Contractor for specification compliance prior to release for the Engineer's review. Failure to comply will be no cause or reason for additional costs to the Owner with project delays.

F. Electrical distribution submittal shall include cut sheets for each piece of equipment. Written description is not acceptable.

G. Bill of materials shall be submitted as part of O&M Manual. Bill of Materials is not considered a shop drawing.

1.9 REGULATORY REQUIREMENTS

A. Conform to applicable Building Code.

B. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

C. Equipment: U.L. tested and approved for its purpose.

D. The Electrical Contractor shall obtain and pay for all permits and inspection fees. Copies of the Certificate of Inspection are to be provided to the Owner after final inspection and approval from authorities having jurisdiction.

E. State of Michigan, Bureau of Fire Services.

F. Equipment: Listed or labeled to conform to requirements of 2008 National Electric Code, State of Michigan Electric Code, and local authority having jurisdiction.

G. Life Safety NFPA 101 – The State of Michigan current adopted edition.

H. Fire Alarm Code NFPA 72 – The State of Michigan current adopted edition.

I. State of Michigan Uniform Energy Code. ASHRAE 90.1 2007.

1.10 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on drawings, unless prevented by project conditions.

B. All bidders shall personally inspect the site and acquaint themselves with all existing conditions involved in execution of this contract, and make all necessary measurements. No "extra" will be considered for additional work required because of bidder's failure to do so.

C. Arc flash warning labels. Provide arc flash warning labels in accordance with 2008 NEC Section 110 requirements.

1.11 TEMPORARY SERVICES

A. Division 26 Trades shall provide and maintain wiring for all interior construction lighting and power to meet OSHA Standards. Division 26 Trade shall provide and maintain all required lamps and guards. Contractor's power tools, cords, etc shall be in strict accordance with National Electrical Code 2008, Article 590.

B. Electrical Contractor shall pay for all temporary telephone costs for their office and or construction trailer.

C. Electrical Contractor shall be responsible to review Division 1 requirements to provide project temporary lighting and power requirements for the construction and demolition phases.

1.12 RECORD DRAWINGS

A. The Electrical Contractor shall furnish as-constructed drawings, including all Addendums, Bulletins and associated Field Directed Changes included as part of the record drawings.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Verbal instruction and written operational instructions are to be given on all equipment and systems under this contract. A time is to be scheduled with the Architect/Engineer and Owner for these instructions and a time submitted in writing for instructions at the facility.

B. Two (2) bound sets of Operating and Maintenance Manuals are to be submitted to the Architect/Engineer for approval. Manuals are to include complete parts list and

maintenance procedures as well as operating instructions on all equipment supplied under Division 26 & 28.

END OF SECTION 26 00 01

MAI 2012-9004

SECTION 26 02 00

MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition per plans and specifications.

B. Conduit supports.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 26 Contractor shall examine the project documents and visit the site as they deem necessary prior to submitting a bid. Do not rely solely on the Electrical Plans for all demolition requirements. Review all Project Documents prior to submitting a bid.

B. The demolition information is provided to assist with labor costs associated with the electrical systems removal. The Division 26 Contractor shall be responsible to confirm all quantities and the information provided.

C. Upon removal of the existing ceiling, the Electrical Trades shall immediately notify the construction manager, Architect and Engineer in writing regarding existing conduits scheduled to remain that are not properly supported. Conduit evaluation shall be conducted with the Owner, Architect and Engineer. Failure for the Electrical Trades to submit a written conduit support condition will obligate the trade to support the conduits to meet current Code methods at no additional cost to the Owner.

3.2 PREPARATION

A. Confirm with the Architect's Office and/or Construction Manager Project Schedules and review the Architectural, Structural and Mechanical drawings prior to commencing demolition.

3.3 DEMOLITION

A. Remove the electrical distribution equipment, lighting, receptacles, switching, associated conduit, surface raceway. Remove the fire alarm system as noted or shown or shown on the drawings. Use care during the demolition phase to avoid damage or any glazed block, tile or brick veneered walls. Division 26 & 28 Contractors are responsible to confirm all quantities and information provided.

B. Mechanical trades or BAS Contractor shall remove all associated temperature components, and associated conduit and wiring.

C. Division 26 Trades shall remove all existing fire alarm devices and associated conduits and surface mounted raceways. Patch to match.

D. Division 26 & 28 Trades shall transport all of the electrical salvaged materials to the Owner and include all transportation costs.

E. Division 26 Trades shall remove all of the existing electrical branch panelboards as noted, scheduled and shown on the drawings and specifications. Confirm all outages with the Owner to starting the replacement work.

F. Remove all of the existing non-metallic type surface raceway or surface metal conduits noted or specified to be removed. Contractor shall also be responsible to review the architectural, structural and mechanical demolition drawings for associated electrical demolition work. Do not rely solely on the electrical drawings for bid submitted.

G. Remove all unused conduits and wiring serving lighting and power being removed from the finished ceiling space. Remove all abandoned low voltage cables from accessible portions in accordance with 2008 NEC Sections 760.3(A), 640(A), 645.3(A), 725.3(B), 770.3(A), 800.3(C), 820.3(A) and 830.3(A).

H. Remove all existing exterior electric bells as noted on the drawings. Install a blank cover plate over existing rough-in.

I. Divisions 26 & 28 Contractors are responsible to confirm all demolition quantities. Make pre-bid site visit arrangements as deemed necessary.

J. All security system removal and reinstallation shall be completed by the Owner.

END OF SECTION 26 02 00

. MAI 2012-9004

SECTION 26 05 19

BUILDING WIRE AND CABLE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Building wire and cable.

B. Wiring connectors and connections.

C. MC cable

D. Non-metallic sheath cable.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

1.4 PROJECT CONDITIONS

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

B. Conductor sizes are based on copper.

C. Routing shown on Drawings is approximate unless dimensioned. Field route as required to best suit Project Conditions.

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

1.5 COORDINATION

A. Coordinate Work under provisions of Division 1.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70, Type THW, THHN/THWN, XHHW, XHHW-2.

2.2 MC CABLE (Not acceptable for this project unless noted otherwise)

A. Factory assembled multiple insulated conductors enclosed in armor of interlocking metal corrugated sheath.

B. Provide all clips and supports.

2.3 NON-METALLIC SHEATH CABLE

A. Use "NM" "Romex" cable. (Not acceptable for this project)

2.4 WIRING CONNECTORS

A. Split Bolt Connectors:

1. Burndy or equal

B. Solderless Pressure Connectors:

1. T & B.
2. 3M.
3. Burndy.

C. Spring Wire Connectors:

1. T & B.
2. 3M.

D. Compression Connectors:

1. T & B.
2. Burndy.

2.5 FIRE RATED CABLE

A. RHH fire rated type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

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

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Use stranded conductors for control circuits.

C. Use conductor size not smaller than 12 AWG for power and lighting circuits.

D. Use conductor size not smaller than 14 AWG for control circuits.

E. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 100 feet.

F. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

G. Pull all conductors into raceway at same time.

H. Protect exposed cable from damage.

I. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.

J. Use suitable cable fittings and connectors.

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

L. Clean conductor surfaces before installing lugs and connectors.

M. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

N. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger.

O. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

R. All power wiring shall be installed in conduit. Low-voltage wiring shall utilize the free-air method. Conduit drops for fire alarm devices shall be required

S. Refer to Section 260926 for Occupancy Sensors wiring.

T. Refer to Section 283100 for Fire Alarm wiring.

U. If the Division 26 Contractor elects, at their option, to combine homerun circuits installed in a single conduit, the derating 2008 NEC 310.15(b) Table must be utilized for allowable conductor ampacity values. If the derating method is utilized, then furnish and install properly derated cables and properly sized conduits to meet Code. The Division 26 Contractor shall be responsible to obtain inspection from the Electrical Inspector and pay all supplemental inspection and/or requested plan review fees.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 260553.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.5 FIELD QUALITY CONTROL

A. Perform field inspection and testing to assure proper operation.

B. Inspect wire and cable for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

END OF SECTION 26 05 19

MAI 2012-9004

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

D. Building foundation grounding.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

1.4 PERFORMANCE REQUIREMENTS

A. Resistance: Meet the NEC Code requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of grounding electrodes.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper-clad steel or copper-weld type.

B. Diameter: as scheduled on the drawings.

C. Length: as scheduled on the drawings.

2.2 MECHANICAL CONNECTORS

A. As scheduled on the drawings.

2.3 EXOTHERMIC CONNECTIONS

A. As scheduled on the drawings.

2.4 WIRE

A. Material: As scheduled on the drawings.

B. Foundation Electrodes: Size to meet NFPA 70 requirements.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site soil conditions before driving rod electrodes.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Provide bonding to meet Regulatory Requirements.

C. Equipment Grounding Conductor: Provide a separate grounding conductor for lighting and power circuits as noted or specified on the drawings.

3.3 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall- of-potential method.

END OF SECTION 26 05 26

MAI 2012-9004

SECTION 26 05 29

SUPPORTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide adequate corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Anchors and Fasteners:
   1. Concrete Structural Elements: Use expansion anchors.
   2. Steel Structural Elements: Use beam clamps.
   3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
   5. Solid Masonry Walls: Use expansion anchors.

6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.1 INSTALLATION

A. Attachments of electrical equipment to structural members are the responsibility of the installing trade. Structural members shall not be field cut, welded or otherwise modified without approval of the Architect/Engineer. Attachment to steel joist shall be made at panel points whenever possible. Structural members shall not be overloaded as a result of attachments. Attachment/equipment loading for all trades resulting in total load greater than an equivalent uniform 5 psf for any member shall be submitted to the Architect/Engineer for review. Electrical Trades are still responsible for design, layout, and fabrication and installation of electrical supports and support attachment methods. Electrical Trades shall submit attachment methods to the Structural Engineer for review.

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

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not use spring steel clips and clamps.

E. Do not use powder-actuated anchors.

F. Do not drill or cut structural members without permission from Architect/Engineer.

G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

I. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

J. Construct generator and transformer concrete pad as detailed on the drawings.

K. No drilling of laminated wood beams without structural engineer review.

END OF SECTION 26 05 29

MAI 2012-9004

SECTION 26 05 33

CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal conduit.

B. Flexible metal conduit.

C. Liquidtight flexible non-metallic conduit.

D. Electrical metallic tubing.

E. Nonmetal conduit.

F. Electrical nonmetallic tubing.

G. Flexible nonmetallic conduit.

H. Fittings and conduit bodies.

I. Surface raceway assembly.

J. MC Cable.

K. Flexible metal conduit.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI C80.3 - Rigid Aluminum Conduit.

D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

E. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

G. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.7 PROJECT CONDITIONS

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

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing shown is diagrammatic, field route conduit to avoid interferences.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum Size: ¾ inch unless otherwise specified.

B. Wet and Damp Locations: Use rigid conduit or liquid-tight non-metallic flexible conduit.

C. Dry Locations:

1. Concealed: Use electrical metallic tubing.

2. Exposed: Use electrical metallic tubing.
3. Use minimum ¾" conduit for fire alarm drops.
4. Use flexible metal conduit for final wiring connections to motors, VFD units, light fixtures in accessible ceiling.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Fittings and Conduit Bodies: ANSI C80.5.

C. Intermediate Metal Conduit (IMC): Rigid Steel.

D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction.

B. Fittings: ANSI/NEMA FB 1.

2.4 LIQUIDTIGHT NON-METALLIC FLEXIBLE METAL CONDUIT

A. Description: Type NM. Manufacturer with a spiral of rigid PVC embedded reinforcement with a flexible PVC wall.

B. Compatible fittings.

C. Use for wet or exterior location as final wiring connections to motors or electrical equipment, etc.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; set screw type.

2.6 NONMETALLIC CONDUIT

A. Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.7 MC CABLE

A. Corrugated steel tubing with integral conductors.

B. Use MC cable as noted on the drawings or listed in wiring methods.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install nonmetallic conduit in accordance with manufacturer's instructions.

B. Arrange supports to prevent misalignment during wiring installation.

C. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

E. Fasten conduit supports to building structure and surfaces under provisions of Section 16190.

F. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

G. Do not attach conduit to ceiling support wires.

H. Arrange conduit to maintain headroom and present neat appearance.

I. Route conduit parallel and perpendicular to walls or building centerlines.

J. Route conduit installed above accessible ceilings parallel and perpendicular to walls. Install metal conduit sleeves or fire rated assembly in all fire rated wall as identified on the electrical or architectural life safety plans.

K. Route conduit in and under slab from point-to-point.

L. Do not cross conduits in slab.

M. Maintain adequate clearance between conduit and piping.

N. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

O. Cut conduit square using saw or pipe cutter; de-burr cut ends.

P. Bring conduit to shoulder of fittings; fasten securely.

Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

R. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.

T. Provide suitable fittings to accommodate expansion and deflection where conduit crosses, control and expansion joints. Use a UL listed expansion joint. If expansion length exceeds the manufactured expansion fitting, the use of PVC coated metallic flexible conduit is an acceptable method.

U. Provide suitable pull wire in each empty conduit except sleeves and nipples.

V. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

W. Ground and bond conduit under provisions of Section 260526.

X. Identify conduit under provisions of Section 260553.

Y. All power, fire alarm, and occupancy sensor lighting wiring installed in exposed spaces shall be installed in conduit.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods consistent with facility standards or this project specification. Contractor is responsible to review the Architectural drawings to determine fire rated locations.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket or detail to match roof type specified.

C. No drilling of the existing gym laminated beams is permitted without a review with the Project Structural Engineer.

END OF SECTION 26 05 33

MAI 2012-9004

SECTION 26 05 34

BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

C. Fire alarm device boxes.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

1.4 SUBMITTALS FOR REVIEW

A. Provide submittal as listed in Section 260100.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 BRANCH DEVICE BOXES

A. Sheet Metal Outlet Boxes: 4" square stamped steel box with single gang device ring.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Aluminum Boxes: for exterior location us a single gang shallow box with thread hub connection. Provide gasketed cover by box manufacturer.

D. Use masonry box in masonry walls.

E. Use 4" octagon box for ceiling smoke detectors.

F. Non-metallic branch device are not permitted for this project unless noted otherwise.

2.2 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes

1. NEMA enclosure for interior location.
2. NEMA 3R for exterior location.
4. Non-metallic pull and junction boxes are not permitted for this project unless noted otherwise.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in locations as shown on Drawings, and as required for wire pulling, equipment connections and compliance with regulatory requirements.

B. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.

D. Orient boxes to accommodate wiring devices oriented as specified in Section 16140.

E. Maintain headroom and present neat mechanical appearance.

F. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

G. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

H. Install boxes to preserve fire resistance rating of partitions and other elements.

I. Coordinate mounting heights and locations of outlets for counters, backsplashes, benches in casework and workstations.

J. Locate outlet boxes to allow luminaires positioned as shown.

K. Align adjacent wall mounted outlet boxes for switches, etc.

L. Use flush mounting outlet box in finished areas. Surface mounted boxes are acceptable for non-finished spaces.

M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

N. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

P. Use stamped steel bridges to fasten flush mounting outlet box between studs.

Q. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

R. Use adjustable steel channel fasteners for hung ceiling outlet box.

S. Do not fasten boxes to ceiling support wires.

T. Support boxes independently of conduit.

U. Use gang box where more than one device is mounted together. Do not use sectional box.

V. Use gang box with plaster ring for single device outlets.

W. Large Pull Boxes: Provide screwed cover or hinged enclosure in interior dry locations as noted or specified on the drawing.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for equipment connected under other sections.

B. Refer to Section 283100 for fire alarm mounting height.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

END OF SECTION 26 05 34

MAI 2012-9004

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

D. Labeling methods and standards.

E. Conductor color coding and identification.

F. Panelboard directory.

G. Arc flash warning labels.

H. Electrical distribution equipment.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. ANSI/NFPA 70 - 2008 National Electrical Code, State of Michigan Electrical Code, 2009 Michigan Building Code, Bureau of Fire Service, 2003 Michigan Barrier Free Manual and local Codes.

1.4 REGULATORY REQUIREMENTS

A. ANSI/NFPA 70 - 2008 National Electrical Code, State of Michigan Electrical Code, 2009 Michigan Building Code, Bureau of Fire Service, 2003 Michigan Barrier Free Manual and local Codes.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 FACILITY STANDARDS

A. Refer also to specific labeling and identification requirements on the drawings in addition to these specifications.

B. Inspect labeling standards to confirm facility standards.

PART 2 PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates:

1. Engraved three-layer laminated plastic, black letters on white background for normal power to match facility standard. Refer to labeling methods and standards for sizes.

B. Locations:
1. Each electrical distribution panelboard, switchboard and power panel.
2. Each starter.
3. Each disconnect.

C. Nameplate size minimum 1"x3" or match existing.
1. Match facility standards.

2.2 WIRE MARKERS

A. Manufacturers:
1. Brady or equal.

B. Description: Tape type wire markers.

C. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

D. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire numbers.

2.3 LABELING METHODS AND STANDARDS

A. Engraved Labels

1. All electrical panels, starters, disconnect switches, fire alarm panel shall be permanently identified using engraved labels. These labels shall be secured with double face type or mechanically fastened in applications where the tape may have a tendency to fail.

2. Normal power fed systems shall have white labels with black lettering. .

3. Lettering sizes may vary due to space constraints or to distinguish between main versus branch systems. Sizes should be consistent throughout the project, use the following guidelines:

Switchboard or Panelboard Main Label:	1" high minimum
Switchboard or Panelboard Branches	1/2" high minimum
Starters, Disconnects	1/2" high minimum
Manual motor starters	1/4" high minimum

4. All labels shall identify where panel or equipment is fed from. Ex (panel A fed from MDP)

B. Adhesive Tape Labels

1. All switches, receptacles, small manual motor starters or toggle switches shall have the circuit number identified on the device cover plate using clear adhesive tape labels with 1/4" high printed block characters in black. No handwritten or printed labeling will be accepted as final record, machine lettered adhesive tape labels shall be used upon project completion.

2. Provide circuit identification on junction or pull box covers for all circuits within.

3. Conductors in branch circuit panelboards shall have phase conductors, neutrals and grounds identified with adhesive labels within the panel at junction or pull boxes and at the device outlet box. Refer also to conductor color coding with respect to operating voltage.

2.5 CONDUCTOR COLOR CODING AND IDENTIFICATION

1. Feeder phase conductors shall be identified as to phase and operating voltage using colored tape as follows:

	480 Volt	120/208 Volt
Phase A	yellow	black
Phase B	brown	red
Phase C	orange	blue
Neutral	gray	white
Ground	green	green

2. Conductors from #18 up through #10 shall have colored insulating jackets to match the color code and phasing scheme as described above for feeders. Receptacle and lighting circuit conductors shall be #12 minimum for 15 or 20 amp circuits. Conductors #18 through #14 shall only be used for control circuits with colored jackets and wire numbers correlated to each system accordingly.

3. Spare conductors shall be clearly identified as such through color, labels, tags, etc.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using adhesive.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Contractor shall review the drawings to confirm all label schemes or ID requirements listed or noted on the drawings. Review mechanical drawings for equipment ID designation to provide a ID tag that corresponds to the mechanical equipment.

E. Provide arc flash warning label on all electrical distribution equipment in accordance with NEC 2008 requirements.

F. Panelboard, switchboards, transformers, etc. shall include their source of power included in nameplate label. (i.e. LPA feed from PP2)

END OF SECTION 26 05 53

MAI 2012-9004

SECTION 26 06 21

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Distribution panelboards.

B. Branch circuit panelboards.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers.

B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

C. NEMA KS 1 - Enclosed Switches.

D. NEMA PB 1 - Panelboards.

E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

F. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

1.4 SUBMITTALS

A. Provide submittal as listed in Section 260100.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

D. Panelboard submittal shall match drawing schedule arrangement. Submittal shall custom edit schedules to match design drawings.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Record actual locations of Products; indicate actual branch circuit arrangement.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.8 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of Division 1.

B. Provide two of each panelboard key.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. As scheduled on the drawings.

2.2 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, circuit breaker type or fusible switch type per plan.

B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

C. 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.

D. Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

E. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1. Provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

F. Current Limiting Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole.

G. Provide circuit breaker accessory trip units and auxiliary switches as indicated.

H. Cabinet Front: Surface type, fastened with concealed trim clamps, hinge and latch. Provide hinged door with flush lock. Finish in manufacturer's standard gray enamel.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type.

B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard[; provide insulated ground bus where scheduled].

C. Panelboard AIC rating shall match the utility rating for series rating.

D. Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

E. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

F. Provide "HID" rated circuit breakers for all lighting circuits scheduled to serve metal halide or high pressure sodium lights.

2.4 FUSES

A. Manufacturers:
1. Bussman, or equal.

B. Fuses 600 Amperes and Less: Dual element, current limiting, time delay, one-time fuse, 600 volt.

C. Fuses 601 Amperes and Larger: Current limiting, time delay one time fuse, 600 volt, UL Class L.

D. Interrupting Rating: 200,000 rms amperes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Height: 6 ft to top of panelboard; install panelboards taller than 6 ft with bottom no more than 4 inches above floor.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

E. Provide engraved plastic nameplates under the provisions of Section 16195.

F. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed to assure proper operation.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 26 06 21

MAI 2012-9004

SECTION 26 06 23

EQUIPMENT WIRING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mechanical equipment.

B. Fire alarm

C. Lighting controls.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

C. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

1.4 COORDINATION

A. Coordinate work under provisions of Division 1.

B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

E. Sequence electrical connections to coordinate with start-up schedule for equipment.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 CORDS AND CAPS

A. Manufacturers:

1. Hubbell, Pass & Seymour, Leviton or equal.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

D. Cord Construction: ANSI/NFPA 70, Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over current protection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Division 1.

B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using metallic flexible conduit for all dry interior locations. Use liquid tight non-metallic flexible conduit with watertight connectors in damp or wet locations.

C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

D. Provide the NEMA configuration that matches receptacle.

E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, VFD's, power relays, motor starters and as noted on the drawings.

G. Provide and install fuses in mechanical trades furnished fused disconnects and combination starters per manufacturer's requirements.

H. Electrical Contractor shall install mechanical furnished motor speed control and as required to control motor speed.

I. Complete all lighting controls as scheduled, noted and shown on the drawings.

J. Electrical Contractor shall complete all main power wiring to the mechanical equipment shown and noted.

END OF SECTION 26 06 23

MAI 2012-9004

SECTION 26 06 24

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Device plates.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. NEMA WD 1 - General Requirements for Wiring Devices.

B. NEMA WD 6 - Wiring Device -- Dimensional Requirements.

C. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

D. ADA - Americans with Disabilities Act - As amended.

1.4 SUBMITTALS FOR REVIEW

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:

1. Pass & Seymore, Hubbell, Leviton or equal.

B. Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.

C. Body and Handle: Color shall be white, ivory, brown or gray as advised by the Architect.

D. Ratings:

1. Voltage: 120/277 volts, AC.

2. Current: 20 amperes.

2.2 RECEPTACLES

A. Manufacturers:

1. Hubbell, Pass & Seymore, Leviton, or equal

B. Description: NEMA WD 1, Heavy-duty specification grade duplex receptacle.

C. Device Body: Color shall be ivory, white, brown or gray as advised by the Architect.

D. Configuration: NEMA WD 6, type as specified and indicated.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

A. Decorative Cover Plate: Smooth nylon. Color shall be white, ivory, brown or gray as advised by the Architect.

B. Use stainless steel cover for food service areas, and healthcare facilities.

C. Use die cast metal "in use" weather proof rated covers at exterior locations as indicated on the drawings to meet 2008 NEC Section 406.

D. Provide blank metal cover plates on abandoned boxes.

E. Provide stamped metal cover plate for unfinished spaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that outlet boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that floor boxes are adjusted properly.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on bottom.

F. Connect wiring device grounding terminal to outlet box with bonding jumper or branch circuit equipment grounding conductor where specified.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Connect wiring devices by wrapping conductor around screw terminal.

I. Use jumbo size plates for outlets installed in masonry walls.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

K. Install protective rings on active flush cover service fittings.

L. Install the boiler emergency shutdown switch at each main boiler room area entrance.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Confirm with architectural drawings for wiring devices mounting heights.

B. Install wall switch 48 inches to top of box above finished floor.

C. Install convenience receptacle 16 inches to bottom of box above finished floor.

D. Electrical Contractor shall obtain a copy of the latest accepted Michigan Barrier Free Design Manual for additional mounting requirements.

E. Refer to all other sections of the specification, drawings, and Architectural drawing for specific mounting requirements.

F. Refer to section 283100 and drawing notes for fire alarm device mounting heights.

G. 18" mounting height is lieu of the 16" minimum specified is acceptable pending masonry course lines.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION 26 06 24

MAI 2012-9004

SECTION 26 09 26

OCCUPANCY SENSORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Relay panels.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. ASHRAE 90.1 2007.

B. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

C. EIA/TIA 568B.

D. CMP/UL.

1.4 SUBMITTALS

A. Provide submittal as listed in Section 260100.

B. Shop Drawings: Control panel layouts, wiring connections, diagrams, and dimensions. Cut sheets shall either be marked or arrowed components with catalog numbers. Failure to comply will be cause to return the submittals for corrections at no delays or extra costs to the Owner.

1.5 REGULATORY REQUIREMENTS

A. ASHRAE 90.1 2007.

B. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

C. Products: Furnish products listed or labeled to conform to requirements of 2008 National Electric Code, State of Michigan Electric Code, and local authority having jurisdiction.

D. EIA/TIA 568B.

E. CMP/UL.

PART 2 PRODUCTS – Acceptable manufacturer's - as scheduled on the drawings.

2.1 RELAY PANEL

A. As scheduled on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and wiring diagrams.

B. Contractor shall provide all components, etc. above those specified or shown for a complete installation.

3.2 SYSTEM TRAINING

A. Include 4 hours of training with the bid. The training shall take place at the Owner's facility.

END OF SECTION 26 09 26

MAI 2012-9004

SECTION 26 18 16

FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual, local code requirements and NFPA 70E Arc Flash Standard.

B. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.4 PROJECT RECORD DOCUMENTS

A. Record actual fuse sizes.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussman or equal.

2.2 FUSE REQUIREMENTS

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Main Service Switches Larger than 600 amperes: Class L (time delay).

2.3 CLASS RK1 (TIME DELAY) CURRENT LIMITING FUSES

A. Manufacturers:

1. Bussman or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions.

B. Install fuse with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet as shown on the drawing.

END OF SECTION 26 18 16

MAI 2012-9004

SECTION 26 24 76

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fusible switches.

B. Nonfusible switches.

C. Fuses.

1.2 REFERENCES

A. NEMA KS 1 - Enclosed Switches.

B. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual, State of Michigan Elevator Codes, and local code requirements.

C. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.

D. UL 198E - Class R Fuses.

1.3 SUBMITTALS

A. Provide submittal as listed in Section 260100.

B. Product Data: Provide switch ratings and enclosure dimensions.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Square D or equal.

2.2 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type Heavy Duty load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type Heavy Duty load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosures: NEMA KS 1.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

2.3 FUSES

A. Manufacturers:
   1. Bussman or equal.

B. Description: Dual element, current limiting, time delay, one-time fuse, 600 volt.

C. Interrupting Rating: 200,000 rms amperes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated.

B. Install fuses in fusible disconnect switches.

C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

D. Division 26 Contractor shall be responsible to review the mechanical equipment schedules to determine if any factory installed switches are scheduled and noted as part of the equipment to minimize duplication by electrical trades.

END OF SECTION 26 24 76

MAI 2012-9004

SECTION 26 51 00

INTERIOR LUMINAIRES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires per schedule.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

B. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.

C. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).

D. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

E. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

F. NFPA 101 - Life Safety Code.

G. Michigan Uniform Energy Code. ASHRAE 90.1 2007.

1.4 SUBMITTALS FOR REVIEW

A. Provide submittal as listed in Section 260100.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. Conform to requirements of NFPA 101.

C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

D. Michigan Uniform Energy Code. ASHRAE 90.1 2007.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Furnish Products as scheduled on the drawings.

2.2 BALLASTS

A. As scheduled on the drawings.

B. Ballasts shall include a factory disconnecting means in accordance with 2008 NEC 410-130G.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

B. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.

C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips at a minimum of (4) points of attachment to prevent movement.

F. Install recessed luminaires to permit removal from below.

G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Install clips to secure recessed grid-supported luminaires in place at a minimum of (4) points of attachment to prevent movement..

I. Install wall mounted luminaires at height as indicated on Drawings and/or architectural drawings.

J. Install accessories furnished with each luminaire.

K. Connect luminaires and exit signs to power station/invertor.

L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Install specified lamps in each luminaire.

3.2 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Contract Closeout: Division 1: Adjusting installed work.

B. Aim and adjust luminaires as indicated or as directed.

C. Position exit sign directional arrows as indicated.

3.4 CLEANING

A. Contract Closeout: Cleaning installed work.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.5 DEMONSTRATION AND INSTRUCTIONS

A. Contract Closeout: Division 1: Demonstrating installed work.

3.6 PROTECTION OF FINISHED WORK

A. Contract Closeout: Protecting installed work.

B. Relamp luminaires that have failed lamps at Substantial Completion.

3.7 SCHEDULES

A. Refer to Drawings.

END OF SECTION 26 51 00

MAI 2012-9004

SECTION 28 31 00

FIRE ALARM SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Extend existing system in accordance with the plans.

B. Fire alarm system shall not be limited to: Manual pull stations, magnetic door holders, duct smoke detectors, ceiling smoke detectors, audio/visual devices and visual devices. Include all associated code mandated components, wiring for a complete operating system.

C. Fire alarm wiring. Match existing.

D. The Fire Alarm vendor shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer. The cost will be $150.00 for the first plan, and $50.00 for each additional plan that may be requested for AutoCAD use. A waiver of responsibility for the Architect and Engineer related to Contractor use of the CAD files shall be signed by the Fire Alarm vendor.

1.2 RELATED SECTIONS

A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. NFPA 72 - Current adopted code.

C. NFPA 101 - Life Safety Code, current adopted code.

D. State of Michigan – Bureau of Fire Services.

E. State of Michigan, 1999 School Rules.

1.4 SUBMITTALS

A. Provide submittal as listed in Section 260100. Submittal cut sheets shall be arrowed or marked with catalog numbers. Failure to comply will be cause for returning submittal for corrections at no delays or extra cost to the Owner.

B. Shop Drawings: Provide control panel layout and system wiring diagram showing each device and wiring connection required.

1.5 PROJECT RECORD DOCUMENTS

A. Record actual locations for complete fire alarm system.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1 and Division 28.

B. Operation Data: Operating instructions.

C. Maintenance Data: Maintenance and repair procedures.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, 2008 National Electric Code, 2009 Michigan Building Code, State of Michigan Electric Code, 2003 Michigan Barrier Free Manual and local code requirements.

B. NFPA 72 - Current adopted code.

C. NFPA 101 - Life Safety Code, current adopted code.

D. State of Michigan, Bureau of Fire Services.

E. State of Michigan, 1999 School Rules.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Extend existing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fire alarm wiring in conduit for device shown storage room, mechanical rooms and similar space. Use 5'-0" minimum conduit drop in for physical protection.

B. All junction boxes for fire alarm raceway system shall be painted red labeled "FIRE ALARM". Junction boxes installed in theatrical space where the project requires a black room finish scheme, label the junction box "fire alarm".

C. Provide and install the fire alarm system in strict accordance with the plans and specifications, codes and manufacturer's instructions.

D. Fully test the fire alarm system in accordance with NFPA 72, Chapter 7.

E. Division 28 Contractor and the fire alarm vendor shall be responsible for furnishing devices above those shown on the drawings to meet the Office of Fire Safety inspector's system walk-thru.

F. Duct smoke detector low voltage wiring to the main fire alarm panel shall be installed in separate raceway to meet code requirements. The detector's 120v motor shut down wiring must maintain physical separation.

G. Fire alarm vendor shall be responsible to certify the sound coverage for the entire facility.

H. Audio/visual and visual units shall be installed in accordance with Michigan Building Code under the fire protection system section or NFPA 72 Fire Alarm Code wall mounted appliance shall be mounted such that the entire lens is not less than 80 inches, and not greater than 96 inches above the finished floor. Ceiling mounted device is an acceptable method. Ceiling mounting devices are designated with a C subscript letter.

I. Manual pull stations shall be mounted a maximum of 48" from the floor level to the activating handle or to the lever. The current adopted Michigan Building Code edition fire protection system Section 907 shall govern over NFPA 72 Fire Alarm Code for mounting heights.

J. Division 28 Contractor shall complete the entire fire alarm system in accordance with plans and specifications.

K. All fire alarm wiring installation that may be required to be installed through non-accessible ceiling spaces, and cannot be installed in conduit or cable tray, free air method will be acceptable for those spaces. The cable shall be plenum rated for this application.

L. Ceiling mounted fire alarm device locations are shown diagrammatic. The design requirement shall be to install the device centered in the classrooms, corridor, offices, etc. Confirm the location with lighting, speaker, HVAC diffusers, to avoid interferences.

M. Division 28 Contractor and their respective fire alarm vendor shall field determine the remote duct detector test station location to maintain easy access for the Owner usage. The test station locations are not shown on the drawings.

3.2 MANUFACTURERS FIELD SERVICES

A. The manufacturer shall provide on-site technical for start-up, programming, trouble shooting. Also provide one training session with the Owner.

B. Provide certification that system operates to meet State requirements.

3.3 WARRANTY

A. Provide a one-year guarantee from date of system acceptance by the Owner.

END OF SECTION 28 31 00