

APPENDIX 2
ELECTRICAL POWER SUPPLY
SPECIFICATION SECTION

RENNEBOHM PARK

RENNEBOHM PARK

TENNIS COURT LIGHTING

Madison, Wisconsin

City of Madison Parks Division
330 E Lakeside Street
Madison, Wisconsin

PROJECT MANUAL

March 01, 2024

DE PROJECT # 24017



IOWA
8801 Prairie View Lane SW, Suite 200
Cedar Rapids, IA 52404-4850
319.841.1944

WISCONSIN
8215 Greenway Blvd, Suite 180
Middleton, WI 53562
608.424.8815

brad.biddick@designengineers.com

SECTION 00 0001 - TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

26 0010	Electrical General Provisions	8
26 0500	Common Work Results for Electrical	2
26 0519	Low-Voltage Electrical Power Conductors and Cables	2
26 0526	Grounding and Bonding for Electrical Systems	2
26 0533	Raceway and Boxes for Electrical Systems	2
26 0553	Identification for Electrical Systems	2

END OF SECTION 00 0001

Division 26

Electrical

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

SECTION 26 0010 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Refer to Division 00 – Procurement, Contracting and Warranty Requirements and Division 01 - General Requirements, which all apply to work under this section.

1.02 DESCRIPTION OF WORK

- A. Work shall include furnishing of all systems, equipment and material specified in this division and as called for on the electrical drawings, to include supervision, operations, methods and labor for the fabrication, installation, start up and tests for the complete electrical installation.
- B. All elements of the construction shall be performed by workmen skilled in the particular craft involved, and regularly employed in that particular craft.
- C. All work shall be performed in a neat, professional manner in keeping with the highest standards of the craft.

1.03 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
 - 1. National Electrical Code
 - 2. National Fire Protection Association
 - 3. National Electrical Manufacturers Association
 - 4. Standards of Institute of Electrical and Electronic Engineers
 - 5. International Building Code
 - 6. Occupational Safety and Health Act
 - 7. Wisconsin Administrative Code
 - 8. NECA Standards
 - 9. Americans With Disabilities Act (ADA)
 - 10. City of Madison General Ordinances (MGO)
- B. All Contractors shall familiarize themselves with all codes and standards applicable to their work and shall notify Design Professional of any discrepancies between the design and applicable code requirements so that any conflicts can be resolved. Where two or more codes or standards are in conflict, that requiring the highest order of professionalism shall take precedence, but such questions shall be referred to Design Professional for final decision.

1.04 REQUIREMENTS & FEES OF REGULATORY AGENCIES

- A. Contractor shall comply with the rules and regulations of the local utility companies. They shall check with each utility company providing service to this project and determine or verify their requirements regarding incoming services.
- B. Secure all required permits and pay for all inspections, licenses and fees required in connection with the electrical work including City of Madison Electrical Inspections. Contractor shall post all bonds and obtain all licenses required by the State, City, and County.

1.05 ELECTRICAL DRAWINGS

- A. The electrical drawings indicate a general site arrangement only. Contractor shall examine construction drawings to become familiar with the specific type of building/site construction, i.e. type of structural system, floors, walls, ceilings, room finishes and elevations.
- B. Drawings for the electrical work are in part diagrammatic, and are intended to convey the scope of the work and to indicate in general the location of equipment.
- C. Contractor shall layout their own work and shall be responsible for determining the exact locations for equipment and rough ins and the exact routing of conduits and raceway so as to best fit the layout of the work within the defined parameters of the project.
- D. Contractor shall take their own field measurements for verifying locations and dimensions; scaling of the drawings will not be sufficient for laying out the work.

- E. Because of the scale of the drawings, certain basic items such as couplings, pull or splice boxes may not be shown, but where such items are required by code or by other sections of the specifications or where they are required for proper installation of the work, such items shall be furnished and installed.

1.06 ACTIVE SERVICES

- A. Contractor shall be responsible for verifying exact locations of all existing services prior to beginning work in that area.
- B. Existing active services, i.e., water, gas, sewer, electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain.
- C. When active services are encountered which require relocation, Contractor shall make request to authorities with jurisdiction for determination of procedures.

1.07 SITE INSPECTION

- A. Contractor shall inspect the site prior to submitting bid for work to familiarize themselves with the conditions of the site which will affect their work and shall verify routing of exterior conduit to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the work required because of Contractor's failure to make this inspection.

1.08 COORDINATION AND COOPERATION

- A. It shall be Contractor's responsibility to schedule and coordinate their work with the schedule of the General Contractor so as to progress the work expeditiously, and to avoid unnecessary delays.
- B. Contractor shall fully examine the drawings and specifications for other trades and shall coordinate the installation of their work with the work of the other contractors. Contractor shall consult and cooperate with the other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to their equipment, other equipment and the building.
- C. Drawings and specifications are intended to be complimentary. Any work shown in either of them, whether in the other or not, shall be executed according to the true intent and meaning thereof, the same as if set forth in all. Conflicts between the drawings and the specifications or between the requirements set forth for the various contractors shall be called to the attention of the Design Professional. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required, and that the Contractor is in agreement with the drawings and specifications as issued. If clarification is required after the contract is awarded, such clarification will be made by the Design Professional and their decision will be final.
- D. Special care shall be taken for protection for all equipment. All equipment and material shall be completely protected from weather elements, painting, plaster, etc., until the project is substantially completed. Damage from rust, paint, scratches, etc., shall be repaired as required to restore equipment to original condition.
- E. Where the final installation or connection of equipment requires the contractor to work in areas previously finished by the General Contractor, the Electrical Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. Electrical Contractor shall arrange with the General Contractor for patching and refinishing of such areas which may be damaged in this respect.

1.09 EXCAVATING AND BACKFILLING

- A. Contractor shall do all excavating necessary for light pole bases, underground wiring, conduit and, and shall backfill trenches and excavations after work has been inspected. Care shall be taken in excavating that walls and footings and adjacent load bearing soils are not disturbed in any way. Excavation shall be kept free from water by pumping if necessary.

- B. Backfilling of trenches shall progress as rapidly as the testing and acceptance of the finished sections of the work will permit and shall be carried to a crown approximately six (6) inches above the existing grades. In backfilling trenches, selected material shall be compacted firmly around and to a depth of not less than six (6) inches over the top of work in trench. All fill and backfill and rough grading shall be compacted thoroughly in layers and shall be brought up to within six (6) inches of finished grades. All fill and backfill shall be sand or pit run sand/gravel graded from 1" size downward.

1.10 MATERIALS AND EQUIPMENT

- A. All materials and equipment shall be the standard product of a reputable U.S.A. manufacturer regularly engaged in the manufacture of the specified item unless authorized in writing by Design Professional. Where more than one unit is required of the same system, they shall be furnished by the same manufacturer except where specified otherwise.
- B. All material and equipment shall be installed in strict accordance with the manufacturer's recommendations.
- C. The equipment specifications cannot deal individually with any minute items such as parts, controls, devices, etc., which may be required to produce the equipment performance and function as specified, or as required to meet the equipment guarantees. Such items when required shall be furnished as part of the equipment, whether or not specifically called for.

1.11 SUBMITTALS

- A. Contractor shall furnish, to the Design Professional, complete sets of shop drawings and other submittal data. Contractor shall review and sign shop drawings before submittal. Refer to Division 01 specifications for additional requirements.
- B. Shop drawings shall be bound into sets and cover related items for a complete system as much as practical and shall be identified with symbols or "plan marks" used on drawings. Incomplete, piecemeal or unbound submittals will be rejected.
- C. Submit required information on the following items:

SPEC SECTION	EQUIPMENT	DETAIL DWGS	PROD DATA	PROD SAMPLES	INSTALL METHODS	O & M MANUAL	CERTIFICATE OF SYSTEM DEMONSTRATION	OTHER (SEE NOTES)
26 0519	Low-Voltage Power Conductors and Cables		X			X		
26 0533	Raceway and Boxes for Electrical Systems		X			X		
NOTES:								
1. NA								

- D. Design Professional will review shop drawings solely to assist contractors in correctly interpreting the plans and specifications.
- E. Contract requirements cannot be changed by shop drawings which differ from contract drawings and specifications.

1.12 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be submitted to Design Professional. Refer to Division 01 specifications for additional information.

- B. Submit manuals in duplicate upon completion of the job. Manuals shall be bound in a three ring hard-backed binder. Front cover and spine of each binder shall have the following lettering done:

OPERATION
AND
MAINTENANCE
MANUAL
FOR
ELECTRICAL SYSTEMS

(PROJECT NAME)
(LOCATION)
(DATE)

SUBMITTED BY
(NAME AND ADDRESS OF CONTRACTOR)

- C. Provide a master index at the beginning of manual showing items included. Use plastic tab indexes for sections of manual. Each section shall contain the following information for equipment furnished under this contract:
1. Equipment and system warranties and guarantees.
 2. Installation instructions.
 3. Operating instructions.
 4. Maintenance instructions.
 5. Spare parts identification and ordering list.
 6. Local service organization, address, contact and phone number.
 7. Shop drawings with reviewed stamp of Design Professional and Contractor shall be included, if applicable, along with the items listed above.
- D. Items to be included shall be those listed in shop drawing section.

1.13 TESTS AND DEMONSTRATIONS

- A. All systems shall be tested by Contractor and placed in proper working order prior to demonstrating systems to Owner.
- B. Prior to acceptance of the electrical installation, the Contractor shall demonstrate to the Owner, or their designated representatives, all essential features and functions of all systems installed, and shall instruct the Owner in the proper operation and maintenance of such systems. Owner instruction shall be provided for the following systems:

Sections	Description	Hrs. on Site	Hrs. off Site	Presented By	Others Present	Remarks
NA	Musco Lighting Controls	2		Manufacturer's Representative	Contractor	

REMARKS:
1. NA

- C. Contractor shall submit to the Design Professional a certificate signed by the Owner stating the date, time, and persons instructed and that the instruction has been completed to the Owner's satisfaction. An example of a certificate form is as follows:

CERTIFICATE OF SYSTEM DEMONSTRATION

This document is to certify that the contractor has demonstrated the hereafter listed systems to the Owner's representatives in accordance with the Contract documents and that the instruction has been completed to the Owner's satisfaction.

A. Project:

B. System(s):

C. Contractor's representatives giving instruction and demonstration:

Contractor: _____

NAMES	DATE	HOURS

D. Owner's representatives receiving instruction:

Owner: _____

NAMES	DATE	HOURS

E. Acknowledgement of demonstration:

Contractor's Representative:

_____ signature

_____ date

Owner's Representative:

_____ signature

_____ date

1.14 SUBSTITUTIONS

- A. To obtain approval to use unspecified equipment, Bidding Contractors (not equipment supplier, manufacturers, etc.) shall submit written requests to Design Professional at least 10 days prior to bid due date. Requests shall clearly describe the equipment for which approval is being requested. Include all data necessary to demonstrate that equipment's capacities, features and performance are equivalent between specified equipment and equipment for which approval is being requested. If the equipment is acceptable, Design Professional will approve it in an addendum. Design Professional will, under no circumstances, be required to prove that an item proposed for substitution is or is not of equal quality to the specified item.
- B. Where substitutions are approved, Contractor assumes all responsibility for physical dimensions and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of the substitution.

1.15 ACCEPTABLE MANUFACTURERS

- A. In most cases, equipment specifications are based on a specific manufacturer's type, style, dimensional data, catalog number, etc. Listed with the base specification, either in the manual or on the plan schedules are acceptable manufacturers approved to bid products of equal quality. These manufacturers are encouraged to submit to Design Professional at least 8 days prior to the bid due date drawings and catalog numbers of products to be bid as equals.
- B. Manufacturers, who do not submit prior to bidding, run the risk of having the product rejected at time of shop drawing submittal. Extra costs associated with replacing the rejected product shall be the responsibility of the Contractor and/or the manufacturer.
 - 1. If Contractor chooses to use a manufacturer listed as an equal, it shall be their responsibility to assure that the manufacturer has complied with the requirements in 'A' above. Contractor shall assume all responsibility for physical dimensions, operating characteristics, and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of using the alternate manufacturer.
 - 2. Where a model or catalog number is provided, it may not be inclusive of all product requirements. Refer to additional requirements provided on the plans or in the specifications as required. Similarly, there may be additional requirements included in the model or catalog number that are not specifically stated. These requirements shall also be met.

1.16 WARRANTY

- A. Refer to Divisions 00 and 01 for information on warranties and correction of work within the warranty period.
 - 1. If a warranty or warranty period are not defined in Division 00 or 01, then the start of all warranty periods shall be the date of Substantial Completion and the length of the warranty shall be for one year.
 - a. If construction is phased with distinct and separate Substantial Completion dates for portions of the building and/or systems, separate warranties shall be provided for each of these phased areas and/or systems.
 - b. The entire Electrical system, including all sub-systems, shall be guaranteed against defect in materials and installation for the duration of the warranty period. Any malfunctions or defects which occur within the warranty period shall be promptly corrected without cost to the Owner. This guarantee shall not limit or void any manufacturer's express or implied warranty.
- B. Refer to other Division 26 sections for systems, equipment, or material requiring extended warranties.
- C. The date of systems/equipment startup or equipment/material shipment to the site shall not be considered the notable date with relation to the warranty of that item. All systems, equipment, material, etc., shall have the same start date with respect to the warranty period.
- D. Systems, equipment or material put into use to facilitate construction activities (e.g. testing and balancing, commissioning, temporary conditioning, etc.) prior to the start of the warranty period shall not impact the length of the warranty in any way.

1.17 CHANGES IN THE WORK

- A. Refer to Divisions 00 and 01.

1.18 COMPLETION

- A. Systems, at time of completion, shall be complete, efficiently operating, non-hazardous and ready for normal use by the Owner.
- B. When all the electrical work is complete Contractor shall thoroughly clean all material and equipment installed as a part of this contract and leave all equipment and material in new condition.
- C. Contractor shall clean up and remove from the site all debris, excess material and equipment left during the progress of this contract at job completion.

1.19 CLEANING

- A. Prior to assembly of electrical equipment, all loose dirt, scale, oil, and other foreign matter on internal and exterior surfaces shall be removed by means consistent with good electrical practices.
- B. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. Name plates, ratings, instruction plates, etc., shall not be obscured by paint, insulation, or placement of units.
- C. Electrical equipment shall be thoroughly cleaned on the interior and exterior of equipment. This includes, but is not limited to: removal of wiring trimmings within electrical panels and dirt/debris from activation boxes.
- D. All light fixtures shall be wiped clean with all fingerprints and dust removed.

END OF SECTION 26 0010

SECTION 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 26 0010 - Electrical General Provisions are applicable to work required of this section.

1.02 DESCRIPTION OF WORK

- A. This section includes the following:
 - 1. Demolition.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials removed shall be the property of the removing contractor and shall be removed from the site unless otherwise specified.

PART 3 - EXECUTION

3.01 GENERAL

- A. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.

3.02 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on casual field observation. Report discrepancies to Owner before disturbing existing installation.

3.03 PREPARATION

- A. Disconnect electrical systems scheduled for removal.
- B. Existing Electrical Services: Maintain existing system in service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.04 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction. Extend existing installations using materials and methods as specified.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit.
- E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- F. Disconnect and remove HID court lighting and ballast enclosures from existing poles. Remove brackets, stems, hangers, and other accessories as required to facilitate new installation.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- I. Clean and repair existing materials and equipment which remain or are to be reused.

3.05 LAMP AND BALLAST DISPOSAL

- A. Lamps and ballasts shall be removed from the site and recycled per state and local regulations.

3.06 WORK BY OTHERS

- A. Unless specifically noted under other contracts, Electrical Contractor shall assume all required work shall be performed by them

3.07 OWNER'S RIGHT OF SALVAGE

- A. Owner may designate and have salvage rights to any material herein demolished by the Contractor.

END OF SECTION 26 0500

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 26 0010 - Electrical General Provisions are applicable to work required of this section.

1.02 DESCRIPTION OF WORK

- A. Contractor shall furnish all material, tools, labor, and supervision necessary to install all wiring systems.
- B. This section describes the basic materials and methods of installation for general wiring systems of 600 volts and less. Wiring for a higher voltage rating, if required, shall be as specified in other sections or called for on the drawings.

1.03 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wire, cable, and connectors.
- B. UL Compliance: Comply with UL standards pertaining to wire, cable, and connectors.
- C. UL Labels: Provide electrical wires, cables and connectors which have been UL listed and labeled.
- D. NEMA/ICEA Compliance: Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of wire and cable.
- E. ANSI/ASTM: Comply with applicable portions of ANSI/ASTM standards pertaining to construction of wire and cable.
- F. The materials used for wiring systems shall be the products of a manufacturer regularly engaged in the manufacturing of the specified material.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each product specified.

PART 2 - PRODUCTS

2.01 WIRE AND CABLE

- A. All wire and cable for power, lighting, control, and signal circuits shall have copper conductors of not less than 98% conductivity and shall be insulated to 600 V. All conductors shall be stranded.
- B. Minimum size conductors shall be #12 AWG for control power and #8 AWG for lighting.
- C. Type of wire and cable for various applications shall be as follows:
 - 1. Type XHHW-2 (90 deg. C)

2.02 CONDUCTOR COLOR CODING

- A. Wiring systems shall be color coded. Conductor insulation shall be colored in sizes up through #8 AWG. Conductors #6 AWG and larger shall be colored or have black insulation and shall be phase color coded with one half inch band of colored tape at all junctions and terminations. Colors shall be assigned to each conductor as described below and carried throughout all main and branch circuit distribution. When necessary to use tape, use colored tape on black wire. Do not use colored tape on colored wire. Match existing color coding scheme. If a scheme does not exist, utilize the following:

	120/240V
Phase '1' Conductor	Black
Phase '2' Conductor	Red
Neutral Conductor	White
Equipment Grounding Conductor	Green

2.03 CONNECTORS

- A. Twist-on Wire Connectors.
 - 1. Wet locations. 600V rated, UL 485D listed with pre-filled silicone sealant. Ideal industries 61/62/63 series or equal by 3M or Thomas and Betts. Use for #8 and smaller. To be used for all above ground splices in exterior locations.
 - 2. Underground locations. 600V rated, UL 485D listed for direct burial with pre-filled silicone sealant. Ideal Industries 60/64/66 series or equal buy 3M or Thomas and Betts. Use for #8 and smaller. To be used for all below ground (hand hole) locations.
- B. Conductor Taps and Splices.
 - 1. Wet and Underground Locations. 600V rated, UL 486D listed, watertight mechanical termination suitable for direct burial in earth. IlSCO SafetySub PDSS or equal by Burndy or 3M. Use for #6 and larger.
 - 2. Insulation piercing taps are not allowed.
 - 3. Split bolt connectors and splices are not allowed.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Conduit shall be swabbed free of moisture and debris prior to pulling in wiring. Pull mouse through conduits prior to pulling conductors.

3.02 INSTALLATION

- A. Branch circuit conductor sizes shall be increased to maintain a maximum 3% voltage drop.
 - 1. 120V, 20A homeruns shall be sized as follows based on one-way circuit length:
 - a. 0'- 210': #8 AWG
 - b. 211' and over: #6 AWG
- B. Splices shall be made only in accessible junction boxes or handholes.
- C. All power feeder cable shall be pulled with the use of approved pulling compound or powder. Compound must not deteriorate conductor or insulation.
- D. If conductor insulation is damaged during installation, replace entire conductor.
- E. Use pulling means, including fish tape, cable or rope which cannot damage raceway.
- F. Keep branch circuit conductor splices to a minimum.
- G. The continuity of circuit conductors shall not be dependent on service connections such as lamp holders, receptacles, etc., where the removal of such devices would interrupt the continuity.
- H. Provide separate green equipment ground conductor throughout entire electrical system.
- I. All branch circuits shall have dedicated neutrals when a neutral conductor is required.

3.03 FIELD QUALITY CONTROL

- A. Prior to energizing system, test cable and wire for continuity of circuitry, and for short circuits. Correct malfunctions when detected.
- B. After wire terminations are complete, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 26 0010 - Electrical General Provisions are applicable to work required of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of grounding work is indicated by drawings and shall comply with NEC.
- B. Applications of grounding work in this section include the following:
 - 1. Grounding electrodes.
 - 2. Equipment grounding conductors.
 - 3. Grounding rods.
- C. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.03 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL-listed and labeled.
- B. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical grounding and bonding.
- C. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

PART 2 - PRODUCTS

2.01 GROUNDING SYSTEMS

- A. Materials and Components
 - 1. General: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.
 - 2. All components shall be listed under ANSI/UL 467 – "Grounding and bonding Equipment".
 - 3. Raceways: Provide raceways, and electrical boxes and fittings complying with Division 26, Section 26 0533 – Raceway and Boxes for Electrical Systems.
 - 4. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.
- B. Connectors
 - 1. Lugs: Grounding and bonding conductors shall terminate in two-hole, long barrel irreversible compression lugs, Burndy YGA series or equal by Blackburn, Ilasco, Erico, Harger or Anderson.
- C. Grounding Rods
 - 1. Ground Rods:
 - a. Copper clad steel, 5/8" dia x 8'.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL GROUNDING

- A. General: Install electrical grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.

- B. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.
- C. Bury ground rods vertically with rod top a minimum of 2 feet below grade, or with rod top terminated in a gravel filled ground well. If extensive rock formation is encountered, inform the Design Professional and relocate ground rods, or provide supplemental ground rods as directed by the Design Professional.
- D. A No. 6 AWG minimum stranded copper wire shall be furnished and exothermically welded to all of the ground rods.
- E. Exothermic Welding
 - 1. Clean and dry the surface to be welded. Wire brush or file the point of contact to a clean bare metal surface.
 - 2. Use welding cartridges and molds for the type of weld recommended by the manufacturer and perform welding in accordance with the manufacturer's recommendations. Worn or damaged molds not to be used.
 - 3. Test all welds by striking with a 2 pound steel hammer. Replace any defective welds.
 - 4. Where exothermic welds are made to a galvanized surface, remove the galvanizing using a non-resin bonded grinding wheel to expose a clean surface. After welding, touch up the steel surface with zinc rich primer.
- F. Provide separate green ground conductor throughout entire electrical system sized as required by the NEC.
- G. Conduit Grounding
 - 1. Provide ground conductors in non-metallic conduits in accordance with the NEC.

END OF SECTION 26 0526

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 26 0010 - Electrical General Provisions are applicable to work required of this section.

1.02 DESCRIPTION OF WORK

- A. Contractor shall furnish all materials, tools labor and supervision necessary to fabricate and install complete conduit systems.
- B. Conduit systems shall be provided for all wiring, except where the drawings or other sections of the specifications indicate that certain wiring may be installed in cable trays, surface raceway, underfloor raceway, wireways and/or auxiliary gutters.
- C. Types of raceways in this section include the following:
 - 1. Rigid non metallic conduit.
- D. Provide factory painted red conduit for fire alarm system.
- E. Contractor shall furnish all material, tools, labor and supervision necessary to install electrical boxes and fittings as required by drawings and specifications.
- F. Types of electrical boxes and fittings in this section include the following:
 - 1. Handholes

1.03 QUALITY ASSURANCE

- A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- B. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL listed and labeled.
- C. NEC Compliance: Comply with requirements as applicable to construction and installation of raceway systems.
- D. The materials used in the fabrication of the raceway system shall be products of a manufacturer regularly engaged in the manufacturing of the specified material.
- E. NEC compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- F. UL Compliance: Provide electrical boxes and fittings which have been UL listed and labeled.
- G. ANSI/NEMA Standards Compliance: Comply with ANSI C 134.1 (NEMA Standards Pub No. OS 1) as applicable to sheet steel outlet boxes, covers and box supports.

1.04 SUBMITTALS

- A. Raceway Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of raceway listed below. Include data substantiating that materials comply with requirements for the following:
 - 1. Raceway
- B. In-Ground Handhole Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations for each type of handhole required. Include data substantiating that units comply with requirements.

PART 2 - PRODUCTS

2.01 RACEWAYS

- A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways. Conduit shall be used where concealed in permanent wall construction or in ceiling plenums

- B. PVC Conduit: Conduit shall be Carlon PV Duit, Type 40, 90 deg.C. Conduit shall be composed of Polyvinyl Chloride and shall conform to NEMA Standards. Conduit, fittings and cement shall be produced by the same manufacturer. May be used where installed in earth fill.
- C. MC cable will not be allowed.

2.02 IN-GROUND HANDHOLES

- A. UL or ETL Listed, polymer concrete construction, open bottom stackable. Quazite PG style or equal.
 - 1. Manufacturer: Subject to compliance with requirements, the following manufacturers are acceptable:
 - a. Quazite
 - b. HiLine
 - c. Armorcast
- B. All stainless steel hardware with minimum two fasteners per lid.
- C. Extra heavy duty covers with non-skid surface, Tier 15.
- D. Refer to schedule on drawings for additional product information.

PART 3 - EXECUTION

3.01 INSTALLATION OF RACEWAY

- A. Minimum size conduit shall be 1" trade size. Where specified size is not called for on drawings or in the specifications, conduit shall be sized per NEC.
- B. Install the conduit system mechanically and electrically continuous from outlet to outlet and to all cabinets, junction or pull boxes. Conduit shall enter and be secured to all cabinets and boxes in such a manner that all parts of the system will have electrical continuity.
- C. Installation of PVC conduit shall comply with the NEC with regard to grounding and expansion fittings.
- D. Support conduit raceway systems in accordance with requirements as set forth in the National Electric Code.
- E. All connections to NEMA 3R enclosures shall maintain the enclosure listing regardless of the equipment location.

3.02 IN-GROUND HANDHOLE INSTALLATION

- A. Install all handholes flush with surrounding grade. Adjust handholes as required for finished grade.
- B. Do not install handholes at low grade points. Install at locations to allow drainage away from box.
- C. Provide 1" clean compacted fill beneath handholes for drainage. Clean fill shall extend 8" beyond the sides of the handhole enclosure, and a minimum of 12" deep.

END OF SECTION 26 0533

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 26 0010 - Electrical General Provisions are applicable to work required of this section.

1.02 DESCRIPTION OF WORK

- A. Contractor shall provide identification for wiring systems and equipment as called for in this section.
- B. Types of electrical identification specified in this section include the following:
 - 1. Buried cable warnings.
 - 2. Cable conductor identification.

1.03 QUALITY ASSURANCE

- A. UL Compliance: Comply with applicable portions of UL safety standards pertaining to electrical marking and labeling identification systems.
- B. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.

PART 2 - PRODUCTS

2.01 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than a single type is specified for an application, selection is Installer's option, but provide single selection for each application.
- B. Underground Type Plastic Line Marker
 - 1. General: Manufacturer's standard permanent, bright colored, continuous printed plastic tape; not less than 6" wide x 4 mils thick intended for underground service. Provide tape with printing which most accurately indicates type of service of buried cable/conduit.
- C. Cable/Conductor Identification Bands
 - 1. General: Provide manufacturer's standard vinyl cloth self-adhesive cable/conductor markers of wrap around type; either pre numbered plastic-coated type or write on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.
- D. Self-Adhesive Tape for Circuit Identification
 - 1. General: Provide clear self-adhesive or pressure sensitive, preprinted, flexible vinyl tape for panel name and circuit number.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

- A. Underground Cable/Conduit Identification
 - 1. General: During back filling/top/soiling of each exterior underground electrical conduit, install continuous underground type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
- B. Cable/Conductor Identification
 - 1. General: Apply cable/conductor identification on each cable and conductor in each box/enclosure/cabinet where wires of more than one circuit are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents and similar previously established identification for project electrical work.

C. Operational Identification and Warnings

1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

END OF SECTION 26 0553