

# CENTRAL COUNTY TRANSPORTATION AUTHORITY

## ELECTRICAL AND LANDSCAPING UPGRADES FOR SHORT TERM PARKING LOT AT 459 NORTH ROSE STREET FOR CCTA

### OWNER CONTACT

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### ADDITIONAL CONTACTS

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FRENALDI@GOWIGHTMAN.COM

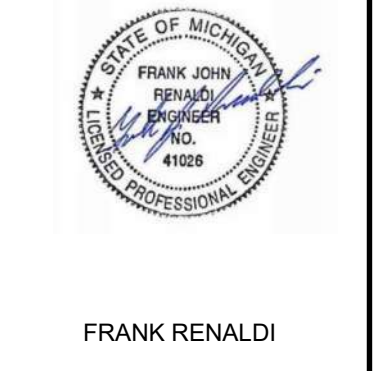
ELECTRICAL ENGINEER  
THE STEELHEAD ENGINEERING COMPANY  
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KALAMAZOO, MI 49007  
BRANDEN COX, PE  
ENGINEERING TECHNICAL MANAGER  
269.459.5207  
BCOX@BODWEGROUP.COM

### NOTES

EXCEPT WHERE OTHERWISE INDICATED ON THESE PLANS OR IN THE PROPOSAL AND SUPPLEMENTAL SPECIFICATIONS CONTAINED THEREIN, ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE 2020 MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION.

THE PLACING OF PAVEMENT MARKINGS AND TRAFFIC CONTROL SIGNS SHALL BE DONE IN ACCORDANCE WITH THE 2011 MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AS AMENDED.

IN CONFORMANCE WITH PUBLIC ACT 174 OF 2013, ALL CONTRACTORS SHALL CALL MISS DIG @ 811 OR 800-482-7171 FOR PROTECTION OF UNDERGROUND UTILITIES A MINIMUM OF THREE FULL WORKING DAYS (EXCLUDING SATURDAYS, SUNDAYS AND HOLIDAYS) PRIOR TO BEGINNING EACH EXCAVATION IN ANY AREA. MEMBERS WILL THUS BE ROUTINELY NOTIFIED. THIS DOES NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY OF NOTIFYING UTILITY OWNERS WHO MAY NOT BE A PART OF THE "MISS DIG" ALERT SYSTEM.



PROJECT NAME:  
**ELECTRICAL AND LANDSCAPING UPGRADES FOR SHORT TERM PARKING LOT AT 459 NORTH ROSE STREET FOR CCTA**  
459 NORTH ROSE STREET,  
KALAMAZOO, MI 49007  
**CENTRAL COUNTY TRANSPORTATION AUTHORITY**  
530 NORTH ROSE STREET,  
KALAMAZOO, MI 49007

### INDEX OF PLANS

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C100	SITE LAYOUT
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E500	ELECTRICAL SPECS
E520	ELECTRICAL SPECS
E600	ELECTRICAL SPECS

### UTILITIES

ELECTRIC	CONSUMERS ENERGY CO. 2500 E. CORK STREET KALAMAZOO, MI 49001 269.337.2246 MIKE SOKOLOV
GAS	CONSUMERS ENERGY CO. 2500 E. CORK STREET KALAMAZOO, MI 49001 269.337.2366 KYLE OAK
CABLE	CHARTER COMMUNICATIONS 4176 COMMERCIAL AVE. PORTAGE, MI 49002 269.217.8152 MARK BURKE
TELEPHONE	AT&T 2919 MILLCORK ST. KALAMAZOO, MI 49001 269.384.4436 TODD SHIBAYAMA
SEWER/WATER	CITY OF KALAMAZOO DEPARTMENT OF PUBLIC SERVICES 415 E. STOCKBRIDGE AVE KALAMAZOO, MI 49001 ANNA CRANDELL / RYAN STOUGHTON
'MISS DIG'	811

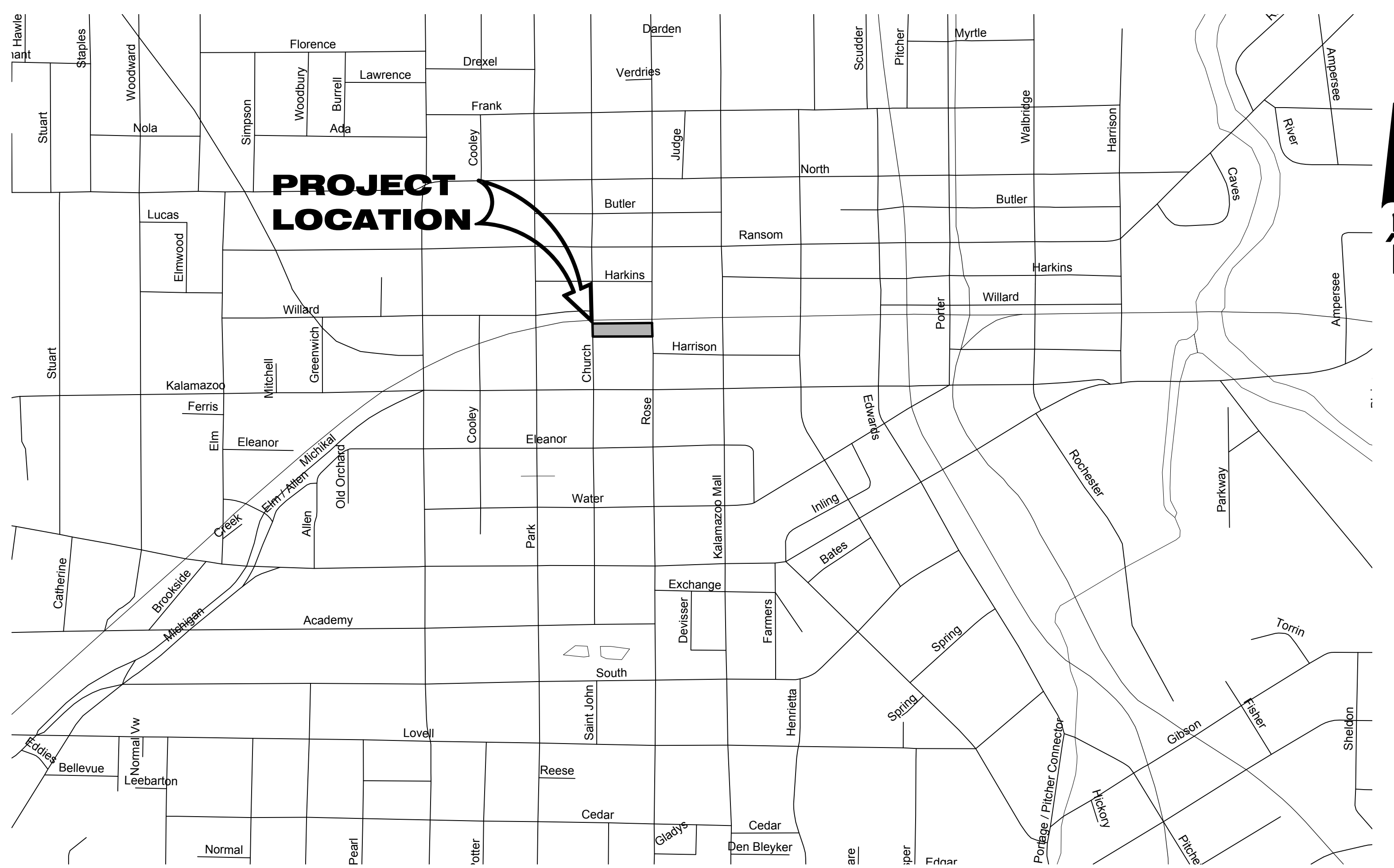
### LEGEND

EXISTING	PROPOSED
—C—	—C— CABLE
—E—	—E— ELECTRIC LINE
—OHE—	—OHE— ELECTRIC LINE (OVERHEAD)
—FO—	—FO— FIBER OPTIC LINE
—G—	—G— GAS LINE
—T—	—T— TELEPHONE LINE
—X—X—X—	—X—X—X— FENCE
—G—G—G—	—G—G—G— FORCEMAIN
—S—S—S—	—S—S—S— GUARDRAIL
—SS—SS—SS—	—SS—SS—SS— SANITARY SEWER
—SSS—SSS—SSS—	—SSS—SSS—SSS— STORM SEWER
—W—W—W—	—W—W—W— WATER MAIN
—CL—CL—CL—	—CL—CL—CL— CENTER LINE
—T—	—T— EXISTING TREE LINE
—D—	—D— EXISTING DITCH LINE
—E—	—E— EASEMENT LINE/GRADING PERMIT
—GL—GL—GL—	—GL—GL—GL— GRADING LIMITS/LIMITS OF DISTURBANCE
—P—P—P—	—P—P—P— PROPERTY LINE
—R—R—R—	—R—R—R— RIGHT-OF-WAY LINE
—S—S—S—	—S—S—S— SECTION LINE
—A—A—A—	—A—A—A— TO BE ABANDONED

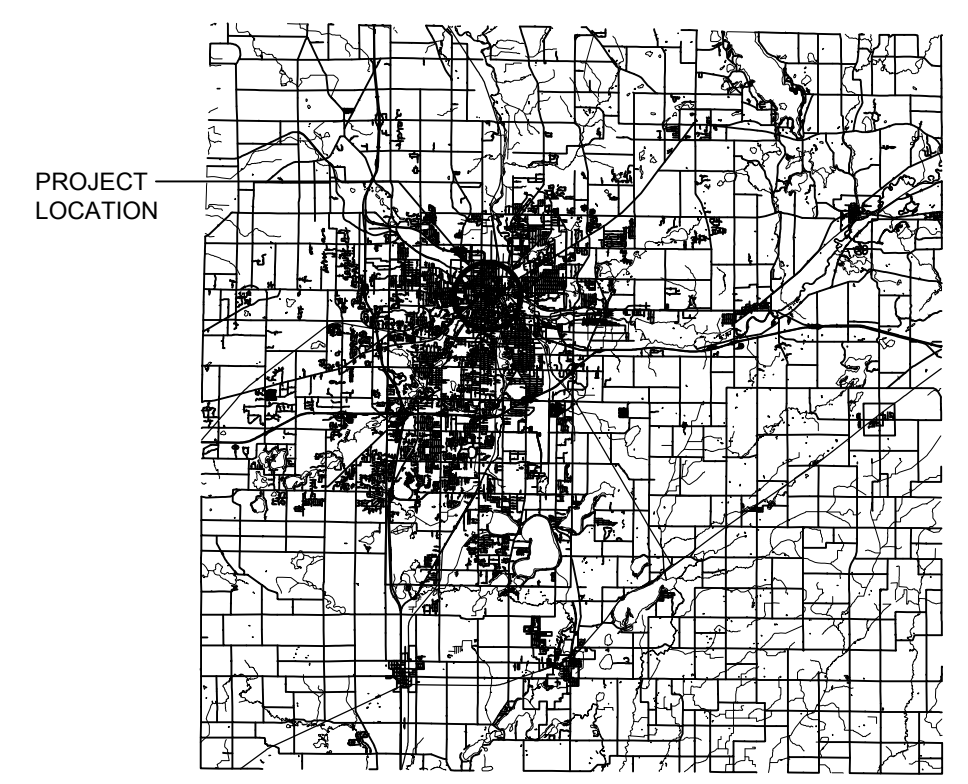
⊕	= ANTENNA	⊕	= PAVEMENT/SOIL BORING
⊠	= CATCH BASIN	⊕	= PROPOSED HYDRANT
⊠	= CABLE RISER BOX	⊕	= PROPOSED GATE VALVE & BOX
⊠	= CLEAN OUT	⊕	= PROPOSED GATE VALVE & VAULT
⊠	= CURB INLET	⊕	= PROPOSED REDUCER
⊠	= ELECTRIC MANHOLE	⊕	= PROPOSED SANITARY MANHOLE
⊠	= FIRE HYDRANT	⊕	= PROPOSED STORM MANHOLE
⊠	= FOUND IRON PIPE	⊕	= STORM MANHOLE
⊠	= GAS VALVE	⊕	= TELEPHONE MANHOLE
⊠	= GUY ANCHOR	⊕	= TELEPHONE RISER BOX
⊠	= LIGHT POLE	⊕	= TURNING POINT/TRVERSE
⊠	= MAILBOX	⊕	= UTILITY POLE
⊠	= MONITORING WELL	⊕	= VAULT
⊠	= POST	⊕	= WATER ELEVATION
⊠	= SATELLITE DISH	⊕	= WATER MANHOLE
⊠	= SANITARY MANHOLE	⊕	= WATER METER
⊠	= SECTION CORNER	⊕	= WATER VALVE
⊠	= SIGN	⊕	= WATER SPIGOT
		⊕	= WELL

### TREE DESIGNATORS

⊕	BUSH	⊕	STUMP
⊕	CONIFEROUS TREE	⊕	DECIDUOUS TREE
⊕	CONIFEROUS TREE TO BE REMOVED	⊕	DECIDUOUS TREE TO BE REMOVED



LONG TERM PARKING LOT  
PROJECT LOCATION MAP  
SCALE: 1" = 500'



KALAMAZOO COUNTY  
VICINITY MAP  
SCALE: NONE

01/27/2023  
SUBMITTED FOR ADMINISTRATIVE REVIEW

### REVISIONS

DATE: JANUARY, 2023  
SCALE: AS NOTED

COVER SHEET

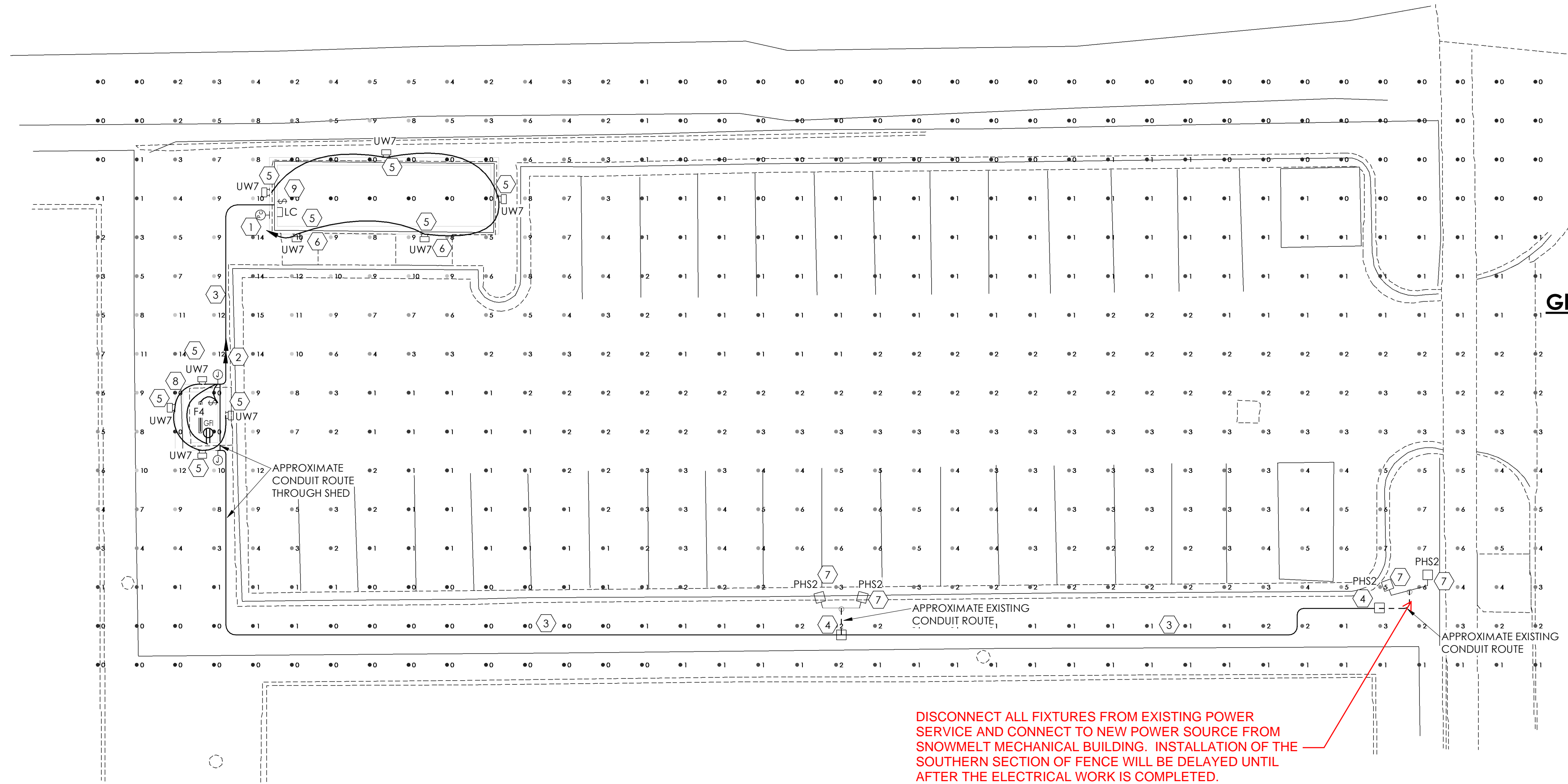
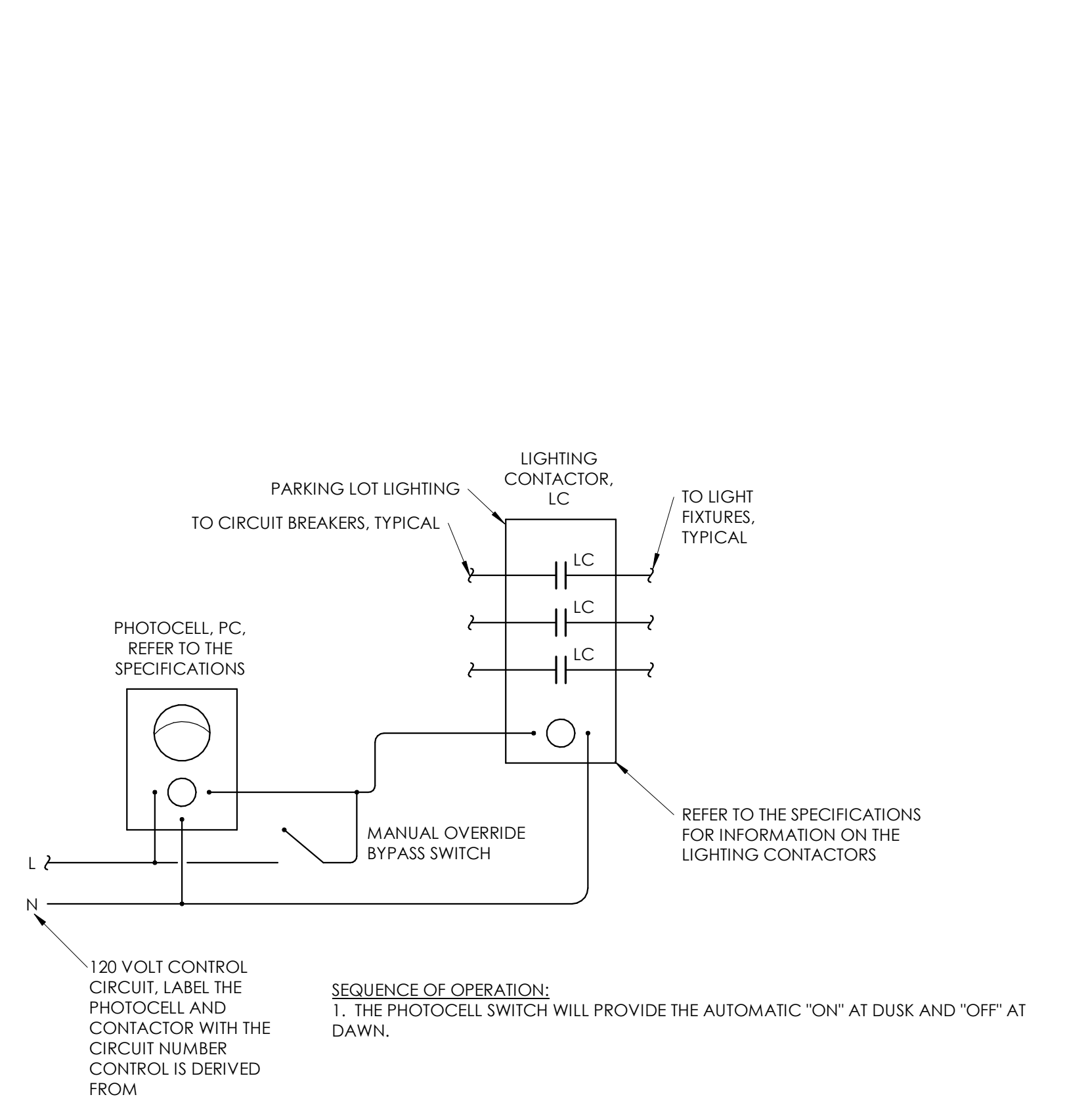


LIGHT FIXTURE SCHEDULE																
MARK	CONSTRUCTION		PRODUCT		CONSTRUCTION		LIGHT SOURCE				ELECTRICAL			NOTES		
	DESCRIPTION	MANUFACTURER	MODEL NO.	LENS/LOUVER	MOUNTING	LAMP	LUMENS DOWN	LUMENS UP	CCT	CRI	BALLAST/ DRIVER	VOLTAGE	PHASE		WATTS	
F4	ROUND LENS LED STRIP	LITHONIA	FEM-L48-4000LM-IMAFD-M-D-MVOLT-GZ10-35K/80CRI	FROSTED SMOOTH ACRYLIC	SURFACE/SUS PENDED	LED	4000 lm	0 lm	3500 K	80	LED NON-DIMMING DRIVER	120 V	1	24 W	--	--
PHS2	OSQ LED AREA/FLOOD LUMINAIRE	CREE	OSQM-9L-30K7-3M-UL-NM-BK	--	OSQ-ML-B-D A	LED	8875 lm	0 lm	3000 K	70	LED DRIVER	120 V	1	166 W	--	1
UW7	EXTERIOR WALL PACK	LITHONIA	DSXW1 LED 10C 1000 30K T2M MVOLT HS	--	WALL	LED	3215 lm	0 lm	3000 K	70	LED DRIVER	120 V	1	39 W	--	2

**SCHEDULE NOTES:**  
1. MOUNTING AND OPTIONS AS REQUIRED.  
2. FIXTURE MOUNTED AT 8'-0" ABOVE THE FINISH GRADE. COORDINATE MOUNTING HEIGHT WITH THE EXISTING BUILDING COMPONENTS AND THE OWNER.

- KEYNOTES**
1. PROVIDE DEDICATED BREAKER 15-AMP BREAKER FROM PANEL ON WEST SIDE OF SNOWMELT BUILDING FOR NEW LIGHTS ON SNOWMELT BUILDING. 2 - #12 COPPER CONDUCTORS AND 1 - #12 COPPER GROUND IN 3/4" CONDUIT THROUGH LIGHTING CONTACTOR. FIELD VERIFY AVAILABLE PANEL SPACE.
  2. PROVIDE ONE 20-AMP 1-POLE BREAKER FOR NEW LIGHTS ON RELOCATED SHED AND NEW POLE MOUNTED LIGHTS - ROUTE 2 - #10 COPPER CONDUCTORS AND 1 - #10 GROUND. ROUTE THROUGH LIGHTING CONTACTOR AND MANUAL OVERRIDE SWITCH. PROVIDE ONE 20-AMP 1-POLE BREAKER FOR NEW GFI RECEPTACLE IN SHED AND SHED LIGHT. ROUTE 2-#12 COPPER CONDUCTORS AND 1-#12 COPPER GROUND IN 3/4" CONDUIT. FIELD VERIFY AVAILABLE PANEL SPACE.
  3. APPROXIMATE ROUTE FOR NEW BELOW GRADE LIGHT FIXTURE FEEDER.
  4. QUAZITE BOX LOCATED NEAR BASE OF EXISTING POLE FOR CONNECTION OF NEW LIGHTING CONDUIT TO EXISTING CONDUIT TO THE LIGHT POLE.
  5. NEW FIXTURE MOUNTED TO THE FACE OF THE EXISTING BUILDING.
  6. EXISTING WALL PACK ON SNOWMELT BUILDING DEMOUSHED ALONG WITH EXISTING LIGHTING CONTROLS.
  7. NEW FIXTURE MOUNTED TO EXISTING LIGHT POLE. EXISTING CIRCUITRY AND CONDUIT FROM LIGHT POLE TO BE CONNECTED TO NEW CIRCUITRY AND CONDUIT IN QUAZITE BOX. FIELD VERIFY THE CONNECTION REQUIREMENTS.
  8. CONDUIT FOR EXTERNAL SHED LIGHTS TO BE ROUTED INSIDE OF SHED FOR CONNECTION TO LIGHT FIXTURES.
  9. MANUAL OVERRIDE BYPASS SWITCH FOR CONTROL/TESTING OF EXTERIOR LIGHTS. LABEL SWITCH 'EXTERIOR LIGHT TEST'.

- GENERAL SITE PLAN NOTES**
1. ALL LIGHTING AND POWER CONDUCTORS SHALL BE INSTALLED BETWEEN 24" (MINIMUM) AND 36" (MAXIMUM) BELOW FINISHED GRADE.
  2. ALL CONDUCTORS FOR EXTERIOR LIGHTING AND POWER CIRCUITS SHALL BE #10 AWG MINIMUM.



**2 EXTERIOR LIGHTING CONTROL DETAIL**  
SCALE: NTS

**ELECTRICAL SITE PLAN**  
SCALE: 1" = 10'-0"

**REVISIONS**  
10/2023 11:45 AM  
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© 2018 WIGHTMAN & ASSOCIATES, INC.  
DATE: 1/24/2023  
SCALE: As indicated

**ELECTRICAL SITE PLAN**



# WIGHTMAN

**BENTON HARBOR**  
2303 Pipestone Road  
Benton Harbor, MI 49022  
Phone: 269.927.0100

**KALAMAZOO**  
433 East Ransom Street  
Kalamazoo, MI 49007  
Phone: 269.327.3532

**ALLEGAN**  
1670 Lincoln Road  
Allegan, MI 49010  
Phone: 269.673.8465

www.gowightman.com



PROJECT NAME:  
**KMETRO  
PARKING LOT  
LIGHTING**

459 NORTH ROSE ST.  
KALAMAZOO, MI 49007

# WIGHTMAN

## DIVISION 26 - ELECTRICAL SECTION 260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Heat shrink tubing.
- E. Oxide inhibiting compound.
- F. Wire pulling lubricant.
- G. Cable ties.

#### 1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

#### 1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2020.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- K. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- L. UL 267 - Outline of Investigation for Wire-Pulling Compounds Most Recent Edition, Including All Revisions.
- M. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- N. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- O. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- P. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- B. Wire Pulling Lubricant: Certification of compatibility with conductors/cables where used with the following insulation/jacket types:
  - C. Field Quality Control Test Reports.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed circling arrangements. Record actual routing for underground circuits.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

#### 1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

#### 1.08 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

### PART 2 PRODUCTS

#### 2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is not permitted.
- H. Manufactured wiring systems are not permitted.

#### 2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 260526.
- H. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  - 3. Tinned Copper Conductors: Comply with ASTM B33.
- I. Minimum Conductor Size:
  - 1. Branch Circuits: 12 AWG.
- J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- K. Conductor Color Coding:
  - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  - 2. Color Coding Method: Integrally colored insulation.
    - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
  - 3. Color Code:
    - a. 480/277 V, 3 Phase, 3 Wire System:
      - 1) Phase 1: Brown
      - 2) Phase 2: Orange
      - 3) Phase 3: Yellow
      - 4) Neutral/Grounded: Gray
    - b. Equipment Ground, All Systems: Green.

#### 2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
  - 1. Copper Building Wire:
    - a. Cerro Wire LLC: www.cerrowire.com/#sle.
    - b. Encore Wire Corporation: www.encorewire.com/#sle.
    - c. General Cable Technologies Corporation: www.generalcable.com/#sle.
    - d. Service Wire Co: www.servicewire.com/#sle.
    - e. Southwire Company: www.southwire.com/#sle.
    - f. Substitutions: See Section 016000 - Product Requirements.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
  - 1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.

#### E. Insulation:

- 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
  - a. Size 4 AWG and Larger: Type XHHW-2.
  - b. Installed Underground: Type XHHW-2.

#### 2.04 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 260526.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
- 4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
- 5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
  - 1. Manufacturers:
    - a. 3M: www.3m.com/#sle.
    - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
    - c. NSI Industries LLC: www.nsiindustries.com/#sle.
    - d. Substitutions will be allowed:.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
  - 1. Manufacturers:
    - a. Burndy LLC: www.burndy.com/#sle.
    - b. IlSCO: www.ilSCO.com/#sle.
    - c. Thomas & Betts Corporation: www.tnb.com/#sle.
    - d. Substitutions will be allowed:.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
  - 1. Manufacturers:
    - a. Burndy LLC: www.burndy.com/#sle.
    - b. IlSCO: www.ilSCO.com/#sle.
    - c. Thomas & Betts Corporation: www.tnb.com/#sle.
    - d. Substitutions will be allowed:.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
  - 1. Manufacturers:
    - a. Burndy LLC: www.burndy.com/#sle.
    - b. IlSCO: www.ilSCO.com/#sle.
    - c. Thomas & Betts Corporation: www.tnb.com/#sle.
    - d. Substitutions will be allowed:.

#### 2.05 ACCESSORIES

- A. Electrical Tape:
  - 1. Manufacturers:
    - a. 3M: www.3m.com/#sle.
    - b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
  - 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
  - 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
  - 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 265 degrees F overload service.
  - 5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
  - 6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
  - 7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, spill-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
  - 1. Manufacturers:
    - a. 3M: www.3m.com/#sle.
    - b. Burndy LLC: www.burndy.com/#sle.
    - c. Thomas & Betts Corporation: www.tnb.com/#sle.
    - d. Substitutions will be allowed:.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
  - 1. Manufacturers:
    - a. Burndy LLC: www.burndy.com/#sle.
    - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
    - c. IlSCO: www.ilSCO.com/#sle.
    - d. Substitutions will be allowed:.
- D. Wire Pulling Lubricant:
  - 1. Manufacturers:
    - a. 3M: www.3m.com/#sle.
    - b. American Polywater Corporation: www.polywater.com/#sle.
    - c. Ideal Industries, Inc: www.idealindustries.com/#sle.
    - d. Substitutions will be allowed:.
  - 2. Listed and labeled as complying with UL 267.
  - 3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
  - 4. Suitable for use at installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that work likely to damage wire and cable has been completed.
- B. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- C. Verify that field measurements are as indicated.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

#### 3.03 INSTALLATION

- A. Circulating Requirements:
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- E. Install conductors with a minimum of 12 inches of slack at each outlet.
- F. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- G. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- H. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  - 3. Do not remove conductor strands to facilitate insertion into connector.
  - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
  - 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- I. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unsplined conductors.
- J. Insulate ends of spare conductors using vinyl insulating electrical tape.
- K. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- L. Install freestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- M. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

## END OF SECTION SECTION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.

#### 1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

#### 1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.
  - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- C. Field quality control test reports.
- D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

#### 1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
  - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- E. Bonding and Equipment Grounding:
  - 1. Provide bonding for equipment grounding conductors, equipment ground buses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  - 3. Between ground conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  - 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  - 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  - 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

#### 2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
  - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
  - 1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:
      - 1) Use bare copper conductors where installed underground in direct contact with earth.
      - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
  - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
  - 3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.
  - 4. Manufacturers - Mechanical and Compression Connectors:
    - a. allG Fabrication: www.allgfab.com/#sle.
    - b. Burndy LLC: www.burndy.com/#sle.
    - c. Harger Lightning & Grounding: www.harger.com/#sle.
    - d. nVent ERICO: www.nvent.com/#sle.
    - e. Thomas & Betts Corporation: www.tnb.com/#sle.
    - f. Substitutions: See Section 016000 - Product Requirements.
  - 5. Manufacturers - Exothermic Welded Connections:
    - a. Burndy LLC: www.burndy.com/#sle.
    - b. nVent ERICO, Cadweld: www.nvent.com/#sle.
    - c. thermoweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
    - d. Substitutions will be allowed.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Make grounding and bonding connections using specified connectors.
  - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  - 2. Remove nonconductive enamel, or similar coating at threads, contact points, and contact surfaces.
  - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- D. Identify grounding and bonding system components in accordance with Section 260553.

#### 3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

## END OF SECTION SECTION 260533.13 CONDUIT FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Rigid polyvinyl chloride (PVC) conduit.

#### 1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
  - 1. Includes additional requirements for fittings for grounding and bonding.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.16 - Boxes for Electrical Systems.

#### REVISIONS

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DATE: 1/27/2023  
SCALE:

### ELECTRICAL SPECS

JOB NO: 224206  
**E500**



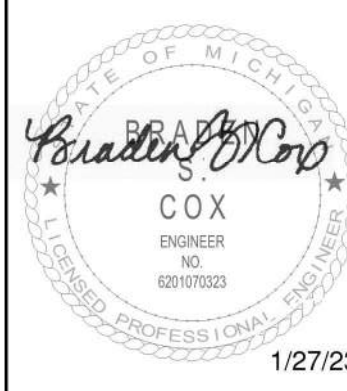
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PROJECT NAME:  
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## 1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- C. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- D. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- G. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds Current Edition, Including All Revisions.

## 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
  - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
  - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
  - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

## 1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

## 1.06 QUALITY ASSURANCE

- A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.
- B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
  - 1. Under Slab on Grade: Use rigid PVC conduit.
  - 2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit.
- D. Embedded Within Concrete:
  - 1. Within Slab on Grade: Use rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.
  - 2. Within Slab Above Ground: Use rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.
  - 3. Within Concrete Walls Above Ground: Use rigid PVC conduit.
  - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from concrete.
- E. Exposed, Interior, Subject to Physical Damage: Use galvanized steel intermediate metal conduit (IMC).
  - 1. Locations subject to physical damage include, but are not limited to:
    - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

### 2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.
- C. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- D. Provide products listed, classified, and labeled as suitable for purpose intended.
- E. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 3/4-inch trade size.
  - 2. Branch Circuit Homeruns: 3/4-inch trade size.
  - 3. Control Circuits: 1/2-inch trade size.
  - 4. Flexible Connections to Luminaires: 3/8-inch trade size.
  - 5. Underground, Interior: 3/4-inch trade size.
  - 6. Underground, Exterior: 1-inch trade size.
- F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

### 2.03 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
  - 1. ABB: Carlon: www.carlon.com/#sle.
  - 2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
  - 3. Cantex Inc: www.cantexinc.com/#sle.
  - 4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.
  - 5. JM Eagle: www.jmeagle.com/#sle.
  - 6. Substitutions will be allowed: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

### 2.04 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- D. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated without specific routing, determine exact routing required.
  - 3. Conceal conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Unless otherwise approved, do not route exposed conduits:
    - a. Across floors.
    - b. Across roofs.
    - c. Across top of parapet walls.
    - d. Across building exterior surfaces.
  - 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
  - 8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
  - 9. Arrange conduit to provide no more than 150 feet between pull points.
  - 10. Route conduits above water and drain piping where possible.
  - 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  - 12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  - 13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.
    - c. Flues.
  - 14. Group parallel conduits in same area on common rack.
- E. Conduit Support:
  - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
  - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on

- ceiling tiles.
- 4. Use conduit strap to support single surface-mounted conduit.
  - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
- 5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
- 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
- 7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
- 8. Use of spring steel conduit clips for support of conduits is not permitted.
- 9. Use of wire for support of conduits is not permitted.
- 10. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

### F. Connections and Terminations:

- 1. Use suitable adapters where required to transition from one type of conduit to another.
- 2. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
- 3. Secure joints and connections to provide mechanical strength and electrical continuity.

### G. Penetrations:

- 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
- 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
- 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
- 4. Conceal bends for conduit risers emerging above ground.
- 5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
- 6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
- 7. Install freestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

### H. Underground Installation:

- 1. Minimum Cover, Unless Otherwise Indicated or Required:
  - a. Underground, Exterior: 18 inches.
  - b. Under Slab on Grade: 12 inches to bottom of slab.
- 2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased;

### I. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

- 1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
- 2. Install conduits within middle one third of slab thickness.
- 3. Secure conduits to prevent floating or movement during pouring of concrete.

### J. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 033000.

### K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

- 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
- 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
- 3. Where conduits are subject to earth movement by settlement or frost.

### L. Conduit Sealing:

- 1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
  - a. Where conduits enter building from outside.
  - b. Where service conduits enter building from underground distribution system.
  - c. Where conduits enter building from underground.
  - d. Where conduits may transport moisture to contact live parts.
- 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
  - a. Where conduits pass from outdoors into conditioned interior spaces.
  - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

### M. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

### N. Provide grounding and bonding; see Section 260526.

### O. Identify conduits;

### 3.03 FIELD QUALITY CONTROL

- A. Correct deficiencies and replace damaged or defective conduits.

### 3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

### 3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**END OF SECTION**  
**SECTION 260533.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

## PART 2 PRODUCTS

### 1.01 BOXES

- A. General Requirements:
  - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
  - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  - 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
  - 4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
  - 5. Use raised covers suitable for the type of wall construction and device configuration where required.
  - 6. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  - 7. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
  - 8. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
  - 9. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
  - 10. Minimum Box Size, Unless Otherwise Indicated:
    - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
    - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
  - 11. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    - b. Hubbell Incorporated; Bell Products: www.hubbell-rb.com/#sle.
    - c. Hubbell Incorporated; RACO Products: www.hubbell-rb.com/#sle.
    - d. Thomas & Betts Corporation: www.tnb.com/#sle.
    - e. Substitutions will be allowed.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
  - 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    - a. Indoor Clean, Dry Locations: Type 1, painted steel.
    - b. Outdoor Locations: Type 3R, painted steel.
  - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
  - 4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
  - 5. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    - b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
    - c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.
    - d. Substitutions will be allowed.

### 1.02 ACCESSORIES

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

## PART 3 EXECUTION

### 2.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 2.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- G. Box Locations:

- 1. Unless dimensioned, box locations indicated are approximate.
- 2. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.

### H. Box Supports:

- 1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
- 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
- 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

### I. Install boxes plumb and level.

### J. Flush-Mounted Boxes:

- 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
- 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
- 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

### K. Install boxes as required to preserve insulation integrity.

### L. Install freestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

### M. Close unused box openings.

### N. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

### O. Provide grounding and bonding in accordance with Section 260526.

## 2.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

## 2.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**END OF SECTION**  
**SECTION 260553**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

## PART 1 GENERAL

### 1.01 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

### 1.02 SUBMITTALS

## PART 2 PRODUCTS

### 2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Time Switches:
      - 1) Identify load(s) served and associated circuits controlled. Include location.
    - b. Enclosed Contactors:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify load(s) and associated circuits controlled. Include location.
- B. Identification for Conductors and Cables:
  - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
  - 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- C. Identification for Boxes:
  - 1. Use voltage markers to identify highest voltage present.
  - 2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

### 2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Labels:
  - 1. Manufacturers:
    - a. Brady Corporation: www.bradyid.com/#sle.
    - b. Brother International Corporation: www.brother-usa.com/#sle.
    - c. Panduit Corp: www.panduit.com/#sle.
    - d. Substitutions will be allowed: See Section 016000 - Product Requirements.
  - 2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
  - 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- B. Format for Equipment Identification:
  - 1. Minimum Size: 1 inch by 2.5 inches.
  - 2. Legend:
    - a. System designation where applicable:
    - b. Equipment designation or other approved description.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height:
    - a. System Designation: 1 inch.
    - b. Equipment Designation: 1/2 inch.
  - 5. Color:
    - a. Normal Power System: White text on black background.
- C. Format for Receptacle Identification:
  - 1. Minimum Size: 3/8 inch by 1.5 inches.
  - 2. Legend: Power source and circuit number or other designation indicated.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 3/16 inch.
  - 5. Color: Black text on clear background.

### 2.03 WIRE AND CABLE MARKERS

- A. Manufacturers:
  - 1. Brady Corporation: www.bradyid.com/#sle.
  - 2. Hellermann-Tyton: www.hellermann-tyton.com/#sle.
  - 3. Panduit Corp: www.panduit.com/#sle.
  - 4. Substitutions will be allowed: See Section 016000 - Product Requirements.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

### 2.04 VOLTAGE MARKERS

- A. Manufacturers:
  - 1. Brady Corporation: www.bradyid.com/#sle.
  - 2. Brimar Industries, Inc: www.brimar.com/#sle.
  - 3. Seton Identification Products: www.seton.com/#sle.
  - 4. Substitutions will be allowed: See Section 016000 - Product Requirements.
- B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- C. Minimum Size:
  - 1. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
  - 2. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- D. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.
- E. Color: Black text on orange background unless otherwise indicated.

## 2.05 UNDERGROUND WARNING TAPE

- A. Manufacturers:
  - 1. Brady Corporation: www.bradyid.com/#sle.
  - 2. Brimar Industries, Inc: www.brimar.com/#sle.
  - 3. Seton Identification Products: www.seton.com/#sle.
  - 4. Substitutions will be allowed: See Section 016000 - Product Requirements.
- B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.

**END OF SECTION**  
**SECTION 265600**  
**EXTERIOR LIGHTING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Exterior luminaires.

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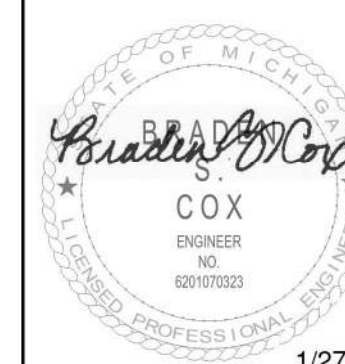
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PROJECT NAME:  
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PARKING LOT  
LIGHTING**

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### ELECTRICAL SPECS

JOB NO: 224206  
**E600**

- B. Ballasts and Drivers.
- C. Luminaire accessories.
- 1.02 RELATED REQUIREMENTS**
- A. Section 260529 - Hangers and Supports for Electrical Systems.
- 1.03 REFERENCE STANDARDS**
- A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2000 (Reaffirmed 2006).
- E. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2020.
- F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012 (Reaffirmed 2018).
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 1598 - Luminaires Current Edition, Including All Revisions.
- I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.
- 1.04 ADMINISTRATIVE REQUIREMENTS**
- 1.05 SUBMITTALS**
- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
  - 2. Lamps: Include rated life and initial and mean lumen output.
  - 3. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
- B. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.
- C. Field Quality Control Reports.
  - 1. Include test report indicating measured illumination levels.
- D. 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.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
- F. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.
- 1.06 QUALITY ASSURANCE**
- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- 1.07 DELIVERY, STORAGE, AND HANDLING**
- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- 1.08 WARRANTY**
- A. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.
- PART 2 PRODUCTS**
- 2.01 LUMINAIRE TYPES**
- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions will be allowed.:
- 2.02 LUMINAIRES**
- A. Manufacturers:
  - 1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
  - 2. Alloy LED: www.alloyled.com/#sle.
  - 3. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
  - 4. Hubbell Lighting, Inc: www.hubbellighting.com/#sle.
  - 5. Philips Lighting North America Corporation: www.lightingproducts.philips.com/#sle.
  - 6. RAB Lighting, Inc: www.rablighting.com/#sle.
  - 7. H.E. Williams, Inc..
  - 8. Substitutions will be allowed.:
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- I. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.
- K. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- 2.03 BALLASTS AND DRIVERS**
- A. Manufacturers:
  - 1. California Accent Lighting, Inc: www.callighting.com/#sle.
  - 2. General Electric Company/GE Lighting: www.gelighting.com/#sle.
  - 3. OSRAM Sylvania, Inc: www.osram.us/ds/#sle.
  - 4. Philips Lighting North America Corporation: www.usa.lighting.philips.com/#sle.
  - 5. Substitutions will be allowed.:
  - 6. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
- B. Ballasts/Drivers - General Requirements:
  - 1. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- C. Dimmable LED Drivers:
  - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
  - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.
- 2.04 ACCESSORIES**
- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- PART 3 EXECUTION**
- 3.01 EXAMINATION**
- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.
- 3.02 PREPARATION**
- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.
- 3.03 INSTALLATION**
- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires in accordance with NECA/IESNA 501.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.

- J. Install lamps in each luminaire.
- 3.04 FIELD QUALITY CONTROL**
- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.
- 3.05 ADJUSTING**
- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- 3.06 CLEANING**
- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- 3.07 PROTECTION**
- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION