L'Anse Creuse Public Schools

Harrison Township and Macomb, MI

Bid Package 25-02 : LCHS & HSN Ballfield Upgrades and HSN Tennis Courts

ADDENDUM NO. 2

March 6th, 2025

Total Pages – 86 pgs.

Barton Malow Write Up – 4 pgs.

Partners in Architecture Write Up – 2 pgs.

PIA Specifications – 72 pgs.

PIA - LCHS Drawings - 5 pgs.

PIA -HSN Drawings – 3 pgs.

MEMORANDUM

ADDENDUM NO. 2

Client:	L'Anse Creuse Public Schools
Project Name(s):	LCHS & HSN Ballfield Upgrades and Tennis Courts
Bid Package No.:	25-02
Issue Date:	March 6th, 2025
Bid Due Date:	**March 13rd, 2025 @ 1 p.m. (Building Connected)**
Mandatory Post Bid	Week of March 17th , 2025

All requirements contained in the Contract Documents shall apply to this addendum no. 2 and the general character of the work called for in this addendum shall be the same as originally set forth in the applicable portions of the contract.

This addendum no. 2 is hereby made a part of the contract documents and shall assume its position of relevance in the contract documents.

- General
    - **Work Scope Changes/Clarifications:**
        - **Post Tension Concrete Contractor**
            - This contractor is responsible for the Tennis equipment in spec section 327101-2 Athletic Equipment. Shown in marked up spec section attached.
        - **Site Work Contractor**
            - This contractor is responsible for the Portable Bleachers and Baseball/Softball equipment items 1,2,3,4 turf accessories in spec section 327101-2 Athletic Equipment. Shown in marked up spec section attached.
            - This contractor is responsible for relocating existing bleachers at both LCHS and HSN to protect and relocating to their final location once project is complete.

- **General Trades Contractor**
  - This contractor is responsible for the custom height wall padding in Baseball/Softball Equipment section of spec section 327101-2 Athletic Equipment. Shown in marked up spec section attached.
  - This contractor is responsible to carry a certified electrical contractor and all the electrical work associated. Electrical drawings can be found in this Addendum #2.
  - This contractor is responsible for all items found on the electrical drawings and electrical specifications.

- **Fencing Contractor**
  - This contractor is responsible for Baseball/Softball Equipment items 1.5,1.7,1.8,1.9,1.10 and 2.1 in spec section 327101-2 Athletic Equipment. Shown in marked up spec section attached.

- **Drawings: Updated Drawings:**
  - L'Anse Creuse High School and L'Anse Creuse High School - North
    - See Partners in Architecture Writeup for drawing changes.

- **Drawings: Updated Specifications:**
  - L'Anse Creuse High School and L'Anse Creuse High School - North
    - See Partners in Architecture Writeup for specification changes/additions.
    - See Partners in Architecture Writeup for responses to contractor pre-bid RFIs.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of athletic equipment through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 ATHLETIC EQUIPMENT (or approved equal)

A. Tennis equipment:

1. Provide equipment, complete and installed, as supplied by Douglas Industries (800 553 8907) or approved equal.

Post-Tension Concrete Contr.: 1) Net: Model TN-36DM (Order #20038).
Post-Tension Concrete Contr.: 2) Post: Premier RD (Order #63050).
Post-Tension Concrete Contr.: 3) Round Steel Ground Sleeves: Model GS-24.
Post-Tension Concrete Contr.: 4) Center Tie-Down: #63428.
Post-Tension Concrete Contr.: 5) Center Strap, Adjustable: Model ACS.

2. Provide complete and installed, as supplied by Bakko Backboards (800 445 BORD) or approved equal.

Fencing Contractor: 1) 10’ H x 20’ L, Professional series.

B. Portable bleachers:

1. Provide equipment, complete and installed, as supplied by Jaypro Sports (800 243 0533) or approved equal.

Site Work Contractor: 1) 3 row, tip and roll bleacher #BLCH-375TRG.

C. Baseball / Softball equipment:

1. Provide equipment, complete and installed, as supplied by Sportsfield Specialties (607 746 8911) or approved equal.

Site Work Contractor: 1) Synthetic turf access frames for pitcher’s plates and bases: Models SHAFIT and SHAFRIT.
Site Work Contractor: 2) Rawlings Hollywood base set (SHBBPLSET) with ground anchors.
Site Work Contractor: 3) Rawlings Pro home plate with ground anchor (SHP-PS).
Site Work Contractor: 4) Rawlings dual stanchion pitching rubber (SHLBMPR224).
Fencing Contractor: 5) Single overhead batting tunnels, ground sleeve insert: Baseball (BTOBS) and Softball (BTOSS).
General Trades Contractor: 6) Custom height wall padding, 3” thick high impact foam with 18 oz outdoor vinyl, custom color and graphics. Provide padding on all freestanding masonry backstop walls, see plans for wall limits.

Fencing Contractor: 7) Batter's eye wall, 20'H x 40'L, direct embedment: BESR2040S. Provide custom graphics.

Fencing Contractor: 8) Foul poles with wings, ground sleeve inserted, 30' high: FPW630.

Fencing Contractor: 9) Custom tie-back tension netting systems, with Ultra Cross nets, TNTBUC. See plans for limits and configuration at each field location.

Fencing Contractor: 10) Windscreens: VCP-Custom (7' High), with custom graphics.

2. Provide equipment, complete and installed, as supplied by Beacon Athletics (800 747 5985) or approved equal.

Fencing Contractor: 1) Fence Guard Standard, color to be selected by Owner from manufacturer's standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of athletic equipment where required.

B. Install equipment level, plumb, true, and securely anchored at locations indicated on Drawings. Provide concrete footings in accordance with manufacturer's requirements or recommendations.

3.3 CLEANING

A. After completing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 327101

ADDENDUM No. 2

Project Name: L'Anse Creuse Public Schools
2024 Bond Projects – BP25-02 – Athletic Field Improvements Addendum No.: Two (2)

Issue Date: March 5, 2025
PIA Project Number: 24-156
Project Location: L'Anse Creuse High School & L'Anse Creuse High School – North

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To the Contract Documents for the LCPS BP25-02 – Athletic Field Improvements Project.

This Addendum forms a part of the above-described Contract Documents and supersedes supplements or clarifies parts thereof to the extent defined by the terms set forth in this Addendum.

This document consists of (2) typed pages and the following Specification and Drawing attachments:

BP25-2A Drawings: C9.0, E0-01, E0-02, E1-01, E1-02
BP25-2B Drawings: E0-01, E1-01, E1-02
Specifications: 260100, 260500, 260519, 260526, 260529, 260533, 260533, 260553, 262416, 262726

RFI RESPONSES:

RFI 1 **Question:** The notes on the demo drawings are asking us to remove all irrigation and drainage under the fields, do you have any as built drawings that show what is under the fields.
Answer: Refer to specification section 03119 - Existing Condition Information and existing design drawings issued in Addendum #1. No confirmed "As-built" drawings are available.

RFI 2 **Question:** [Per Specification 312100-1] 2.1 Dynamic Base Construction it references a few times that the turf manufacturer is responsible for selection and approval of all base materials to meet specified performance. The turf company is not installing the base on this project. The only thing turf contractors should be approving is the planarity of the final surface and if it's hard enough to install turf on. We do not hold the warranty on the base. Please advise.
Answer: As noted on sheet C7.00 for both projects, the open graded limestone used below the synthetic fields must have a void space ratio of 30%, and be comprised of 100% limestone as specified. The sitework contractor shall provide confirmation on this on the project submittals. This will be reviewed with the apparent low turf bidders during post-bid interviews.

RFI 3 **Question:** [Per Specification 312100-1] 2.3 B. Field composite drains shall be 12 inch wide by 1" thick strip drain consisting of a nylon core of fused and entangled filaments completely encased in a non-woven heat bonded geotextile fabric. Material to be Enkaturf Drain 9323 as manufactured by Colbond Geosynthetics, or as otherwise specified by turf manufacturer. Again, we aren't installing the base, this should be decided by the engineer and architects. Please advise.
Answer: The specified drain or an approved equal shall be included in the sitework contractor's bid. This will be reviewed with the apparent low turf bidders during post-bid interviews.

RFI 4 **Question:** Can you clarify the depth of base stone and finish stone? The Edge detail at artificial turf C8.0 for LCHS and C8.1 for HSN is showing 12" from bottom of turf to top of flat pipe and 8" from bottom of turf to subgrade at the nailer and curb. I am unable to scale that drawing. Please clarify.
Answer: Refer to drawings C6.0B and C6.0S both both schools for required elevations and stone depths.

RFI 5 **Question:** Alternate #2 - Is confusing. Is the turf contractor to provide turf no matter what and then the fence contractor to provide the batting cage or not? It is reading like the fence contractor is supposed to F/I the turf as well as the batting cage. Please clarify.
Answer: Section 012300 – Alternates does not dictate work scopes – refer to work scopes provided by Barton Malow. The intent of Alternate #2 is to provide pricing to omit the batting cage on the Visitor's side at each of the four ballfields. The turf is part of the base bid and is to be provided whether Alternate #2 is accepted or not.

SPECIFICATION REVISIONS:

ITEM SP1 DIVISION 26 - ELECTRICAL (Issued in This Addendum)

A. 260100 GENERAL ELECTRICAL REQUIREMENTS
B. 260500 COMMON WORK RESULTS FOR ELECTRICAL
C. 260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
D. 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
E. 260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
F. 260533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
G. 260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
H. 262416 PANELBOARDS
I. 262726 WIRING DEVICES

BP25-02A DRAWING REVISIONS – L'Anse Creuse High School:

Civil

ITEM C1 Drawing C9.0 – LCHS – SESC Plan (Revised & Re-Issued)
A. The drawing scale was added to the SESC plan.

Electrical

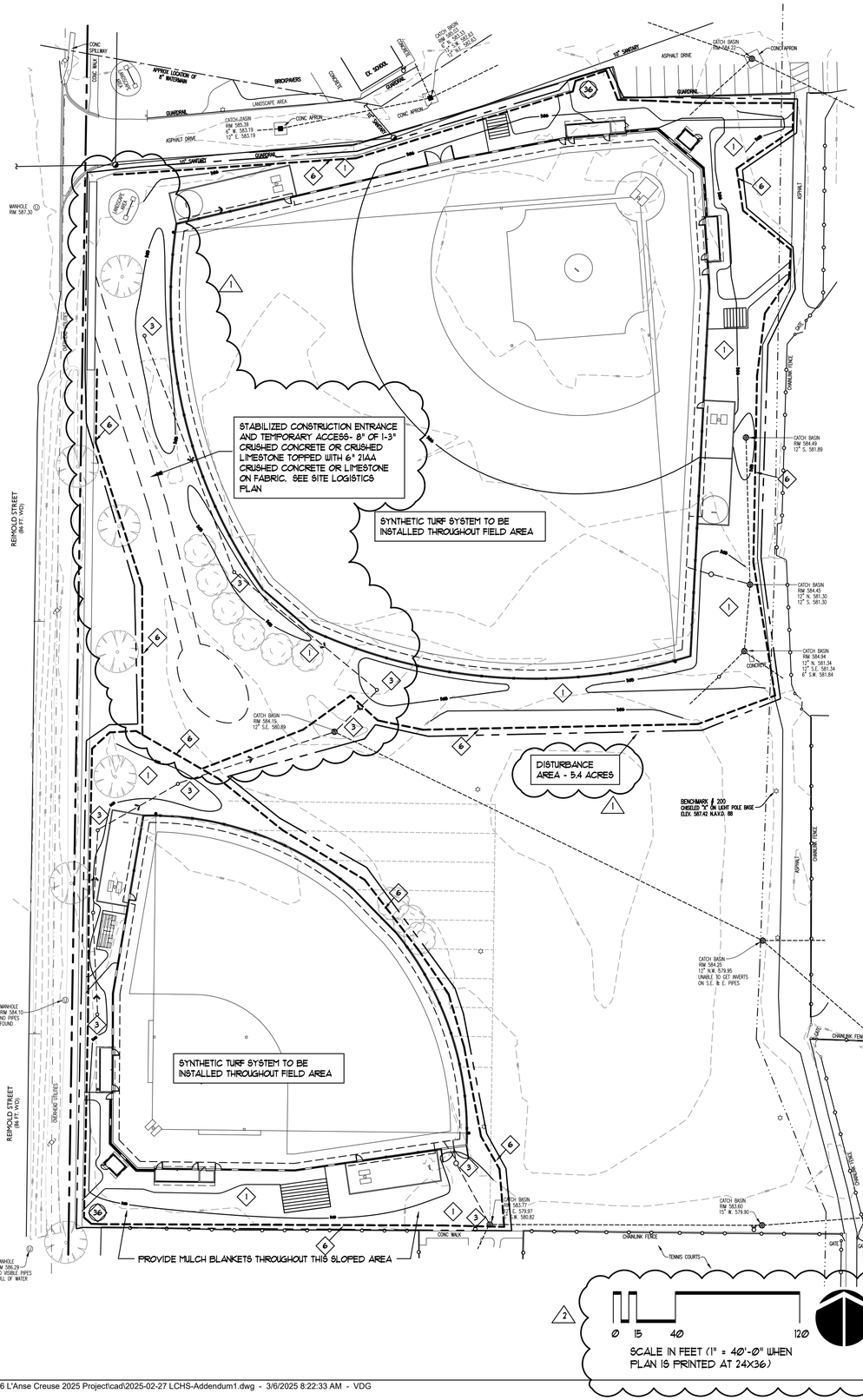
ITEM E1 Drawing E0-01 – Electrical Legend, Sheet Index and Details – HS Central (Issued in This Addendum)
ITEM E2 Drawing E0-02 – Electrical Riser Diagram – HS Central (Issued in This Addendum)
ITEM E3 Drawing E1-01 – Electrical Site Plan – HS Central (Issued in This Addendum)
ITEM E4 Drawing E1-02 – Enlarged Site Plan – HS Central (Issued in This Addendum)

BP25-02B DRAWING REVISIONS – L'Anse Creuse High School – North:

Electrical

ITEM E1 Drawing E0-01 – Electrical Legend, Sheet Index and Details – North (Issued in This Addendum)
ITEM E3 Drawing E1-01 – Electrical Site Plan – Baseball North (Issued in This Addendum)
ITEM E4 Drawing E1-02 – Electrical Site Plan – Softball North (Issued in This Addendum)

***** End of Addendum *****



PROJECT SCHEDULE

• SUBJECT TO FINAL CONTRACTOR SCHEDULE UPDATE

SEQUENCE 2025	MAY	JUNE	JULY	AUG
SILT FENCING / SESC	X			
EARTHWORK	X			
STORM STRUCTURES		X		
PAVING / TURF			X	
SEEDING AND MULCH				X
• REMOVE TEMPORARY MEASURES				X

• TEMPORARY MEASURES MUST REMAIN IN PLACE UNTIL LAWN IS FULLY RE-ESTABLISHED AND SITE IS STABILIZED.

PROJECT LOCATION: 38495 L'Anse Creue Rd.

SECTION 24, T2N, R14E,
HARRISON TOWNSHIP, MACOMB COUNTY, MICHIGAN

TAX ID: 17-11-24-279-001

SEE SHEET C9.1 FOR MACOMB COUNTY SESC NOTES AND DETAILS

SEE SHEET C9.2 FOR SOIL REPORT AND BORINGS

NO COUNTY DRAIN EXISTS WITHIN THE DISTURBANCE AREA. VANTER-DEBEUFF DRAIN IS APPROXIMATELY 1,000 FEET NORTHEAST OF THE PROJECT SITE. NO DEWATERING AREA OR SOIL STOCKPILES ARE ANTICIPATED. IF THE CONTRACTOR STOCKPILES SOIL, IT SHALL BE SURROUNDED BY SILT FENCING AND PROTECTED FROM EROSION.

LEGAL DESCRIPTION

DESCRIBED PROPERTY F232 COM AT SE COR OF P.C. 229;TH N ALG P.C. LINE 371.04FT TO POB;TH N ALG P.C. LINE 2050.26 FT TO CEN LINE L'ANSE CREUSE RD;TH N24°00'W 362.09FT;TH S68°00'W 208.61FT;TH N24°00'W 208.61FT;TH N68°00'E 208.61 FT TO CEN LINE L'ANSE CREUSE RD;TH N24°00'W ALG SD HWY TO E LINE TO TWP RD;TH SLY ALG SD E LINE 3193.53FT TO CEN LINE CROCKER BLVD;TH SELY ALG CEN LINE OF CROCKER BLVD TO A PT 286.78FT NWLY FROM INTER OF S LINE OF P.C. 229 & CEN LINE OF CROCKER BLVD;TH NELY TO POB. 49.0 ACRES EXCLUDING THE ROW FOR CROCKER BLVD.

LEGEND

SYMBOL	DESCRIPTION
825 / 824	EXISTING CONTOURS
823	PROPOSED CONTOURS
825.52	PROPOSED SPOT ELEVATIONS

SESC MAINTENANCE

DUST CONTROL AND STREET SWEEPING WILL BE PROVIDED AS NEEDED. STREETS SHALL BE SWEPT OR SCRAPED DAILY OR AS NEEDED WHEN TRACKING IS VISIBLE. SITE SHALL BE SPRAYED WITH WATER ON DRY WINDY DAYS TO CONTROL AIRBORNE DUST FROM LEAVING THE SITE. ALL SESC MEASURES WILL BE CHECKED ONCE A WEEK AND AFTER A HALF INCH OR MORE STORM EVENT, REPAIRED AND REPLACED AS NECESSARY.

LOCATION MAP

NOT TO SCALE

SESC GENERAL NOTES

ALL CONSTRUCTION SHALL COMPLY WITH THE SOIL EROSION AND SEDIMENTATION CONTROL REQUIREMENTS OF MACOMB COUNTY, AND THE STATE OF MICHIGAN. PROTECTIVE MEASURES AS SHOWN BELOW SHALL BE PROVIDED AT A MINIMUM AND CONFIRMED WITH LOCAL AGENCY REQUIREMENTS.

ALL TEMPORARY EROSION CONTROL DEVICES SHALL BE REMOVED AFTER PERMANENT GROUND COVER IS ESTABLISHED. TEMPORARY EROSION CONTROL DEVICES SHOULD BE IN PLACE PRIOR TO EXCAVATION, TO THE EXTENT POSSIBLE.

KEY	DESCRIPTION
1	PERMANENT SEEDING WITH MULCH
3	INLET PROTECTION FABRIC DROP
6	SILT FENCE
36	CONCRETE WASHOUT AREA

PARTNERS

PARTNERS in Architecture, PLC

65 MARKET STREET
MOUNT CLEMENS, MI 48043
P 586.469.3600

CONSULTANT

VIRIDIS Design Group

KEY PLAN

OWNER

L'Anse Creuse Public Schools

PROJECT NAME

LCPS 2024 Bond Bid Package #25-02A LCHS Athletic Field Improvements

38495 L'Anse Creuse Road
Harrison Township, MI 48045

PROJECT NO.

24-156A

ISSUES / REVISIONS

Bidding / Construction	02/17/2025
1 - Addendum #1	03/04/2025
2 - Addendum #2	03/05/2025

DRAWN BY

CHECKED BY
WSI

APPROVED BY
WSI

SHEET NAME

LCHS - SESC PLAN

SHEET NO.

C9.0

ELECTRICAL LEGEND ✱

"A"	FIXTURE TYPE
	1x4 LIGHT FIXTURE
	POLE MOUNTED LIGHTING FIXTURE
	STRIP LIGHTING FIXTURE
	2'X2' OR 2'X4' LIGHTING FIXTURE
	FULL SHADED LIGHTING FIXTURES ARE WIRED UNSWITCHED NIGHT LIGHTS
	HALF SHADED FIXTURES ARE FIXTURES PROVIDED WITH BUILT-IN EMERGENCY BATTERY PACK FOR EGRESS LIGHTING
	RECESSED DOWN LIGHT
	WALL MOUNTED LIGHTING FIXTURE
	TRACK LIGHTING FIXTURE
	EXIT LIGHTING FIXTURE – SHADING INDICATES ILLUMINATED FACE (S) CHEVRONS AS INDICATED
	EMERGENCY LIGHTING UNIT
	COMBINATION OF EXIT AND EMERGENCY LIGHTING UNIT
S	SINGLE POLE LIGHT SWITCH
S_3	THREE WAY LIGHT SWITCH
S_4	FOUR WAY LIGHT SWITCH
S_K	KEY OPERATED SWITCH
S_P	LIGHT SWITCH WITH PILOT LIGHT
S_{P3}	THREE WAY LIGHT SWITCH WITH PILOT LIGHT
S_D	DIMMER SWITCH, COMPATIBLE WITH LIGHTS CONTROLLED
S_{MD}	DIMMER SWITCH WITH WALL OCCUPANCY SENSOR (SINGLE POLE)
S_{D3}	THREE WAY LIGHT SWITCH WITH DIMMER
S_T TS	TIMER SWITCH
S_{LV}	LOW VOLTAGE CONTROL STATION WITH DIMMING CAPABILITIES, NUMBER OF BUTTONS AS INDICATED TO PROVIDE PRESET SCENES, RISER, LOWER, ON, OFF CONTROL FOR ZONES INDICATED, COORDINATE WITH LIGHT DIMMING CONTRACTOR FOR DEVICE MODEL NUMBERS, QUANTITIES, LOCATIONS, AND ADDITIONAL REQUIREMENTS.
RPD	RELAY PACK WITH 0–10V DIMMING OUTPUT
OS	CEILING MOUNTED OCCUPANCY SENSOR. DUAL TECHNOLOGY (PASSIVE INFRARED AND MICROPHONIC/ULTRASONIC), WITH AUXILIARY RELAY FOR HVAC CONTROL. PROVIDE QUANTITY OF 20A, 120V/277V RATED POWER PACKS AND RELAY PACKS AS REQUIRED TO CONTROL SWITCH LEGS INDICATED. ALL FIXTURES IN ROOM/SPACE ARE TO BE CONTROLLED BY THE SENSORS.
S_W	WALL MOUNTED VACANCY SENSOR, SINGLE POLE. DUAL TECHNOLOGY (PASSIVE INFRARED AND MICROPHONICS/ULTRASONIC), 120/277V. SWITCH IS RATED 800W AT 120V AND 1200W AT 277V, 1/4 HP. IVORY WITH STAINLESS STEEL COVERPLATE. FACTORY COLOR-MATCHED PLATE IS NOT ACCEPTABLE.
S_{W2}	SAME AS Sw EXCEPT WITH DUAL POLE
	SINGLE RECEPTACLE
	DUPLEX RECEPTACLE
	QUADRUPLEX RECEPTACLE
	DUPLEX RECEPTACLE WITH GROUND FAULT (GFCI)
GFP	FACELESS GROUND FAULT CIRCUIT INTERRUPTER
$_C$	SAME AS DUPLEX RECEPTACLE EXCEPT CEILING MOUNTED
$_C$	SAME AS QUADRUPLEX RECEPTACLE EXCEPT CEILING MOUNTED
$_S$	SAME AS DUPLEX RECEPTACLE EXCEPT SHOW WINDOW TO BE MOUNTED 6" ABOVE WINDOW, COORDINATE WITH OWNER/ ARCHITECT PRIOR TO INSTALLATION
	COMBINATION DUPLEX POWER RECEPTACLE AND TWO USB PORTS
$_H$	SAME AS DUPLEX RECEPTACLE EXCEPT HORIZONTALLY MOUNTED
	SPLIT RECEPTACLES
	FLOOR RECEPTACLE
$_R$	COMMERCIAL GRADE CORD REEL WITH GFCI MOUNTED TO STEEL STRUCTURE
$_R$	SPECIAL PURPOSE RECEPTACLE – NEMA TYPE
$_R$	SPECIAL PURPOSE RECEPTACLE – NEMA TYPE ON A CORD REEL MOUNTED TO STEEL STRUCTURE
	DUPLEX RECEPTACLE FLOOR MOUNTED
J	CEILING JUNCTION BOX
J	WALL JUNCTION
	PUSH BUTTON STATION (1, 2, OR 3 BUTTON)
PP	DOOR ACTIVATOR PUSH PLATE
	ELECTRIC CLOCK OUTLET
	COMBINATION DATA AND TELEPHONE OUTLET
	PHONE OUTLET SAME AS COMBINATION VOICE/DATA (W: WALL MOUNTED AT +48")
	DATA OUTLET
	UNLESS OTHERWISE NOTED PROVIDE DOUBLE GANG BOX WITH SINGLE MUD RING AND 3/4"C UP TO CEILING SPACE
TV	TELEVISION OUTLET, DOUBLE GANG BOX WITH SINGLE MUD RING AND 1"C TO CEILING SPACE
AV	AUDIO/VIDEO OUTLET, DOUBLE GANG BACK BOX WITH 1 1/4"C TO ABOVE ACCESSIBLE CEILING, TERMINATE CONDUIT WITH INSULATING BUSHING, PROVIDE PULL STRING
AV	FLOOR MOUNTED THREE GANG (3G) FLUSH BOX, DUPLEX RECEPTACLE, A/V & DATA/PHONE COMPARTMENTS
	DUPLEX RECEPTACLE & DATA/PHONE FLUSH FLOOR MOUNTED TWO GANG (2G) COMPLETE WITH FLANGE AND COVER
C	CEILING MOUNTED TWO GANG (2G) FLUSH BOX, DUPLEX RECEPTACLE & DATA/PHONE COMPARTMENTS
F1	MULTI-SERVICE STAMPED STEEL FLUSH FLOOR BOX – TYPE F1 – WITH (2)-20A DUPLEX RECEPTACLES & (2) DATA COMPARTMENT, WIREMOLD #RFB4 SERIES OR APPROVED EQUAL BY HUBBELL
F2	MULTI-SERVICE STAMPED STEEL FLUSH FLOOR POKE-THROUGH BOX – TYPE F2 – WITH (2)-20A DUPLEX RECEPTACLES & (2) DATA COMPARTMENT, WIREMOLD OR APPROVED EQUAL BY HUBBELL.
PXD	FLOOR MOUNTED TWO GANG (2G) FLUSH BOX WITH SEPARATE POWER AND DATA COMPARTMENTS FOR FURNITURE CONNECTION PROVISION

PXD	FIRE RATED FLUSH FLOOR POKE THRU WITH SEPARATE POWER AND DATA COMPARTMENTS FOR FURNITURE CONNECTION SIMILAR TO LEGRAND 4FFATC.
HV HV	FIRE RATED FLUSH FLOOR POKE THRU WITH DUPLEX OR QUAD RECEPTACLE & LOW VOLTAGE COMPARTMENTS SIMILAR TO LEGRAND RC7 OR RC4.
HV 6	FIRE RATED RECESSED DEEP FLOOR POKE THRU WITH DUPLEX OR QUAD RECEPTACLE & LOW VOLTAGE COMPARTMENTS SIMILAR TO LEGRAND EVOLUTION 6 SERIES.
P D J	JUNCTION BOX FOR FLEXIBLE CONNECTION TO SYSTEMS (P: POWER, D: DATA). FURNITURE WHIP PROVIDED BY FURNITURE SUPPLIER. FOR NEW WORK PROVIDE 1"C OR 1 1/4"C FOR DATA TO ABOVE ACCESSIBLE CEILING. UNLESS OTHERWISE NOTED. COORDINATE LOCATION WITH FURNITURE SYSTEM SUPPLIER. PROVIDE FINAL CONNECTION AND COVERPLATE SUITABLE FOR WHIP CONNECTION.
	DISTRIBUTION PANEL
	SURFACE MOUNTED LIGHTING AND/OR RECEPTACLE PANEL
	RECESSED MOUNTED LIGHTING AND/OR RECEPTACLE PANEL
CB	MOLDED CASE CIRCUIT BREAKER – SURFACE MOUNTED IN NEMA ENCLOSURE
CB	MOLDED CASE CIRCUIT BREAKER – FLUSH MOUNTED IN NEMA ENCLOSURE
	MOTOR – SINGLE PHASE
	MOTOR – THREE PHASE
	MANUAL SINGLE PHASE MOTOR STARTER WITH PILOT LIGHT, LOCKABLE OFF, FOR MOTOR APPLICATIONS. MANUAL SINGLE PHASE MOTOR SWITCH WITH PILOT LIGHT, LOCKABLE OFF AND WITHOUT OVERLOADS FOR DISCONNECT APPLICATIONS TO EQUIPMENT NOT REQUIRING OVERLOADS AND FOR APPLICATIONS WHERE OVERLOADS ARE INTEGRAL TO MOTOR-BASED LOADS. FLUSH MOUNT STARTERS / SWITCHES IN FINISHED SPACES. SURFACE MOUNT IN UNFINISHED SPACES.
	NON-FUSIBLE DISCONNECT SWITCH
	FUSIBLE DISCONNECT SWITCH
	THREE PHASE COMBINATION MAGNETIC FUSIBLE MOTOR STARTER
	BUS PLUG FUSIBLE DISCONNECT SWITCH
T	TRANSFORMER
C	CONTACTOR
M	METER
	GROUND
	HOMERUN TO LIGHTING PANEL
CT	CABLE TRAY
PS	PLUG-IN STRIP

EF	EXHAUST FAN	EWC	ELECTRIC WATER COOLER
EDH	ELECT. DUCT HTR.	AFF	ABOVE FINISHED FLOOR
A	ABOVE COUNTER	WP	WEATHERPROOF
A/E	ARCHITECT / ENGINEER	RT	RAINTIGHT
CM	COFFEE MAKER	UFD	UNDER FLOOR DUCT
MW	MICROWAVE	FPB	FAN POWER BOX
HOA	HAND-OFF-AUTOMATIC	DW	DISHWASHER
PC	PHOTOCELL	GD	GARBAGE DISPOSAL
HG	HOSPITAL GRADE	REF	REFRIGERATOR
UH	UNIT HEATER	(E)	EXISTING TO REMAIN
UON	UNLESS OTHERWISE NOTED	(RE)	RELOCATED EXISTING
EG	EQUIPMENT GROUND	IG	ISOLATED GROUND
H	HORIZONTALLY MOUNT 6" ABOVE COUNTER BACK SPLASH		
GFI or GFR	GROUND FAULT CIRCUIT INTERRUPTER		

	POWER POLE VOICE/DATA/POWER
	AUDIO/VISUAL HEAD END EQUIPMENT
DR	DRIVER FOR 24V UNDER CABINET LED LIGHT
CR	CARD READER
IC	INTERCOM OUTLET
PC	PHOTOELECTRIC CONTROLLER
WPS	COMBINE PARTITION SENSOR
WAP	WIRELESS ACCESS PANEL
PP	POWER POLE VOICE/DATA/POWER
CP	CONTROL PANEL, PROVIDE AS PART OF THE EQUIPMENT THEY CONTROL
TS	TIME SWITCH
B B	BELL
RB	RADIO ALERT SYSTEM BELL
DS	DOOR SWITCH
IC	INTERCOM STATION
EPO	EMERGENCY POWER OFF PUSHBUTTON
FACP	FIRE ALARM CONTROL PANEL
FAA	FIRE ALARM ANNUNCIATOR PANEL
NACP	NOTIFICATION APPLIANCE CONTROL PANEL
MC	MICROPHONE
S	CEILING MOUNTED SPEAKER
V V	VOLUME CONTROL DIAL
SD	SMOKE DETECTOR
HD	HEAT DETECTOR
TS	TAMPER SWITCH
FS	FLOW SWITCH
A/V	OUTDOOR FIRE DEPARTMENT CONNECTION – AUDIO VISUAL DEVICE
DH	MAGNETIC DOOR HOLDER
DS	DUCT SMOKE DETECTOR
SCD	COMBINATION SMOKE/CO DETECTOR
F	MANUAL FIRE ALARM STATION
F	FIRE ALARM STROBE
F	FIRE ALARM HORN/STROBE
F	FIRE ALARM HORN/STROBE – CEILING MOUNTED
F S	FIRE ALARM STROBE – CEILING MOUNTED

✱ THIS IS STANDARD SYMBOL LIST – SOME OF THESE SYMBOL MAY NOT APPEAR ON DRAWINGS.

ELECTRICAL SHEET INDEX

STATE OF MICHIGAN
SALIM M. SESSINE
ENGINEER
No. 6201034939
LICENSED PROFESSIONAL ENGINEER

PARTNERS

PARTNERS in Architecture, PLC
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CONSULTANT

MAENGINEERING
MECHANICAL ELECTRICAL
180 HIGH OAK ROAD
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t 248.625.8111610
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KEY PLAN

OWNER

L'Anse Creuse
Public Schools

PROJECT NAME

LCPS 2024 Bond
Bid Package #25-02A
LCHS Athletic Field
Improvements

38495 L'Anse Creuse Road
Harrison Township, MI 48045

PROJECT NO.

24-156A

ISSUES / REVISIONS

Bidding / Construction	2/17/2025
Addendum #2	3/5/2025

DRAWN BY
GS

CHECKED BY
WZ

APPROVED BY
SS

SHEET NAME

ELECTRICAL LEGEND, SHEET INDEX & DETAILS - HS CENTRAL

SHEET NO.
E0-01

EXISTING

PANELBOARD: **RP-FBF (EXISTING)**
VOLTAGE: 208Y/120V, 3 PHASE, 4 WIRE + G
MAIN: 200 A MCB
LOCATION: FIELD
MOUNTING: EXISTING
AIC: EXISTING
FEEDER: EXISTING
SPD EQUIPPED: NO

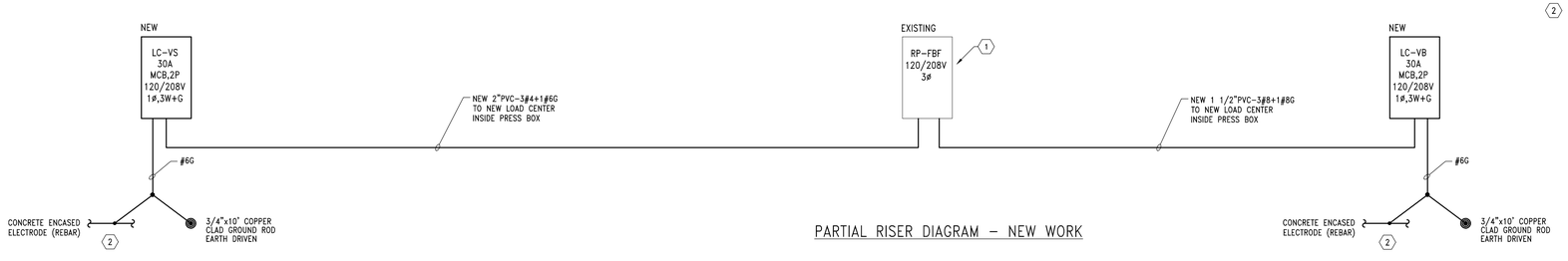
Circ	Breaker		Load Information			Connected Watts		
No	Pole	Trip	Location	Description	Code	Phase A	Phase B	Phase C
1	3				EXISTING	1000		
3			PRESS BOX ABOVE	SUB-PANEL	EXISTING		1000	
5		100			EXISTING			1000
7	1	20	FIELD	SCOREBOARD	EXISTING	1000		
9	1	20	BLEACHERS	RECEPTACLES	EXISTING		360	
11	1	20	BATTING CAGE	RECEPTACLES	EXISTING			360
13	1	20	DUGOUT	RECEPTACLES	EXISTING	360		
15	1	20	SPARE					
17	1	20	FIELD	SCOREBOARD	EXISTING			1000
19	1	20	FIELD	SCOREBOARD	EXISTING	1000		
21	**2**		**SOFTB. PRESS BOX**	**LC-VS**			**1440**	
23		**30**						**400**
25	1	20	SPARE					
27	1	20	SPARE					
29	1	20	SPARE					
31	1		SPACE					
33	1		SPACE					
35	1		SPACE					
37	1		SPACE					
39	1		SPACE					
41	1		SPACE					
2	1	20	SOUTH STORAGE	RECEPTACLES	EXISTING	360		
4	1	20	SOUTH STORAGE	LIGHTS	EXISTING		800	
6	1	20	SPARE					
8	1	20	SPARE					
10	1	20	PRACTICE FIELD	LIGHTS	EXISTING		800	
12	1	20	SPARE					
14	1	20	SPARE					
16	1	20	WALK-WAY	LIGHTS	EXISTING		800	
18	1	20	SPARE					
20	1	20	SPARE					
22	**2**		**BASEB. PRESS BOX**	**LC-VB**			**1440**	
24		**30**						**400**
26	1		SPACE					
28	1		SPACE					
30	1		SPACE					
32	1		SPACE					
34	1		SPACE					
36	1		SPACE					
38	1		SPACE					
40	1		SPACE					
42	1		SPACE					
				CONNECTED KW:	14			
				CONNECTED AMPS:	38	Phase Watts:	3,720	6,640	3,160
				DEMAND KW:	14			
				DEMAND AMPS:	38			

PANELBOARD: **LC-VS**
VOLTAGE: 120/208V, 1 PHASE, 3 WIRE + G
MAIN: 30 A MCB, 2P
LOCATION: PRESS BOX - SOFTBALL
MOUNTING: SURFACE
AIC: 10000
FEEDER: REFER TO RISER DIAGRAM
SPD EQUIPPED: NO

Circ	Breaker		Load Information			Connected Watts	
No	Pole	Trip	Location	Description	Code	Phase A	Phase C
1	1	20	PRESS BOX	EQUIPMENT		720	
3	1	20	PRESS BOX	LIGHT, GENERAL RECEPTACLES			400
5	1	20	PRESS BOX	GENERAL RECEPTACLES		720	
7	1		SPACE				
9	1		SPACE				
2	1	20	SPARE				
4	1		SPACE				
6	1		SPACE				
8	1		SPACE				
10	1		SPACE				
				CONNECTED KW:	2		
				CONNECTED AMPS:	9	Phase Watts:	1,440	400
				DEMAND KW:	2		
				DEMAND AMPS:	9		

PANELBOARD: **LC-VB**
VOLTAGE: 120/208V, 1 PHASE, 3 WIRE + G
MAIN: 30 A MCB, 2P
LOCATION: PRESS BOX - BASEBALL
MOUNTING: SURFACE
AIC: 10000
FEEDER: REFER TO RISER DIAGRAM
SPD EQUIPPED: NO

Circ	Breaker		Load Information			Connected Watts	
No	Pole	Trip	Location	Description	Code	Phase A	Phase C
1	1	20	PRESS BOX	EQUIPMENT		720	
3	1	20	PRESS BOX	LIGHT, GENERAL RECEPTACLES			400
5	1	20	PRESS BOX	GENERAL RECEPTACLES		720	
7	1		SPACE				
9	1		SPACE				
2	1	20	SPARE				
4	1		SPACE				
6	1		SPACE				
8	1		SPACE				
10	1		SPACE				
				CONNECTED KW:	2		
				CONNECTED AMPS:	9	Phase Watts:	1,440	400
				DEMAND KW:	2		
				DEMAND AMPS:	9		



PARTIAL RISER DIAGRAM – NEW WORK

KEY NOTES :

1. PROVIDE (2) NEW 30A,2P BREAKERS IN EXISTING RP-FBF TO FEED NEW LC-VB AND LC-VS.
2. BOND ALL CONCRETE ENCASED ELECTRODES TO THE GROUNDING ELECTRODE SYSTEM. ONLY ONE IS SHOWN IN DETAIL. COORDINATE WITH CONCRETE INSTALLER TO PROVIDE ELECTRODES WHICH REMAIN ACCESSIBLE AFTER POUR FOR BONDING.

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KEY PLAN

OWNER

L'Anse Creuse
Public Schools

PROJECT NAME

LCPS 2024 Bond
Bid Package #25-02A
LCHS Athletic Field
Improvements

38495 L'Anse Creuse Road
Harrison Township, MI 48045

PROJECT NO.

24-156A

ISSUES / REVISIONS

Bidding / Construction	2/17/2025
Addendum #2	3/5/2025

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GS

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WZ

APPROVED BY
SS

SHEET NAME

ELECTRICAL
RISER DIAGRAM -
HS CENTRAL

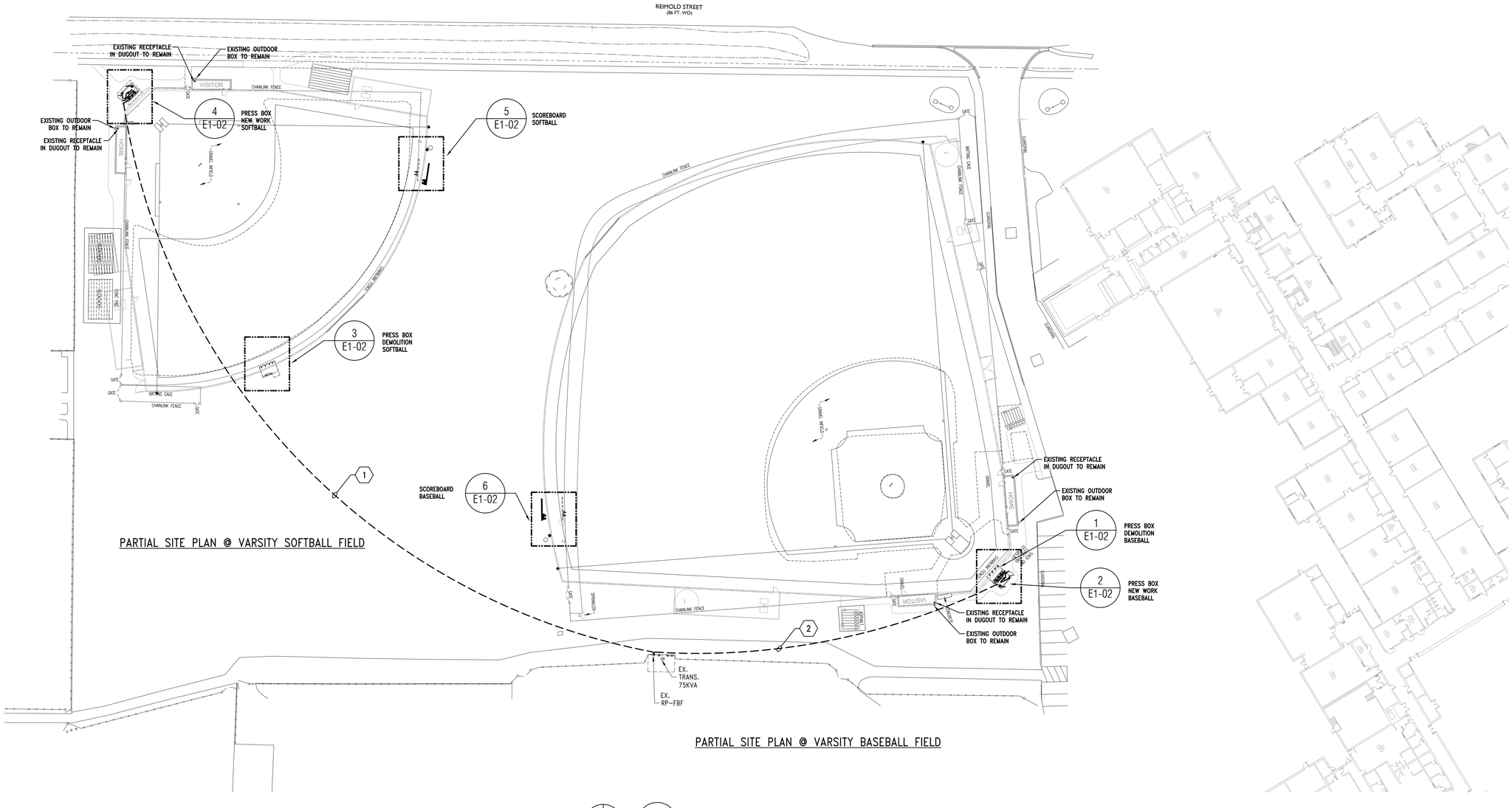
SHEET NO.
E0-02

FIELD COORDINATION NOTE :

ELECTRICAL CONTRACTOR SHALL TRACE EXISTING ELECTRICAL INSTALLATIONS ON FIELD STRUCTURES AND/OR PEDESTALS INCLUDING RECEPTACLES, DISCONNECTS AND SPLICE BOXES, ALL THESE ITEMS SHALL BE SALVAGED AND/OR RE-INSTALLED IF INTERFERING WITH NEW SITE WORK UNLESS OTHERWISE NOTED IN THESE DOCUMENTS.

NEW WORK KEY NOTES :

1. UNDERGROUND FEEDER TO NEW LC-VS, SEE RISER DIAGRAM ON SHEET E0-02. PROVIDE WEATHERPROOF PULL BOXES AS REQUIRED AND VERIFY EXACT ROUTING WITH OWNER/ARCHITECT.
2. UNDERGROUND FEEDER TO NEW LC-VB, SEE RISER DIAGRAM ON SHEET E0-02. PROVIDE WEATHERPROOF PULL BOXES AS REQUIRED AND VERIFY EXACT ROUTING WITH OWNER/ARCHITECT.



N 1 E3-01 Electrical Site Plan
1" = 40'-0"

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KEY PLAN

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L'Anse Creuse Public Schools

PROJECT NAME

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Bid Package #25-02A
LCHS Athletic Field Improvements

38495 L'Anse Creuse Road
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SHEET NAME

ELECTRICAL SITE PLAN
HS CENTRAL

SHEET NO.
E1-01

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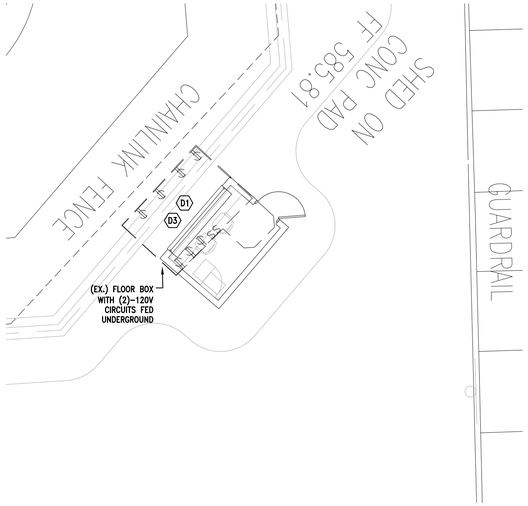
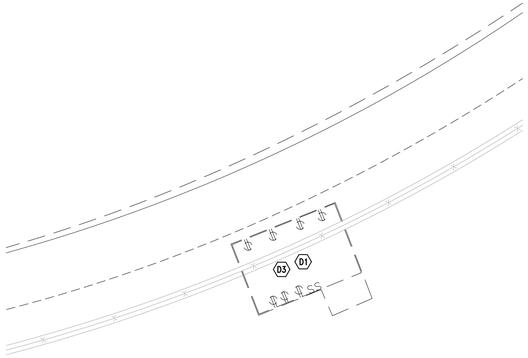
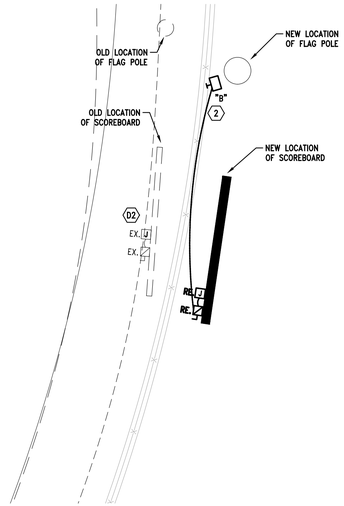


1 E1-02 Enlarged Press Box Demolition Plan - Baseball Field
1/8" = 1'-0"



3 E1-02 Enlarged Press Box Demolition Plan - Softball Field
1/8" = 1'-0"



5 E1-02 Scoreboard - Sofball Field
1/8" = 1'-0"

DEMOLITION KEY NOTES :

D1 DISCONNECT AND REMOVE EXISTING RECEPTACLES AND LIGHTS INSIDE EXISTING PRESS BOX, REMOVE BRANCH CIRCUIT WIRING BACK TO SOURCE UNLESS CIRCUITS ARE SERVING OTHER LOADS OUTSIDE THE SHED.

D2 RELOCATE EXISTING SCOREBOARD POWER TO NEW LOCATION AND RELATED DISCONNECTS AND/OR CONTROL, EXTEND WIRING AS REQUIRED, PROVIDE WEATHERPROOF SPLICE BOX AS REQUIRED.

D3 PROTECT AND MAINTAIN ANY LOW VOLTAGE AND AV WIRING TO BE RE-INSTALLED IN THE NEW PRESS BOX.

NEW WORK KEY NOTES :

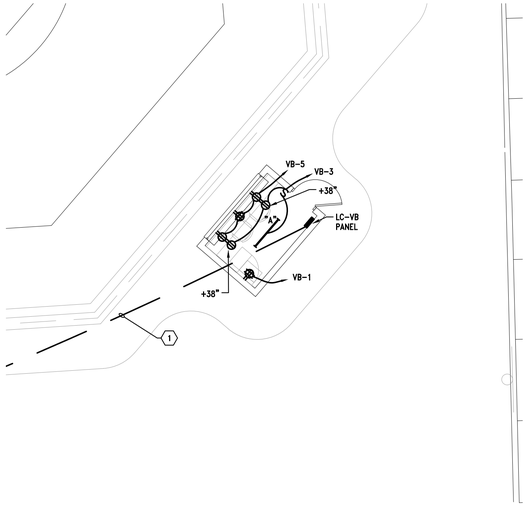
1 NEW FEEDER, REFER TO SHEET E1-01.

2 WIRE NEW FLOG POLE FLOOD LIGHT TO SAME BRANCH CIRCUIT AND CONTROL OF EXISTING SCOREBOARD, RUN CONDUIT STRAIGHT DOWN ON FENCE AND THEN UNDERGROUND TO SCOREBOARD.

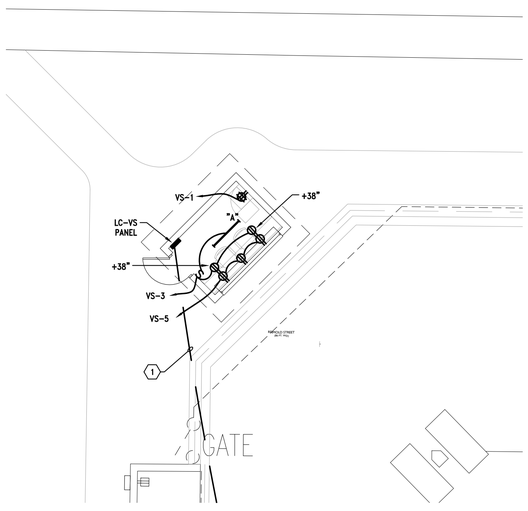
LIGHTING FIXTURE SCHEDULE :

"A" LED SURFACE MOUNTED STRIP, 4' LONG, VAPOR TIGHT, SIDE MOUNTED OCCUPANCY SENSOR, THERMOPLASTIC HOUSING, UNIVERSAL VOLTAGE, 5000 LUMENS, 40W.
ELITE LIGHTING #4-OWS-LED-5000L-DIM10-MVOLT-40K-85-FSP-311-B-D OR APPROVED EQUAL.

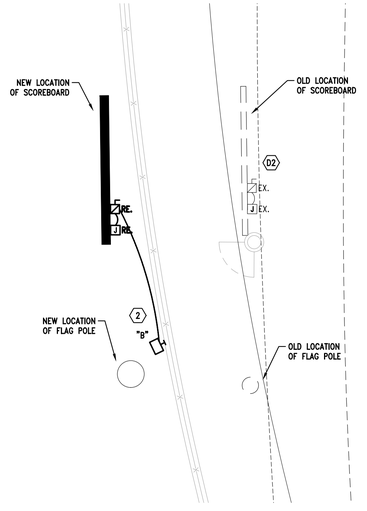
"B" LED OUTDOOR FLOOD LIGHT 9"x8"x4" MOUNTED TO CHAIN LINK FENCE AT HIGHEST POINT POSSIBLE TO LIGHT UP FLAG POLE, DARK BRONZE FINISH, MEDIUM SPOT DISTRIBUTION, 120-277V DRIVER, 3000 LUMENS, 4000K, PROVIDE ALL REQUIRED MOUNTING HARDWIRE.
LITHONIA #DSXF1-LED-P1-40K-MSP-MVOLT-DDBXD



2 E1-02 Enlarged Press Box New Work Plan - Baseball Field
1/8" = 1'-0"



4 E1-02 Enlarged Press Box New Work Plan - Softball Field
1/8" = 1'-0"



6 E1-02 Enlarged Scoreboard - Baseball
1/8" = 1'-0"

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KEY PLAN

OWNER
L'Anse Creuse Public Schools

PROJECT NAME
LCPS 2024 Bond
Bid Package #25-02A
LCHS Athletic Field Improvements
38495 L'Anse Creuse Road
Harrison Township, MI 48045

PROJECT NO.
24-156A

ISSUES / REVISIONS

Bidding / Construction	2/17/2025
Addendum #2	3/5/2025

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SHEET NAME
ENLARGED SITE PLAN - HS CENTRAL

SHEET NO.
E1-02

PANELBOARD: **LC-BB**
VOLTAGE: 120/208V, 1 PHASE, 3 WIRE + G
MAIN: 30 A MCB, 2P
LOCATION: PRESS BOX - BASEBALL

MOUNTING: SURFACE
AIC: 10000
FEEDER: REFER TO RISER DIAGRAM
SPD EQUIPPED: NO

Circ No	Breaker Pole	Breaker Trip	Load Information Location	Description	Code	Connected Watts Phase A	Phase C
1	1	20	PRESS BOX	EQUIPMENT		720	
3	1	20	PRESS BOX	LIGHT, GENERAL RECEPTACLES			400
5	1	20	PRESS BOX	GENERAL RECEPTACLES		720	
7	1		SPACE				
9	1		SPACE				
2	1	20	SPARE				
4	1		SPACE				
6	1		SPACE				
8	1		SPACE				
10	1		SPACE				
			CONNECTED KW:	2			
			CONNECTED AMPS:	9	Phase Watts:	1,440	400
			DEMAND KW:	2			
			DEMAND AMPS:	9			

PANELBOARD: **RP-LF**
VOLTAGE: 208Y/120V, 3 PHASE, 4 WIRE + G
MAIN: 150 A MCB
LOCATION: ELECTRICAL ROOM L-010

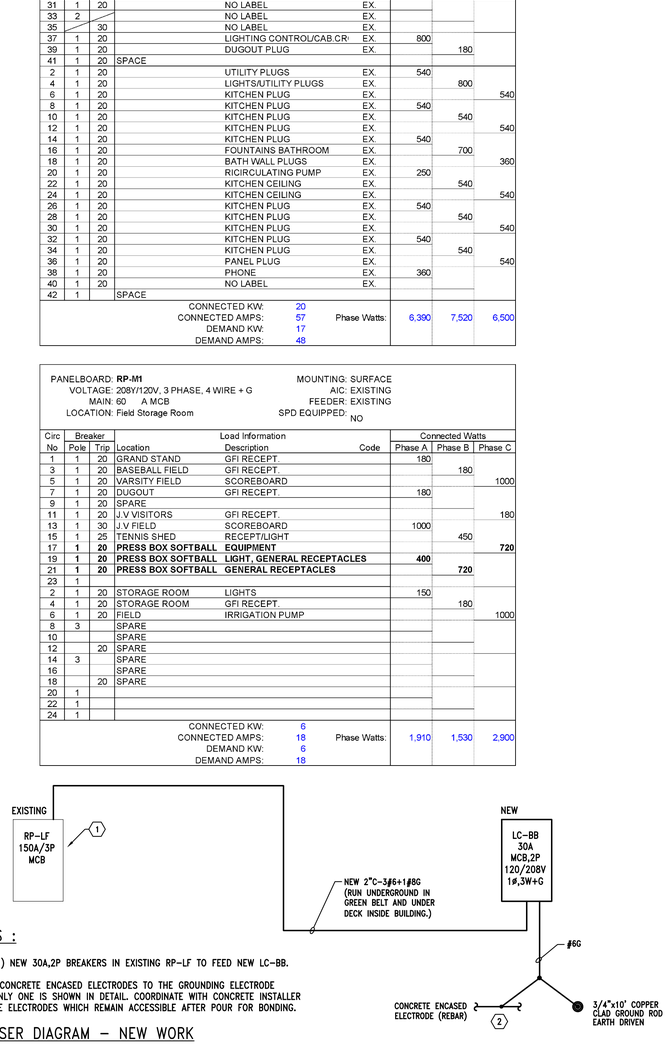
MOUNTING: SURFACE
AIC: EXISTING
FEEDER: EXISTING
SPD EQUIPPED: NO

Circ No	Breaker Pole	Breaker Trip	Load Information Location	Description	Code	Connected Watts Phase A	Phase B	Phase C
1	1	20		MENS ROOM LIGHTS	EX.	400		
3	1	20		LIGHT IN STORAGE	EX.		800	
5	1	20		TEAM ROOM N LIGHTS	EX.			800
7	1	20		TEAM ROOM S LIGHTS	EX.	800		
9	1	20		OUTSIDE PLUG	EX.		400	
11	1	20		POPCORN M./KITCHEN PLG.	EX.			1200
13	1	20		POPCORN M./KITCHEN PLG.	EX.	540		
15	1	20		KITCHEN PLUGS	EX.		540	
17	1	20		KITCHEN PLUGS	EX.			540
19	1	20		KITCHEN PLUGS	EX.	540		
21	2		**PRESS BOX BASEBALL**	**NEW LC-BB PANEL**			**1440**	
23		**30**						**400**
25	1	20		KITCHEN PLUG 30A	EX.			
27	1	20		BATH FAN	EX.		500	
29	1	20		BATH FAN	EX.			500
31	1	20		NO LABEL	EX.			
33	2			NO LABEL	EX.			
35		30		NO LABEL	EX.			
37	1	20		LIGHTING CONTROL/CAB.CR	EX.	800		
39	1	20		DUGOUT PLUG	EX.		180	
41	1	20	SPACE					
2	1	20		UTILITY PLUGS	EX.	540		
4	1	20		LIGHTS/UTILITY PLUGS	EX.		800	
6	1	20		KITCHEN PLUG	EX.			540
8	1	20		KITCHEN PLUG	EX.	540		
10	1	20		KITCHEN PLUG	EX.		540	
12	1	20		KITCHEN PLUG	EX.			540
14	1	20		KITCHEN PLUG	EX.	540		
16	1	20		FOUNTAINS BATHROOM	EX.		700	
18	1	20		BATH WALL PLUGS	EX.			360
20	1	20		RICIRCULATING PUMP	EX.	250		
22	1	20		KITCHEN CEILING	EX.		540	
24	1	20		KITCHEN CEILING	EX.			540
26	1	20		KITCHEN PLUG	EX.	540		
28	1	20		KITCHEN PLUG	EX.		540	
30	1	20		KITCHEN PLUG	EX.			540
32	1	20		KITCHEN PLUG	EX.	540		
34	1	20		KITCHEN PLUG	EX.		540	
36	1	20		PANEL PLUG	EX.			540
38	1	20		PHONE	EX.	360		
40	1	20		NO LABEL	EX.			
42	1		SPACE					
			CONNECTED KW:	20				
			CONNECTED AMPS:	57	Phase Watts:	6,390	7,520	6,500
			DEMAND KW:	17				
			DEMAND AMPS:	48				

PANELBOARD: **RP-M1**
VOLTAGE: 208Y/120V, 3 PHASE, 4 WIRE + G
MAIN: 60 A MCB
LOCATION: Field Storage Room

MOUNTING: SURFACE
AIC: EXISTING
FEEDER: EXISTING
SPD EQUIPPED: NO

Circ No	Breaker Pole	Breaker Trip	Load Information Location	Description	Code	Connected Watts Phase A	Phase B	Phase C
1	1	20	GRAND STAND	GFI RECEPT.		180		
3	1	20	BASEBALL FIELD	GFI RECEPT.			180	
5	1	20	VARSITY FIELD	SCOREBOARD				1000
7	1	20	DUGOUT	GFI RECEPT.		180		
9	1	20	SPARE					
11	1	20	J.V VISITORS	GFI RECEPT.				180
13	1	30	J.V FIELD	SCOREBOARD		1000		
15	1	25	TENNIS SHED	RECEPT/LIGHT			450	
17	**1**	**20**	**PRESS BOX SOFTBALL**	**EQUIPMENT**				**720**
19	**1**	**20**	**PRESS BOX SOFTBALL**	**LIGHT, GENERAL RECEPTACLES**		**400**		
21	**1**	**20**	**PRESS BOX SOFTBALL**	**GENERAL RECEPTACLES**			**720**	
23	1							
2	1	20	STORAGE ROOM	LIGHTS		150		
4	1	20	STORAGE ROOM	GFI RECEPT.			180	
6	1	20	FIELD	IRRIGATION PUMP				1000
8	3		SPARE					
10			SPARE					
12		20	SPARE					
14	3		SPARE					
16			SPARE					
18		20	SPARE					
20	1							
22	1							
24	1							
			CONNECTED KW:	6				
			CONNECTED AMPS:	18	Phase Watts:	1,910	1,530	2,900
			DEMAND KW:	6				
			DEMAND AMPS:	18				



KEY NOTES :

1. PROVIDE (1) NEW 30A,2P BREAKERS IN EXISTING RP-LF TO FEED NEW LC-BB.
2. BOND ALL CONCRETE ENCASED ELECTRODES TO THE GROUNDING ELECTRODE SYSTEM. ONLY ONE IS SHOWN IN DETAIL. COORDINATE WITH CONCRETE INSTALLER TO PROVIDE ELECTRODES WHICH REMAIN ACCESSIBLE AFTER POUR FOR BONDING.

PARTIAL RISER DIAGRAM – NEW WORK

ELECTRICAL LEGEND *

"A"	FIXTURE TYPE
	1x4 LIGHT FIXTURE
	POLE MOUNTED LIGHTING FIXTURE
	STRIP LIGHTING FIXTURE
	2'X2' OR 2'X4' LIGHTING FIXTURE
	FULL SHADED LIGHTING FIXTURES ARE WIRED UNSWITCHED NIGHT LIGHTS
	HALF SHADED FIXTURES ARE FIXTURES PROVIDED WITH BUILT-IN EMERGENCY BATTERY PACK FOR EGRESS LIGHTING
	RECESSED DOWN LIGHT
	WALL MOUNTED LIGHTING FIXTURE
	TRACK LIGHTING FIXTURE
	EXIT LIGHTING FIXTURE – SHADING INDICATES ILLUMINATED FACE (S) CHEVRONS AS INDICATED
	EMERGENCY LIGHTING UNIT
	COMBINATION OF EXIT AND EMERGENCY LIGHTING UNIT
S	SINGLE POLE LIGHT SWITCH
S_3	THREE WAY LIGHT SWITCH
S_4	FOUR WAY LIGHT SWITCH
S_K	KEY OPERATED SWITCH
S_P	LIGHT SWITCH WITH PILOT LIGHT
S_{P3}	THREE WAY LIGHT SWITCH WITH PILOT LIGHT
S_D	DIMMER SWITCH, COMPATIBLE WITH LIGHTS CONTROLLED
S_{WD}	DIMMER SWITCH WITH WALL OCCUPANCY SENSOR (SINGLE POLE)
S_{D3}	THREE WAY LIGHT SWITCH WITH DIMMER
S_T [TS]	TIMER SWITCH
S_{LV}	LOW VOLTAGE CONTROL STATION WITH DIMMING CAPABILITIES, NUMBER OF BUTTONS AS INDICATED TO PROVIDE PRESET SCENES, RISER, LOWER, ON, OFF CONTROL FOR ZONES INDICATED, COORDINATE WITH LIGHT DIMMING CONTRACTOR FOR DEVICE MODEL NUMBERS, QUANTITIES, LOCATIONS, AND ADDITIONAL REQUIREMENTS.
[RPD]	RELAY PACK WITH 0–10V DIMMING OUTPUT
[OS]	CEILING MOUNTED OCCUPANCY SENSOR. DUAL TECHNOLOGY (PASSIVE INFRARED AND MICROPHONIC/ULTRASONIC), WITH AUXILIARY RELAY FOR HVAC CONTROL. PROVIDE QUANTITY OF 20A, 120V/277V RATED POWER PACKS AND RELAY PACKS AS REQUIRED TO CONTROL SWITCH LEGS INDICATED. ALL FIXTURES IN ROOM/SPACE ARE TO BE CONTROLLED BY THE SENSORS.
S_W	WALL MOUNTED VACANCY SENSOR, SINGLE POLE. DUAL TECHNOLOGY (PASSIVE INFRARED AND MICROPHONICS/ULTRASONIC), 120/277V. SWITCH IS RATED 800W AT 120V AND 1200W AT 277V, 1/4 HP. IVORY WITH STAINLESS STEEL COVERPLATE. FACTORY COLOR-MATCHED PLATE IS NOT ACCEPTABLE.
S_{W2}	SAME AS Sw EXCEPT WITH DUAL POLE
	SINGLE RECEPTACLE
	DUPLEX RECEPTACLE
	QUADRUPLEX RECEPTACLE
	DUPLEX RECEPTACLE WITH GROUND FAULT (GFCI)
[GFP]	FACELESS GROUND FAULT CIRCUIT INTERRUPTER
$_C$	SAME AS DUPLEX RECEPTACLE EXCEPT CEILING MOUNTED
$_C$	SAME AS QUADRUPLEX RECEPTACLE EXCEPT CEILING MOUNTED
$_S$	SAME AS DUPLEX RECEPTACLE EXCEPT SHOW WINDOW TO BE MOUNTED 6" ABOVE WINDOW, COORDINATE WITH OWNER/ ARCHITECT PRIOR TO INSTALLATION
	COMBINATION DUPLEX POWER RECEPTACLE AND TWO USB PORTS
$_H$	SAME AS DUPLEX RECEPTACLE EXCEPT HORIZONTALLY MOUNTED
	SPLIT RECEPTACLES
	FLOOR RECEPTACLE
$_R$	COMMERCIAL GRADE CORD REEL WITH GFCI MOUNTED TO STEEL STRUCTURE
$_R$	SPECIAL PURPOSE RECEPTACLE – NEMA TYPE
$_R$	SPECIAL PURPOSE RECEPTACLE – NEMA TYPE ON A CORD REEL MOUNTED TO STEEL STRUCTURE
	DUPLEX RECEPTACLE FLOOR MOUNTED
(J)	CEILING JUNCTION BOX
(J)	WALL JUNCTION
	PUSH BUTTON STATION (1, 2, OR 3 BUTTON)
[PP]	DOOR ACTIVATOR PUSH PLATE
	ELECTRIC CLOCK OUTLET
	COMBINATION DATA AND TELEPHONE OUTLET — UNLESS OTHERWISE NOTED PROVIDE DOUBLE GANG BOX WITH SINGLE MUD RING AND 3/4"C UP TO CEILING SPACE
	PHONE OUTLET SAME AS COMBINATION VOICE/DATA (W: WALL MOUNTED AT +48")
	DATA OUTLET
[TV]	TELEVISION OUTLET, DOUBLE GANG BOX WITH SINGLE MUD RING AND 1"C TO CEILING SPACE
[AV]	AUDIO/VIDEO OUTLET, DOUBLE GANG BACK BOX WITH 1 1/4"C TO ABOVE ACCESSIBLE CEILING, TERMINATE CONDUIT WITH INSULATING BUSHING, PROVIDE PULL STRING
[AV]	FLOOR MOUNTED THREE GANG (3G) FLUSH BOX, DUPLEX RECEPTACLE, A/V & DATA/PHONE COMPARTMENTS
	DUPLEX RECEPTACLE & DATA/PHONE FLUSH FLOOR MOUNTED TWO GANG (2G) COMPLETE WITH FLANGE AND COVER
C	CEILING MOUNTED TWO GANG (2G) FLUSH BOX, DUPLEX RECEPTACLE & DATA/PHONE COMPARTMENTS
$_{F1}$	MULTI-SERVICE STAMPED STEEL FLUSH FLOOR BOX – TYPE F1 – WITH (2)–20A DUPLEX RECEPTACLES & (2) DATA COMPARTMENT, WIREMOLD #RFB4 SERIES OR APPROVED EQUAL BY HUBBELL
$_{F2}$	MULTI-SERVICE STAMPED STEEL FLUSH FLOOR POKE–THROUGH BOX – TYPE F2 – WITH (2)–20A DUPLEX RECEPTACLES & (2) DATA COMPARTMENT, WIREMOLD OR APPROVED EQUAL BY HUBBELL.
[PXD]	FLOOR MOUNTED TWO GANG (2G) FLUSH BOX WITH SEPARATE POWER AND DATA COMPARTMENTS FOR FURNITURE CONNECTION PROVISION

[PXD]	FIRE RATED FLUSH FLOOR POKE THRU WITH SEPARATE POWER AND DATA COMPARTMENTS FOR FURNITURE CONNECTION SIMILAR TO LEGRAND 4FFATC.
[PV] [PV]	FIRE RATED FLUSH FLOOR POKE THRU WITH DUPLEX OR QUAD RECEPTACLE & LOW VOLTAGE COMPARTMENTS SIMILAR TO LEGRAND RC7 OR RC4.
[PV R]	FIRE RATED RECESSED DEEP FLOOR POKE THRU WITH DUPLEX OR QUAD RECEPTACLE & LOW VOLTAGE COMPARTMENTS SIMILAR TO LEGRAND EVOLUTION 6 SERIES.
[P] [D] [J]	JUNCTION BOX FOR FLEXIBLE CONNECTION TO SYSTEMS (P: POWER, D: DATA). FURNITURE WHIP PROVIDED BY FURNITURE SUPPLIER. FOR NEW WORK PROVIDE 1"C OR 1 1/4"C FOR DATA TO ABOVE ACCESSIBLE CEILING. UNLESS OTHERWISE NOTED. COORDINATE LOCATION WITH FURNITURE SYSTEM SUPPLIER. PROVIDE FINAL CONNECTION AND COVERPLATE SUITABLE FOR WHIP CONNECTION.
	DISTRIBUTION PANEL
	SURFACE MOUNTED LIGHTING AND/OR RECEPTACLE PANEL
	RECESSED MOUNTED LIGHTING AND/OR RECEPTACLE PANEL
[CB]	MOLDED CASE CIRCUIT BREAKER – SURFACE MOUNTED IN NEMA ENCLOSURE
[CB]	MOLDED CASE CIRCUIT BREAKER – FLUSH MOUNTED IN NEMA ENCLOSURE
	MOTOR – SINGLE PHASE
	MOTOR – THREE PHASE
	MANUAL SINGLE PHASE MOTOR STARTER WITH PILOT LIGHT, LOCKABLE OFF, FOR MOTOR APPLICATIONS. MANUAL SINGLE PHASE MOTOR SWITCH WITH PILOT LIGHT, LOCKABLE OFF AND WITHOUT OVERLOADS FOR DISCONNECT APPLICATIONS TO EQUIPMENT NOT REQUIRING OVERLOADS AND FOR APPLICATIONS WHERE OVERLOADS ARE INTEGRAL TO MOTOR–BASED LOADS. FLUSH MOUNT STARTERS / SWITCHES IN FINISHED SPACES. SURFACE MOUNT IN UNFINISHED SPACES.
	NON–FUSIBLE DISCONNECT SWITCH
	FUSIBLE DISCONNECT SWITCH
	THREE PHASE COMBINATION MAGNETIC FUSIBLE MOTOR STARTER
	BUS PLUG FUSIBLE DISCONNECT SWITCH
[T]	TRANSFORMER
[C]	CONTACTOR
[M]	METER
	GROUND
	HOMERUN TO LIGHTING PANEL
[CT]	CABLE TRAY
[PS]	PLUG–IN STRIP

EF	EXHAUST FAN	EWC	ELECTRIC WATER COOLER
EDH	ELECT. DUCT HTR.	AFF	ABOVE FINISHED FLOOR
A	ABOVE COUNTER	WP	WEATHERPROOF
A/E	ARCHITECT / ENGINEER	RT	RAINTIGHT
CM	COFFEE MAKER	UFD	UNDER FLOOR DUCT
MW	MICROWAVE	FPB	FAN POWER BOX
HOA	HAND–OFF–AUTOMATIC	DW	DISHWASHER
PC	PHOTOCELL	GD	GARBAGE DISPOSAL
HG	HOSPITAL GRADE	REF	REFRIGERATOR
UH	UNIT HEATER	(E)	EXISTING TO REMAIN
UON	UNLESS OTHERWISE NOTED	(RE)	RELOCATED EXISTING
EG	EQUIPMENT GROUND	IG	ISOLATED GROUND

H	HORIZONTALLY MOUNT 6" ABOVE COUNTER BACK SPLASH
GFI or GFR	GROUND FAULT CIRCUIT INTERRUPTER
	POWER POLE VOICE/DATA/POWER
	AUDIO/VISUAL HEAD END EQUIPMENT
[DR]	DRIVER FOR 24V UNDER CABINET LED LIGHT
[CR]	CARD READER
[IC]	INTERCOM OUTLET
[PC]	PHOTOELECTRIC CONTROLLER
[WPS]	COMBINE PARTITION SENSOR
[WAP]	WIRELESS ACCESS PANEL
[PP]	POWER POLE VOICE/DATA/POWER
[CP]	CONTROL PANEL, PROVIDE AS PART OF THE EQUIPMENT THEY CONTROL
[TS]	TIME SWITCH
(B) [B]	BELL
[RB]	RADIO ALERT SYSTEM BELL
[DS]	DOOR SWITCH
[IC]	INTERCOM STATION
[EPO]	EMERGENCY POWER OFF PUSHBUTTON
[FACP]	FIRE ALARM CONTROL PANEL
[FAA]	FIRE ALARM ANNUNCIATOR PANEL
[NACP]	NOTIFICATION APPLIANCE CONTROL PANEL
(MC)	MICROPHONE
(S)	CEILING MOUNTED SPEAKER
(V) [V]	VOLUME CONTROL DIAL
[SD]	SMOKE DETECTOR
[HD]	HEAT DETECTOR
[TS]	TAMPER SWITCH
[FS]	FLOW SWITCH
[A/V]	OUTDOOR FIRE DEPARTMENT CONNECTION – AUDIO VISUAL DEVICE
[DH]	MAGNETIC DOOR HOLDER
[DS]	DUCT SMOKE DETECTOR
[SCD]	COMBINATION SMOKE/CO DETECTOR
[F]	MANUAL FIRE ALARM STATION
[F]	FIRE ALARM STROBE
[F]	FIRE ALARM HORN/STROBE
(F)	FIRE ALARM HORN/STROBE – CEILING MOUNTED
(F)$_S$	FIRE ALARM STROBE – CEILING MOUNTED

* THIS IS STANDARD SYMBOL LIST – SOME OF THESE SYMBOL MAY NOT APPEAR ON DRAWINGS.

ELECTRICAL SHEET INDEX

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KEY PLAN

OWNER
L'Anse Creuse Public Schools

PROJECT NAME
LCPS 2024 Bond Bid Package #25-02B HS North Athletic Field Improvements

23700 Twenty One Mile Road
Macomb, MI 48042

PROJECT NO.
24-156B

ISSUES / REVISIONS

Bidding / Construction	2/17/2025
Addendum #2	3/5/2025

DRAWN BY
GS

CHECKED BY
WZ

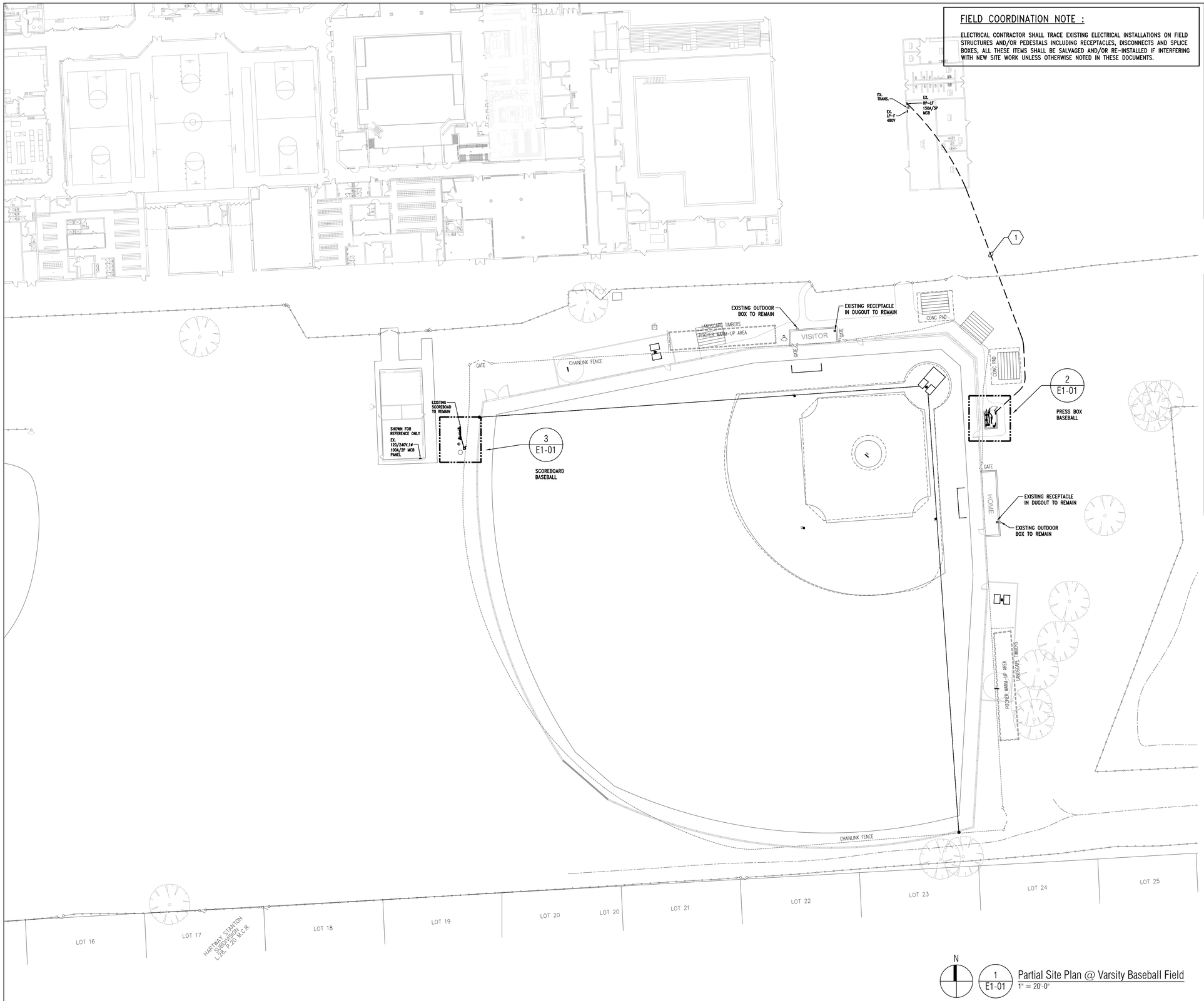
APPROVED BY
SS

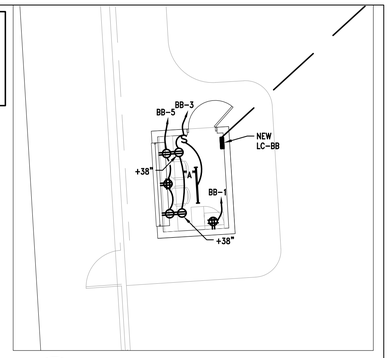
SHEET NAME
ELECTRICAL LEGEND, SHEET INDEX & DETAILS - NORTH

SHEET NO.
E0-01

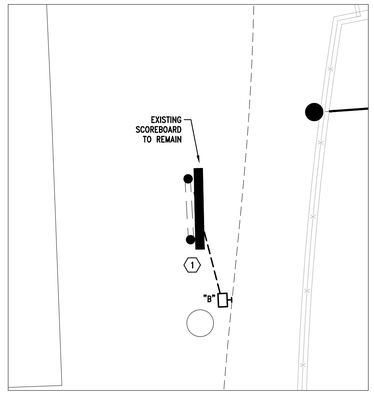
FIELD COORDINATION NOTE :

ELECTRICAL CONTRACTOR SHALL TRACE EXISTING ELECTRICAL INSTALLATIONS ON FIELD STRUCTURES AND/OR PEDESTALS INCLUDING RECEPTACLES, DISCONNECTS AND SPLICE BOXES, ALL THESE ITEMS SHALL BE SALVAGED AND/OR RE-INSTALLED IF INTERFERING WITH NEW SITE WORK UNLESS OTHERWISE NOTED IN THESE DOCUMENTS.





2 E1-01 Enlarged Press Box Plan - Baseball Field
1/8" = 1'-0"



3 E1-01 Enlarged Scoreboard - Baseball Field
1/8" = 1'-0"

NEW WORK KEY NOTES :

(1) NEW FEEDER TO NEW LC-BB INSIDE PRESS BOX BASEBALL, SEE RISER DIAGRAM ON SHEET E0-01. PROVIDE WEATHERPROOF PULL BOXES AS REQUIRED AND VERIFY EXACT ROUTING WITH OWNER/ARCHITECT.

LIGHTING FIXTURE SCHEDULE :

"A" LED SURFACE MOUNTED STRIP, 4' LONG, VAPOR TIGHT, SIDE MOUNTED OCCUPANCY SENSOR, THERMOPLASTIC HOUSING, UNIVERSAL VOLTAGE, 5000 LUMENS, 40W.
ELITE LIGHTING #4-OWS-LED-5000L-DIM10-MVOLT-40K-85-FSP-311-B-D OR APPROVED EQUAL.

N

1 E1-01 Partial Site Plan @ Varsity Baseball Field
1" = 20'-0"

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PROJECT NAME

LCPS 2024 Bond
Bid Package #25-02B
HS North Athletic Field Improvements

23700 Twenty One Mile Road
Macomb, MI 48042

PROJECT NO.

24-156B

ISSUES / REVISIONS

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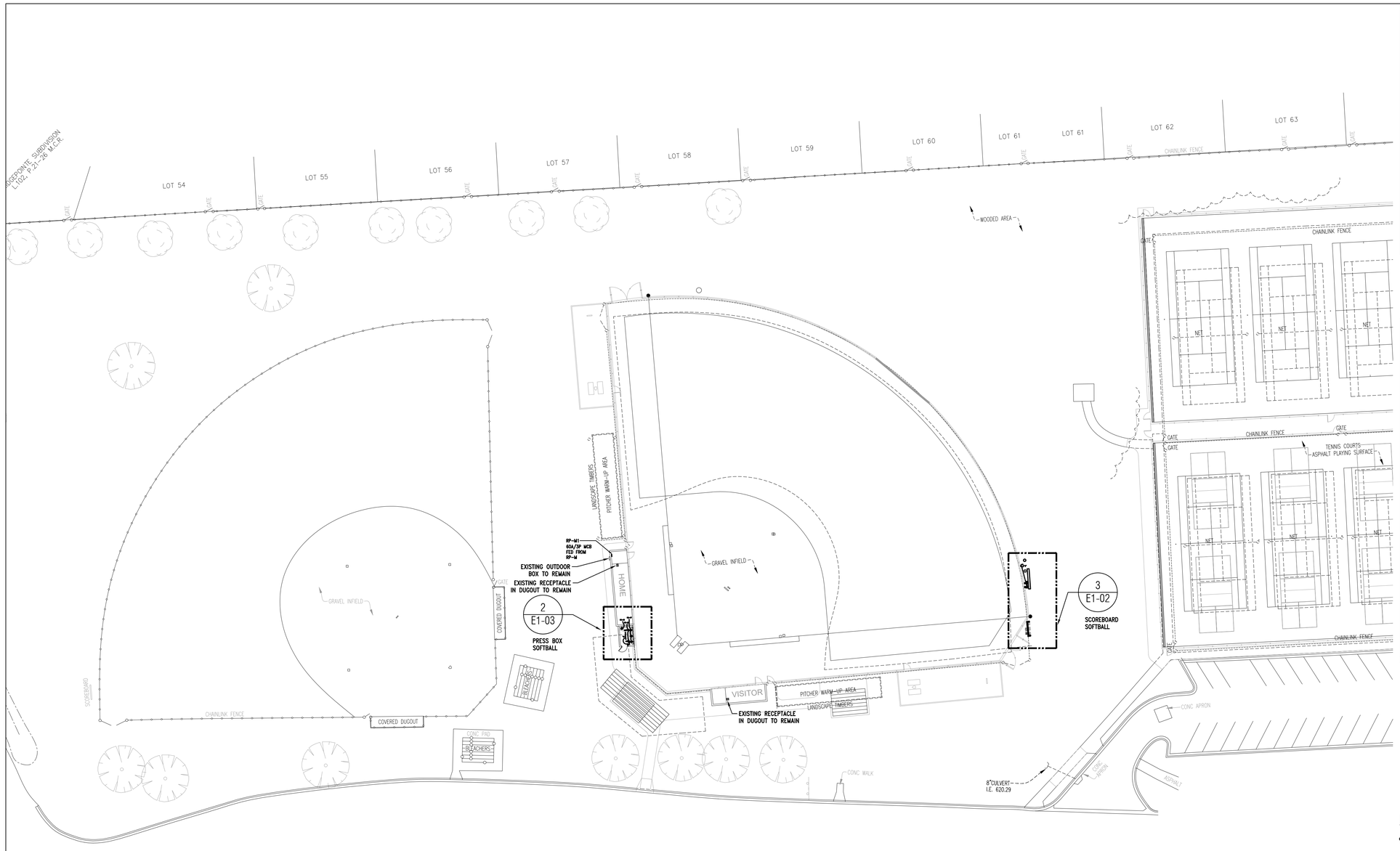
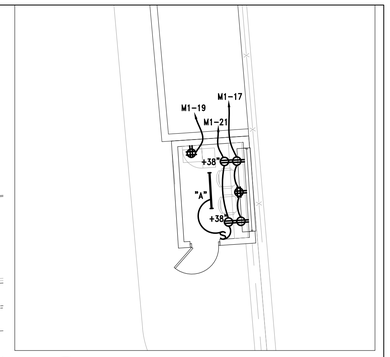
SHEET NAME

ELECTRICAL SITE PLAN - BASEBALL NORTH

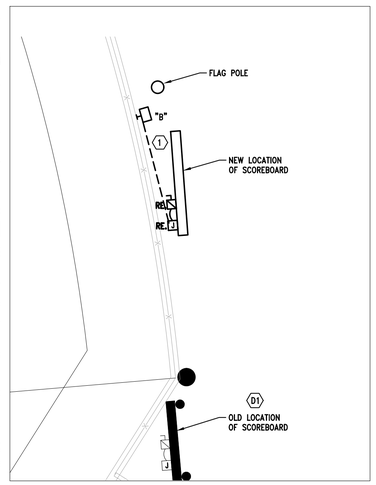
SHEET NO.

E1-01





2 E1-02 Enlarged Press Box Plan - Softball Field
1/8" = 1'-0"



3 E1-01 Enlarged Scoreboard - Softball Field
1/8" = 1'-0"

DEMOLITION KEY NOTES :

(D1) RELOCATE EXISTING SCOREBOARD POWER TO NEW LOCATION, EXTEND WIRING AS REQUIRED, PROVIDE WEATHER PROOF SPLICE BOX AS REQUIRED.

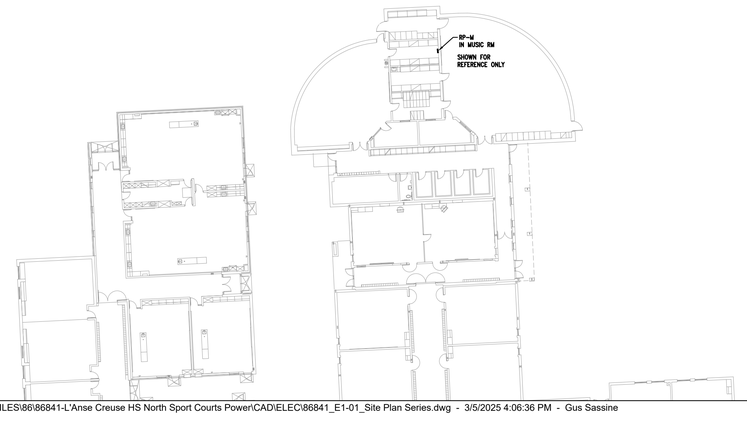
NEW WORK KEY NOTES :

(1) WIRE NEW FLOG POLE FLOOD LIGHT TO SAME BRANCH CIRCUIT AND CONTROL OF EXISTING SCOREBOARD, RUN CONDUIT STRAIGHT DOWN ON FENCE AND THEN UNDERGROUND TO SCOREBOARD.

LIGHTING FIXTURE SCHEDULE :

"A" LED SURFACE MOUNTED STRIP, 4' LONG, VAPOR TIGHT, SIDE MOUNTED OCCUPANCY SENSOR, THERMOPLASTIC HOUSING, UNIVERSAL VOLTAGE, 5000 LUMENS, 40W.
ELITE LIGHTING #4-OWS-LED-5000L-DIM10-MVOLT-40K-85-FSP-311-B-D OR APPROVED EQUAL.

"B" LED OUTDOOR FLOOD LIGHT 9"X8"X4" MOUNTED TO CHAIN LINK FENCE AT HIGHEST POINT POSSIBLE TO LIGHT UP FLAG POLE, DARK BRONZE FINISH, MEDIUM SPOT DISTRIBUTION, 120-277V DRIVER, 3000 LUMENS, 4000K, PROVIDE ALL REQUIRED MOUNTING HARDWIRE.
LITHONIA #DSXF1-LED-P1-40K-MSP-MVOLT-DDBXD



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1 E1-02 Partial Site Plan @ Varsity Softball Field
1" = 20'-0"

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KEY PLAN

OWNER

L'Anse Creuse
Public Schools

PROJECT NAME

LCPS 2024 Bond
Bid Package #25-02B
HS North Athletic Field
Improvements

23700 Twenty One Mile Road
Macomb, MI 48042

PROJECT NO.

24-156B

ISSUES / REVISIONS

Bidding / Construction	2/17/2025
Addendum #2	3/5/2025

DRAWN BY

CHECKED BY

APPROVED BY

SHEET NAME

ELECTRICAL SITE
PLAN - SOFTBALL
NORTH

SHEET NO.

E1-02

SECTION 260100 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Attention is directed to General Conditions, Supplementary Conditions and General Requirements which are hereby made a part of this Section.

1.2 INTENT:

A. The Electrical Specifications are, for convenience, divided into the following Sections which contain the requirements applicable to the systems named:

26 01 10 - General Electrical Requirements
26 05 00 - Common Work Results for Electrical
26 05 19 - Low-voltage Electrical Power Conductors and Cables
26 05 26 - Grounding and Bonding for Electrical Systems
26 05 29 - Hangers and Supports for Electrical Systems
26 05 33 - Raceways and Boxes
26 05 53 - Identification for Electrical Systems
26 24 16 - Panelboards
26 27 26 - Wiring devices

B. The “General Electrical Requirements” contained herein are hereby made a part of all the above named Sections of the Specifications, Division 26, 27 & 28.

1.3 WORK INCLUDED:

A. Furnish all labor and material, appliances, equipment and supervision to put in place a complete and functioning electrical system, ready for operation as specified herein and as indicated on the Drawings. System shall include, but not necessarily be limited to the following major equipment or operations:

1. Electrical and Telephone Service.
2. Underground Conduit and Duct Banks.
3. Complete Lighting System: Interior and Exterior.
4. Complete Power Distribution System.
5. Panels, Safety Switches and Control Equipment.
6. Branch Circuits, Wiring and Devices.
7. Voice/Data Conduits and Outlets.

8. Electrical Service to Building and Mechanical Equipment, Final Connection and Testing.
9. Miscellaneous Systems as specified hereinafter.

1.4 SEPARATE AND ALTERNATE PRICES:

A. As Required.

1.5 DEFINITIONS:

A. "Provide" shall mean "furnish and install" or "furnish labor and material required for installation of".

1.6 SITE EXAMINATION:

A. Examination of the site is mandatory. Contractor is hereby held to have examined the site and have satisfied himself as to the conditions under which the work will be performed and have included in his Bid price all costs related thereto.

1.7 QUALITY ASSURANCE:

A. References to standards, codes, Specifications, recommendations etc., shall mean the latest edition of such publications adopted and published at date of invitation to submit Bid Proposals.

B. In addition to requirements shown or specified, comply with the applicable standards, specifications and codes listed below. Where requirements of the Contract Documents are in excess of these requirements, the Contract Documents shall govern.

C. The following associations, codes, standards and abbreviations are included herein by reference:

ANSI	American National Standards Institute
BFS	State of Michigan Department of Labor and Economic Growth, Bureau of Fire Services
DEQ	Department of Environmental Quality
MBC	Michigan Building Code
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
UFAS	Uniform Federal Accessibility Standards
UL	Underwriters' Laboratories, Inc.

D. Approved manufacturers shall be considered for material in accordance with the requirements of Division 26, 27 & 28, subject to the approval of the Architect/Engineer. Such approval applies to the manufacturer only and does not in any way act to permit any deviation from strict compliance with the requirements of these Specifications.

E. All electrical equipment and materials used in the work shall be listed and labeled by a recognized testing laboratory – i.e. UL, ETL, or CSA. The label shall be for the assembled device as delivered by the manufacturer. Assembled with UL rated devices, labeled sub-assemblies, or equivalent are not acceptable alternates.

F. Licensed Journeyman or registered Apprentice Electricians shall perform electrical work. The number of Apprentices on a project shall not exceed the number of Journeymen. Electricians shall carry a copy of their license or registration while working on site.

1.8 COORDINATION DRAWINGS:

A. Prior to performing any work, Contractor is to produce detailed coordination drawings with other trades indicating routing and installation details for electrical systems which are coordinated with other trades and with existing conditions. Coordinate with Construction Coordinator/Construction Manager to organize coordination meetings with all trades as required and to implement development of coordination drawings. Remove finished lay-in ceilings and any other obstructions and survey to determine existing conditions, systems and structural elements and potential interferences above and below finished coolings. Coordinate with existing to-remain elements and with new work drawings. Proposed solutions to any conflicts found on coordination drawings.

B. In addition to lighting fixture installation and other electrical and raceway work, closely coordinate installation of new cable tray and relocation/raising of existing-to-remain cable tray.

C. Note the installation of steel for patient lifts and service booms. Coordinate with Architectural plans for locations.

1.9 SUBMITTALS:

A. Submit Shop Drawings for all major components or systems of the project, and where specified.

B. Refer to General Conditions and Division 1, General Requirements, for Shop Drawings to be submitted in transparency form, procedure and other pertinent data. For brochures and other non-reproducible forms of Shop Drawings, submit to the Architect for review, the required number of copies of Shop Drawings, of each piece of equipment and/or apparatus to be used, together with such descriptions and/or explanatory notes as may be required to give a clear idea of its arrangement and construction.

C. Prior to issuing any submittals, provide a complete schedule to the Electrical Engineer through the Architect showing all submittals that will be issued for the project. For each product/shop drawing being submitted, indicate the following information in the schedule:

1. System/Subject and material (product data and/or shop drawings).
2. Relevant specification number.
3. Expected quantity of pages/sheets in the submittal (provide approximate count to gauge review time, e.g. 100 pages versus 10 pages).
4. Expected date submittal will be issued.
5. Requested return date of submittal.
6. If any submittals overlap in review time, numerically prioritize the requested submittal review/return by the A/E or adjust requested review duration/return date so there is not overlap.

D. Where items are referred to by symbolic designation on the drawings and specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical specifications for additional requirements. Submit the following in addition to any other specified systems/equipment.

1. Arc Flash Study and Labeling – Note requirement to submit proof of adequate ratings prior to distribution equipment submittals.
2. Power Distribution Equipment
3. Disconnect Switches, Starters, Motor Controls
4. Contactors

5. Time Switches
6. Wiring Devices & Coverplates
7. Lighting Fixtures, Lamps, Ballasts
8. Identification
9. Lighting Controls
10. Fire Alarm
11. Nurse Call System
12. Lightning Protection System
13. Transfer Switch System

E. Where new work ties into existing systems, include the detailed location and tie-in requirements in the submittal. Include any accessories necessary for tie-in.

F. No apparatus or equipment shall be shipped from stock or fabricated until Shop Drawings for same have been stamped “Reviewed” or “Reviewed as Noted”. If “Reviewed as Noted” status is applied all review comments must be incorporated for equipment to be ordered/fabricated and for work to proceed.

G. Submit system components, product data and shop drawings complete for each system under one submittal. Do not break out equipment for one system between multiple submittals.

H. If different systems are included in one submittal, clearly separate information with tabs or binding and provide different sub-numbering of systems.

I. All Shop Drawings must be clearly marked to show equipment submitted and any deviations from specifications shall be noted in writing. Deviations not specifically noted in writing will be the Contractors responsibility to replace if installed. Do not include only model numbers to indicate submitted equipment. Model numbers/ordering numbers will not be reviewed. Edited product data will be reviewed. Strike out any information on product data that is not project specific, and edit relevant information to show actual equipment submitted. Electrical Contractor must review, sign and approve all shop drawings prior to submittal.

J. Identify submitted equipment with nomenclature indicated on the Contract Documents.

K. Provide project specific submittals from contractor to reviewer rather than supplier/manufacturer to reviewer. Do not include any claim of work or product “by others” if the work is the contractor’s responsibility. Contractor’s signature on submittal indicates that contractor finds submitted equipment and systems to meet contract document requirements.

L. Uniquely and consecutively number each page in submittal.

M. Shop Drawings that are incomplete, unsigned and not plainly marked will not be reviewed.

N. Coordinate submittal schedule and construction schedule with CM/GC. Provide complete, accurate submittals to avoid re-submittals. Time required for any re-submittals is to be planned into project schedule by the Contractor. The A/E will not be responsible for construction delays due to re-submittals and will not be required to accelerate re-submittal review times. Pricing changes will not be approved due to re-submittals. Include in bid all costs required to allow for re-submittals.

1.10 CONTRACT DRAWINGS:

A. Contract Drawings for electrical work are diagrammatic, intended to convey the scope of the work and indicate general arrangement of systems and approximate locations of equipment and outlets. Do not scale Drawings for measurements.

B. Consult Architectural, Structural and Mechanical Contract Drawings and Specifications to become familiar with all conditions affecting the work, coordinate interconnecting work and other Trades affected, and verify all spaces in which the work will be installed.

C. Where job conditions require reasonable changes in indicated locations and arrangements, make changes without extra cost to the Owner.

D. The Contract Documents (Drawings and Specifications) are to be cooperative, and whatever is called for by either shall be binding as if called for by both.

E. Various items of apparatus and equipment will be furnished and set under other Contracts.

1.11 WORK INVOLVING OTHER TRADES:

A. Certain items of equipment or materials specified in the Electrical Division may have to be installed by other Trades such as Mechanical Trades or Architectural Trades due to code requirements or union jurisdictional requirements. Where this occurs, Electrical Trades shall include the full cost for completing the work installed by others.

B. Include allowance in bid for variations in electrical services (branch circuits/feeders) to mechanical equipment specified. Equipment specified and designed into Contract Documents may vary due to manufacturer differences and equipment selections and substitutions. Allow for revisions to services with no extra charge prior to installation. Coordinate with approved mechanical submittals to verify equipment characteristics prior to beginning electrical installation.

1.12 RECORD DRAWINGS:

A. After completion of the work, provide a complete set of “Record” Drawings to Owner and the Engineer. Contractor shall obtain from Engineer at cost ($10.00 per drawing) the project electronic files on which Contractor shall record all as-built data. Submit updated electronic Auto Cad files along with a set of marked up drawings with as-built changes for final approval.

B. In addition to hard copy, submit on compact disks electronic versions of as built panel schedules. Submit to A/E and to Owner’s Building Engineer in Microsoft excel format. Match format of schedule used for construction documents. Template file is available to Contractor from Engineer upon request.

1.13 CODES, PERMITS, INSPECTIONS AND FEES:

A. All work shall be in accordance with National Electrical Code, latest edition and all local, state and national bodies having jurisdiction thereof.

B. Contractor shall be licensed in the municipality in which the work is located.

C. Contractor shall take out all permits required and arrange for all necessary inspections, licenses and approvals as required by local and state laws and shall pay all fees and expenses in connection therewith and shall include same in Base Bid prices. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

D. Upon completion of the work, furnish to the Engineer all certificates of inspection and/or approvals which are customary for the classes of work involved.

1.14 COORDINATION AND COOPERATION:

A. Electrical Contractor shall coordinate his work with that of the Construction Manager/General Contractor as applicable and other Subcontractors for the Project.

B. Contractor shall coordinate with designated Representative the placing of panels, flush devices or other equipment installed in masonry walls or partitions. All such flush installations shall be coordinated with masonry coursing as applicable.

C. Chases and recesses are provided by the architectural trades, but the contractor shall be responsible for their accurate location and size.

1.15 SCHEDULING OF WORK:

A. Work may be scheduled in phases and/or may be performed on a fast-track schedule. Prior to bid submission, coordinate with GC/CM and with Owner to determine project schedule. Include in bid all costs to achieve completion of work within project schedule.

1.16 USE OF EQUIPMENT:

A. The use of any equipment, or any part thereof, for any purpose including testing even with the Owner’s consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor shall it be construed to obligate him in any way to accept improper work or defective materials.

B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

1.17 PROPOSED SUBSTITUTIONS AND CONTRACTOR’S RESPONSIBILITY:

A. Manufacturers other than those listed in Divisions 26, 27 and 28 may be submitted for consideration in accordance with “Substitutions” of the General Conditions and Division 1, General Requirements of these Specifications.

B. Any substitutions contemplated shall be subject to the final approval of the Architect/Engineer at their sole and absolute discretion prior to bid award. After bid award all products submitted shall comply with Contract Documents.

C. Substitute equipment and material submittals shall be complete and clear and shall include all data required to establish equal quality, to specified and indicated products.

D. Substitutions will be considered only once and if found lacking in detail or required supportive data, or if they are not found to be equal by the A/E review, they will be rejected outright, and such rejection shall be final. Substitutions and changes to products will not be considered after the product has been approved or approved as noted with comments in a submittal.

E. "Approved Equal" equipment, material or systems are intended to provide the same quality, aesthetics and performance and function as those named and are not considered as substitutes for the purpose of this article. The Architect/Engineer will review products submitted as equal and will allow or disallow their use in the project. If submitted products are not determined to be equal by the Architect/Engineer for any reason, provide the specified/listed product at no change in project cost. The Contractor's bid is to include all costs to comply with specified/indicated work. Changes in costs will not be approved for equal products. Refer to Section 265000 for additional requirements specific to Lighting Systems.

F. Submit product data and written description of how proposed substitution varies from specified product. Any characteristics not specifically submitted in writing as a deviation from the Contract Documents will be assumed to conform to the intent of the specified product.

G. Submit project cost increases or deductions that result from the acceptance of each substitution. Additional cost to the project will not be approved unless specifically included with the substitution.

1.18 OPERATION AND MAINTENANCE MANUALS:

A. Upon completion of the work and fourteen (14) days before final inspection, the Contractor is to compile and deliver to the Architect, three (3) sets of Manuals of material and equipment used in the building. This shall include, but shall not be limited to, transformers, switchboards, light fixtures, panels, switches, wiring devices, lighting controls, fire alarm systems, etc.

B. In each set of manuals, the following information shall be included for each item of material, equipment and hardware installed:

1. Name and address of manufacturer and/or fabricator.
2. Trade names, catalog number, serial number, contract number of other accurate provision for ordering replacement and spare parts.
3. Certified Drawings, where applicable, showing the amount of parts and general dimensions.
4. Operating and maintenance instructions and/or manuals.
5. Routine maintenance procedures.
6. Trouble-shooting procedures.
7. Shop drawings and product data.

1.19 TEMPORARY LIGHT AND POWER:

A. Consult Supplementary General Conditions, for requirements pertaining to this work and comply.

B. Provide complete systems of adequate capacity and design, and in accordance with Federal, State and Local Codes. Provide lighting (normal and emergency/egress) which matches the pre-

construction levels. Coordinate with Architect to maintain proper egress and exit lighting during all phases of work.

1.20 CONSTRUCTION POWER:

A. Contractor to provide for all trades.

1.21 TRAINING:

A. Provide training to Owners personnel as specified in individual specification sections.

B. Hours of training in each section are the actual time spent training Owners personnel. Travel and preparation time are not included in this time.

1.22 WARRANTY:

A. Unless a longer period is specified in individual specification sections, provide a minimum of a one year warranty on all electrical work beginning the date of final acceptance of the project by the Owner. A manufacturer's warranty on equipment shall be extended a minimum of one year from final project acceptance. Manufacturer's warranties which are longer than a one year term shall remain in effect for their entire length.

PART 3 - EXECUTION

3.1 ACCESSIBILITY:

A. Install all electrical work with working clearances and dedicated electrical space as applicable per National Electrical Code requirements. Relocate any existing equipment and building system interferences in locations where adequate working clearances and electrical space are not present. Field verify that proper working clearances will be achieved for the actual equipment to be installed and notify the Architect/Engineer of any non-compliant conditions found prior to the installation of any electrical work including but not limited to raceways, supports and equipment. Note that installed equipment dimensions and locations and field conditions may vary from the basis of design. No extra costs will be approved for rework of installed non-Code-compliant work.

B. Provide minimum 18" x 18" hinged access doors (panels) for all junction, outlet and pull boxes and for all equipment requiring inspection, maintenance, service, replacement and access which is located behind walls or above permanent non-lay-in ceilings and canopies. Provide larger hinged access doors if required to adequately access equipment. Coordinate door size with approved submittals and manufacturer's recommended installation and maintenance instructions. Coordinate location with Architect prior to installation. Paint to match architectural finish at installed surface. Access doors are not indicated on plan drawings.

C. As a minimum, route conduits, as high as possible in ceiling spaces, cable tray, and other materials high enough above the accessible ceiling tiles to allow easy removal of the tiles, or above access hatches ease of maintenance and inspection.

D. Layout devices in ceilings so there are enough 'free' (removable) tiles to allow maintenance of above ceiling equipment, pulling new cables in tray, and making minor additions of new conduits and the like (during renovations).

E. Coordinate work with other trades prior to installation to maximize accessibility.

3.2 INSERTS, SLEEVES AND PENETRATIONS:

A. Provide and install all necessary inserts, conduit sleeves, hanger bolts, etc., to hang equipment and to run conduit through walls, floor slabs or footings.

B. Holes through walls, ceilings or floor slabs shall be sealed completely in an approved manner to form a fire barrier.

C. All electrical lines to roof mounted equipment shall be installed within equipment curbs.

D. For penetrations through fire-rated assemblies, provide UL listed system for the penetration, equal to or greater than the rating of the rated assembly. Refer to Architectural documents for fire rated assembly types and locations.

E. In addition to manufactured systems indicated (such as fire-rated poke-throughs), fire stop components shall consist of packer-style red pillows and moldable fire-stop compound. Packets shall be used where multiple cables pass through a fire-rated wall, ceiling or floor, such as data and phone cable trays. Fire-stop compound shall be used where individual cables in conduit penetrate fire-rated wall, ceiling or floors.

F. Fire stopping shall be performed by a Contractor who is certified in its installation. Fire stopping Contractor is a sub-contractor to the Electrical Contractor.

G. Provide sleeves for all conduits penetrating floors and concrete/masonry walls.

3.3 PROTECTION AND HANDLING:

A. All electrical systems or divisions thereof shall be duly cared for and properly protected until all systems have been completely tested, inspected and finally accepted by Owner.

B. After delivery, before and after installation, protect equipment and material against theft, injury or damage from all causes.

C. Protect equipment outlets, conduit openings and electrical raceways with temporary plugs or caps.

D. Receive, properly house, hoist, handle and deliver to the proper location, equipment and material required for this Division of the work.

E. Deliver materials to the job site in original containers and packages, bearing the manufacturer's labels indicating name, type and brand.

3.4 PAINTING, CLEANING AND TOUCH-UP:

A. Any required painting of electrical equipment in existing areas will be done by Architectural Trades. Whenever painting is required by this Trade for certain portions of the work, it will be specifically specified hereinafter.

B. All factory finished equipment shall be thoroughly cleaned at the completion of the work. Any equipment showing mars or rust spots shall be refinished and restored to original factory finish.

3.5 ELECTRICAL REQUIREMENTS FOR MECHANICAL WORK:

A. Motor starters, except for those included with packaged mechanical equipment, will be furnished and installed by the Electrical Trades Contractor. These starters will be sized and shown on the Electrical Drawings. Reference is made to Mechanical Section 220500 and Electrical Sections 260500 and 264500.

B. Furnish and install disconnects for mechanical and building equipment requiring the same unless otherwise specified herein or noted.

3.6 TEMPERATURE CONTROL REQUIREMENTS:

A. All temperature control work, including electrical will be done under Mechanical Trades Specifications. Any exceptions will be noted on drawings. Consult Mechanical Specifications Section 230900, for more information.

3.7 BUILDING EQUIPMENT AND MECHANICAL EQUIPMENT:

A. Provide and install all electrical work required to put in operation building and mechanical equipment requiring electrical service.

B. Connections to new equipment shall be done in accordance with manufacturer's Shop Drawings and installation instructions. Requirements generally vary from one manufacturer to another and Contractor is bound to comply and provide all work as required although certain discrepancies regarding requirements may exist.

C. Provide power wiring, protection and disconnect devices to all mechanical equipment and make final connections, including testing and motors for proper rotation. Exhaust fans are generally provided with integral disconnects by Mechanical Trades.

D. Packaged equipment is provided as a unit by manufacturer including all control and power wiring at a main junction box. Install disconnect switch, power wiring and make final connections.

E. All electric unit heaters are furnished by Mechanical Trades with integral disconnects. Provide power wiring and make final connections.

F. Prior to installation of electrical work, perform the following coordination:

1. Coordinate lug sizes on approved equipment shop drawings with conductor size indicated feeding the equipment. Conductors may be upsized for voltage drop. Include cost in bids to provide reducing adaptors at equipment terminations to reduce conductor size to fit lug size for each piece of equipment. Refer to 600V Wire Terminations and Connections for reducing adapter requirements.

2. Coordinate equipment lug listing for compatibility with conductor type to be installed (copper or aluminum where permitted).
3. Coordinate equipment lug listing for compatibility with reducing adaptors to be installed (copper or aluminum).

3.8 IDENTIFICATION:

A. Identify all electrical system components. Identification shall be subject to final approval by Architect/Engineer.

B. Identification shall be all inclusive and shall include switchboards and switchboard individual devices, distribution panels and individual devices, power panels and individual devices, transformers, lighting and receptacle panels, time switches, relays, contactors, push-button stations, pull and junction boxes, toggle switches used for motor disconnects, disconnects and safety switches, motor starters, variable frequency drives, transformers, meters, control panels, NEMA enclosures housing electrical system components, etc. Include equipment name from the contract documents, voltage, rating, power source room number of power source as applicable, eg "RP-A", 208Y/120V, fed from Service Disconnect in this Room". Submit list of nameplates for Owner review.

C. All lighting and receptacle panels shall be provided with a typewritten directory on inside of panel given complete and accurate description of all circuits and devices and/or equipment connected to each circuit. Description shall include number of outlets, load and a readily identifiable location statement. Submit as-built electronic schedules as specified in Record Drawings, this Section.

D. Nameplates shall be white plastic laminate with 1/4" black engraved letters. Nameplates shall be fastened to equipment with stainless steel machine screws. Magic markers and Dymo labels are strictly prohibited.

E. Identify wiring device coverplates with lettered tape identifying panelboard and branch circuit number serving device, e.g. "A-15". Provide identification for all switches, dimmers receptacles in all applications. Provide ¼" machine-written black lettering on clear plastic adhesive tape. Locate on bottom front of coverplate, centered below wiring device(s). For weatherproof coverplates, locate circuit identification on the inside of the flip up coverplate lid. Submit sample of labeled tape with wiring device/coverplate submittal. Sample may be adhered to paperwork in submittal, rather than to a coverplate.

3.9 TESTS AND CERTIFICATION:

A. Test all circuits as soon as conductors are installed. If circuits are not properly controlled and insulated, make all necessary repairs.

B. Perform any additional tests specified hereinafter and any other tests deemed necessary by Architect/Engineer for systems supplied or installed.

C. Provide testing work as specified in Section 269500, "Electrical Acceptance Test".

3.10 EQUIPMENT CONNECTIONS:

A. Connection to equipment, fixtures, etc., shall be made in accordance with the Shop Drawings and rough-in measurements provided by the manufacturer of the particular equipment furnished.

3.11 BASIC SUPPORTING PROCEDURES:

A. Unless otherwise shown, all overhead mechanical and electrical items supported from the building structural steel system shall be supported from structural beams or purlins or truss and open web steel joist panel points (or within 6" thereof). Panel points being the point of intersection of web members (rods, angles, etc.) with top or bottom chords (horizontal members).

B. Item distribution shall be such that multiple loads are not concentrated on single hanging points.

C. Provide U-channel supports and miscellaneous steel and hardware as required to support electrical work in dry interior applications. Provide hot-dipped galvanized finish for all components and hardware.

D. Attachment devices shall be a type resulting in the load being centered on the center of the members.

E. Rigidly support all electrical equipment.

F. Provide fiberglass u-channel support for exterior locations, damp and wet locations, and where specified or indicated to support equipment, raceways and wiring devices. Provide stainless steel or fiberglass fittings and hardware suitable for fiberglass u-channel system. Manufacturers: Aickinstrut, Champion Fiberglass, or approved equal.

G. Coordinate support system components, hardware and fastening method as required for each load supported per manufacturer's recommendation.

H. Support electrical items independently of the supports provided by other trades and independently from existing electrical system supports. Do not support electrical items from conduits/raceways.

I. Provide concrete pad for freestanding electrical equipment. Pads may not be specifically indicated. Size pad to extend 4" around footprint of equipment. Coordinate size with manufacturer's dimensions based approved equipment submittals, unless a larger pad is indicated.

3.12 MOUNTING HEIGHTS:

A. Height above finished floor for all control and wiring devices shall be in accordance with the Americans with Disabilities Act (ADA). Switches shall not be more than 48" above finish floor (AFF). General purpose receptacles shall not be less than 12" AFF and no more than 48" AFF.

B. General purpose convenience receptacles shall be mounted at 16" AFF to the bottom of outlet box. Telephone outlets shall be installed at the same height as receptacles except for wall mounted instruments, outlets shall be installed at 48" AFF.

C. Light control switches, dimmers, manual starters and similar devices shall be generally mounted at 48" AFF.

D. Consult Drawings for special mounting heights, base mounted devices, horizontally mounted receptacles and other special mounting requirements.

E. Receptacles in Toilet Rooms, Janitor Closets and Mechanical Rooms shall be installed at 48" AFF. Receptacles and switches at counters shall be installed at 6" above counter measured to the center of the box. Height of special devices shall be as indicated on the Drawings or as directed.

F. Mounting heights indicated on the Drawings shall take precedence over the requirements stated herein.

G. Whenever the mounting heights of any device is in question, consult the Architect for direction prior to installation of raceway and outlet box.

3.13 RESPONSIBILITY FOR VOLTAGE VERIFICATION:

A. Contractor shall be responsible for verification of correct voltages for all mechanical and building equipment. In case of discrepancy, notify Engineer immediately and prior to Shop Drawing submittals. Failure to comply with this requirement holds Contractor fully responsible for any subsequent equipment revisions and work.

3.14 RESPONSIBILITY FOR SUBSTITUTIONS:

A. In the event that substitute equipment, material or whole systems are approved for use on the project, the Trade Contractor using the substitute material, equipment or systems shall pay all subsequent additional costs; that may be incurred for proper implementation, function and use of such equipment; In addition, the Trade Contractor shall pay for all time expended by the Architect and/or Engineer relative to the substitution.

END OF SECTION 260100

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Include two for each sealing element.
4. Connecting Bolts and Nuts: of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

F. Do not run conduits in the concrete slabs unless it is approved by the Structural Engineer.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

SECTION 2605190 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

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

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. Copper Conductors: Comply with NEMA WC 70. Aluminum only where indicated.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN and XHHW.

E. Multiconductor Cable: Comply with NEMA WC 70.

2.2 CONNECTORS AND SPLICES

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

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

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

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

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.3 CONNECTIONS

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

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:

1. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Ground rods.
2. Ground rings.
3. Grounding arrangements and connections for separately derived systems.
4. Grounding for sensitive electronic equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at ground rings, grounding connections for separately derived systems based on NFPA 70B.

a. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Having the experience and capability to conduct the testing indicated, and that is acceptable to authorities having jurisdiction.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad 3/4 inch by10 feet (19 mm by 3 m) in diameter.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts where required.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.

4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning

protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches (600 mm) from building foundation.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4/0 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration and Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. Fabco Plastics Wholesale Limited.
    d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

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

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

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

C. Rigid Steel Conduit: ANSI C80.1.

D. Aluminum Rigid Conduit: ANSI C80.5.

E. IMC: ANSI C80.6.

F. PVC-Coated Steel Conduit: PVC-coated, rigid steel conduit IMC.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: ANSI C80.3.

H. FMC: Zinc-coated steel or aluminum.

I. LFMC: Flexible steel conduit with PVC jacket.

J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel or die-cast compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

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

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

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

C. ENT: NEMA TC 13.

D. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

E. LFNC: UL 1660.

F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

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

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

1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

C. Description: Comply with UL 2024; flexible type, approved for plenum, riser and general-use installation as required.

2.4 METAL WIREWAYS

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

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

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Wireway Covers: Screw-cover type and as indicated.

F. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

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

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

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

2.7 BOXES, ENCLOSURES, AND CABINETS

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

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

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

F. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

G. Nonmetallic Floor Boxes: Nonadjustable, round.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum or galvanized, cast iron with gasketed cover.

J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

K. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC." "TELEPHONE." or as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation.
    d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. Christy Concrete Products.

d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers suitable for the location.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Carson Industries LLC.
b. Christy Concrete Products.
c. Nordic Fiberglass, Inc.

2.9 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.10 SLEEVE SEALS

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

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

2.11 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: IMC, RNC, Type EPC-40-PVC, RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: IMC, EMT.
3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, Fiberglass enclosures with polymer-concrete frame and cover, Fiberglass-reinforced polyester resin, SCTE 77, Tier 15 structural load rating.
b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer-concrete frame and cover, SCTE 77, Tier 8 structural load rating.
c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: IMC. Includes raceways in the following locations:

a. Loading dock.
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.
6. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway or EMT.
7. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway or EMT.
8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway.
9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.
10. Do not run conduits in the concrete slabs unless it is approved by the Structural Engineer.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.9 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

    a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    b. Colors for 208/120-V Circuits:

        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.

    c. Colors for 480/277-V Circuits:

        1) Phase A: Brown.
        2) Phase B: Orange.
        3) Phase C: Yellow.

    d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels or Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

L. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer and load shedding.

M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Adhesive film label with clear protective overlay, Self-adhesive, engraved, laminated acrylic or melamine label or Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

g. Substations.
h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

END OF SECTION 260553

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Lighting and appliance branch-circuit panelboards.

1.3 DESCRIPTION OF WORK:

A. General: Provide basic materials and methods for electrical work and install in accordance with the Contract Documents.

B. Contractor/manufacturer may re-arrange circuit order in panels; however circuit numbers from panelboard schedules in contract documents must be indicated on any submitted panelboard elevations, drawings, tables and schedules.

2.4 LIGHTING AND RECEPTACLE PANELBOARDS:

A. Panels shall be of voltage, phase and service as required and further specified herein. All panels shall be equipped with thermal magnetic, toggle type, molded case circuit breakers with “quick-make”, “quick-break” operating mechanism. Breakers shall be rated 10,000 A.I.C. minimum at 240 V.A.C. and single, double or triple pole as indicated. Single pole circuit breakers, rated 20 amperes or less shall be “SWD” marked in compliance with NEC Article 240-83(d).

B. Cabinets shall be dead front construction, flush or surface type as indicated, constructed of code gauge galvanized steel and with 4” wiring gutters on all sides. Fronts shall be heavy gauge steel, equipped with flush doors to fit the cabinet boxes, hinged and supplied with flush key locks and interchangeable keys.

C. Panels shall be designed for 75 degrees C. minimum operating temperature.

D. Cabinet fronts shall be finished in manufacturer’s standard color. Tops of all cabinets shall be 6’-0” above finish floor. Provide 2 keys for each panel. Key all locks alike.

E. All panels shall be provided with a directory frame and a typewritten directory. Submit as-built directories.

F. Where space positions are indicated, the panel shall be fully equipped for the simple addition of these future breakers.

G. Upon completion of the project, the Contractor shall check each panel and properly balance the load on all phases.

H. Panels shall be factory assembled, similar to Square “D” type “NQOD” for 120/208V service and as manufactured by Park Metal, ITE, Siemens, Square D, Cutler Hammer.

I. Include TVSS in panels where indicated.

J. Mount main device, when present, separate from (above or below) and not within feeder device locations.

K. Provide panelboards with tub sized to accept field-installed feeder breakers with a minimum rating of 175A, 3-pole. Provide larger factory installed breakers as indicated.

M. Include panelboard dimensions and maximum field-installed feeder breaker size in submittal.

N. MCB denotes Main Circuit Breaker.

PART 3 - EXECUTION:

3.1 EXAMINATION

A. Receive, inspect, handle and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wring and components; provide warning signs complying with Division 25 Section “Identification for Electrical Systems.”

B. Create a directory to indicate installed circuit loads; incorporate Owner’s final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with nameplate complying with requirements for identification specified in Division 26 Section “Identification for Electrical Systems.”

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section “Identification for Electrical Systems.”

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification.
2. Correct malfunctioning units on-site, where possible and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.4 ADJUSTING

A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated in Division 26 Section “Overcurrent Protective Device Coordination Study.”

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal systems loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer’s written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches and wall-box dimmers.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. All devices in spaces accessible to the public to be tamper proof.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 2221PL for 120 V and 277 V.
    b. Hubbell; HPL1221PL for 120 V and 277 V.
    c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
    d. Pass & Seymour; PS20AC1-PLR for 120 V.

3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 2221L.
    b. Hubbell; HBL1221L.
    c. Leviton; 1221-2L.
    d. Pass & Seymour; PS20AC1-L.

3. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 1995.
    b. Hubbell; HBL1557.
    c. Leviton; 1257.
    d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 1995L.
    b. Hubbell; HBL1557L.
    c. Leviton; 1257L.
    d. Pass & Seymour; 1251L.

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider or rotary knob; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices.

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 6111 for 120 V, 6117 for 277 V.
b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; AT120 for 120 V, AT277 for 277 V.
b. Leviton; ODS 15-ID.

3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; ATP1600WRP.
    b. Leviton; ODWWV-IRW.
    c. Pass & Seymour; WA1001.
    d. Watt Stopper (The); CX-100.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; ATD1600WRP.
    b. Leviton; ODW12-MRW.
    c. Watt Stopper (The); DT-200.

3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

E. Wide-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; ATP120HBRP.
    b. Leviton; ODWHB-IRW.
    c. Pass & Seymour; HS1001.
    d. Watt Stopper (The); CX-100-3.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

2.8 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.9 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular or Round die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

2.10 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: White or as selected and approved by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
2. blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726