

**WAUNAKEE COMMUNITY SCHOOL DISTRICT
BOARD OF EDUCATION FACILITY COMMITTEE MEETING**

Wednesday, March 8, 2023

7:30 AM

Waunakee Community School District
905 Bethel Circle
Waunakee, WI 53597

Members of the public may attend Board of Education meetings in-person, and will be asked to check in with District personnel when you arrive.

Public comments will be limited to 3 minutes. The Board will allow 30 Minutes for public comments.

Public comments may be sent to Rebecca McDonough at district_administrator@waunakee.k12.wi.us up to one hour before the start of the Board meeting. All comments will be reviewed by the Board members. Emailed comments will be reviewed by the board but not read out loud. Emailed comments sent during any part of the board meeting (Board Development, Closed session, Open session) will be forwarded to the board but may or may not be reviewed by the board until after the board adjourns. Comments must include the commentator's name, address, and must identify their connection to the District (if any) and any group they are representing in order to be considered by the Board.

If you would like to address the Board in-person during the public comments section of the meeting, you will be greeted in the lobby of the building, asked to check in with District personnel when you arrive so that you can be recognized and address the Board when your name is called.

A recording of the meeting will be posted on the District webpage within 24 hours of the meeting time.

AGENDA

I. CALL TO ORDER

II. ROLL CALL

III. APPROVE AGENDA

IV. PUBLIC COMMENTS

V. CONSIDERATION OF HERITAGE ELEMENTARY SCHOOL BIDS

The purpose of this agenda item is to review bids related to the new Heritage Elementary School project. Vogel is requesting consideration of approving bids for elevators and fire protection at the March 13th School Board meeting. Bids will be available for review by the Facility Committee on March 8th. Bids are not available at the time of the release of this packet.

A. Fire Protection

B. Elevators

VI. ATHLETIC FIELD PROJECTS

A. Consideration of Warrior Stadium Project

4

The purpose of this agenda item is to review the Warrior Stadium project planning process. The School Board has previously approved a planning process for the track replacement, bleacher expansion, and related improvements. Attached please find information from Roxanne Johnson on the design for this work and a construction estimate.

Roxanne Johnson will be present at the meeting to share progress to date. There is a potential path to move forward with this project in the summer of 2023. This path would require the School Board to approve the project at the March 13th School Board meeting with a motion similar to the following " Approval for administration to proceed with the Warrior Stadium track replacement, bleacher expansion, and related improvements at a cost not to exceed \$1.2 million." Administration would work with Roxanne Johnson to select the vendors for this project. The alternative approach would be a summer of 2024 project where the bids for each section of the project work can be formally presented to the School Board for approval. Administration will seek input from the Facility Committee on these project options.

B. Softball Lighting Project Update

7

The purpose of this agenda item is to provide an update on the varsity softball field lighting project. The School Board has previously approved a planning process to install lights on the varsity softball field. The design process has been completed for the lighting project, and the project is ready for bidding. Attached please find information from Retter on the design of the softball field lights on the varsity field.

The district has received communication from the softball boosters group requesting consideration of a review of which field should be considered the best long term option for the varsity field. The current junior varsity field may be a better option for the varsity field. The district originally considered lights on the junior varsity field when the fundraising effort for the team center building was taking place. Administration is seeking feedback from the Facility Committee on this topic.

We can pause the bidding process for the varsity field softball lights while this review is taking place. The district would need to invest additional design into evaluating the lighting project on the current junior varsity field, as well as a professional review of the two fields so that the Facility Committee would be able to evaluate the option of moving the varsity field to the junior varsity field. If the Facility Committee supports this review, administration would recommend beginning this work immediately. The additional design work on the lights would cost approximately \$7,000 plus the evaluation of the

fields and supporting facilities.

C. Softball Boosters Indoor Batting Cage Donation

The softball booster club is requesting consideration of donating an indoor batting cage for the softball program to be used at the Middle School or the Intermediate School. The softball booster club has been invited to the meeting to share information on this request.

VII. DISTRICTWIDE MAINTENANCE PLANNING

The purpose of this agenda item is to review the district's funding strategy for districtwide maintenance. The school board has reserved \$300,000 per year in Fund 10 for future maintenance projects. All maintenance projects could then be funded through the Fund 49 November 2022 referendum funding, likely through the 2026-27 school year. The 2027-28 school year would then begin the use of the Fund 10 reserved maintenance dollars, which will have accumulated to \$1.8 million. Administration will seek input from the Facility Committee and the Budget Committee on this funding strategy.

VIII. FUTURE MEETINGS

Administration will be requesting several meetings over the next several months to continue the various steps with the November referendum planning process.

IX. ADJOURN

“Any person who has a qualifying disability as defined by the Americans with Disabilities Act who requires assistance with access or materials should contact the Waunakee Community School District Office at 849-2000, 905 Bethel Circle Drive Waunakee, WI 53597, at least twenty-four hours prior to the commencement of the meeting so that necessary arrangements can be made to accommodate the request.”

CONSTRUCTION ESTIMATE

PROJECT: Waunakee Stadium Track Reconstruction
 AGENCY: Waunakee High School
 PROJECT #: 1447

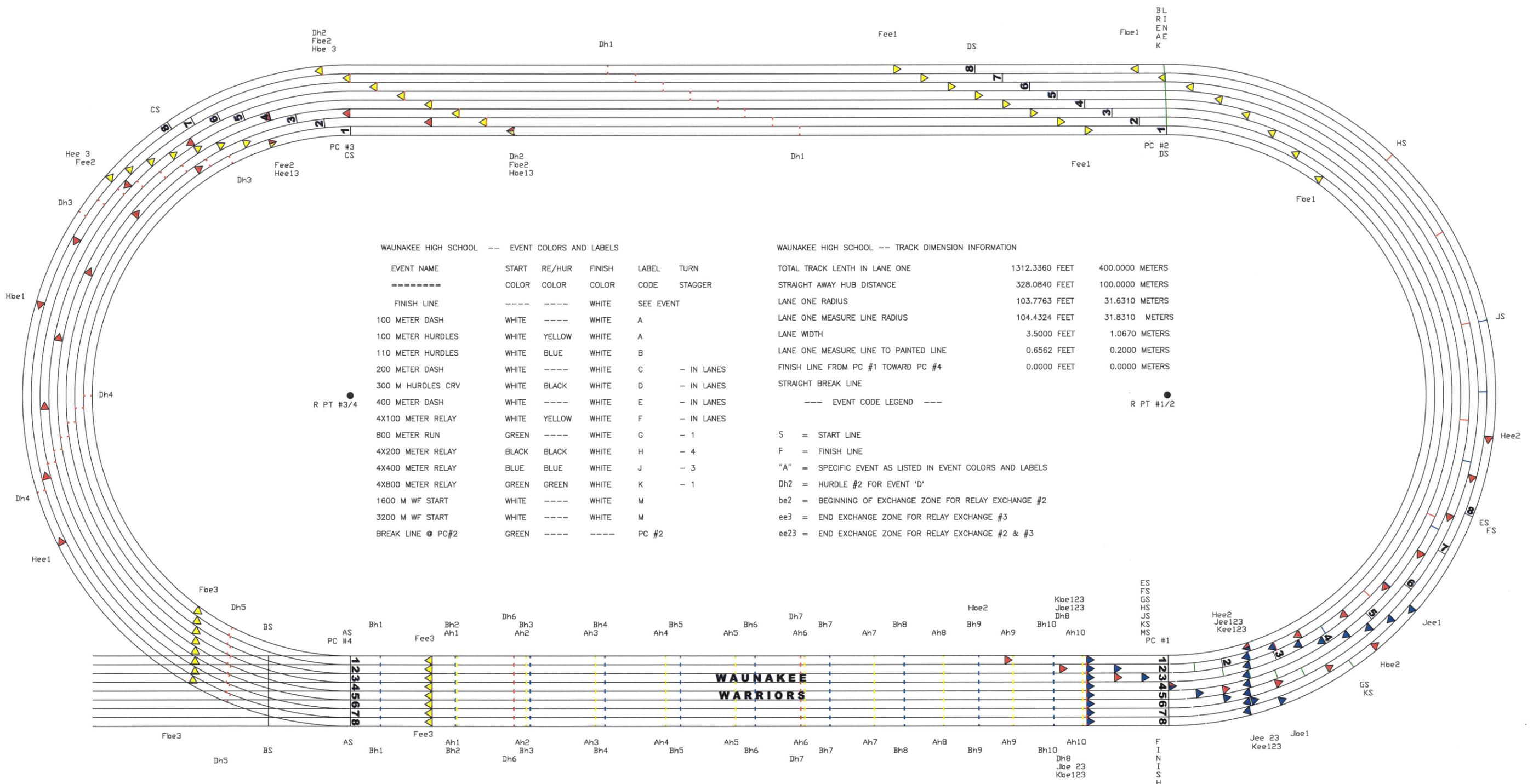
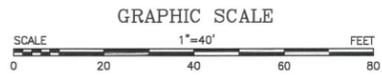
Date: February 28, 2023
 By: Roxanne Johnson

No.	Description of Items	Qty	Unit	Unit Price	Total
1	Mobilization	1	LS	\$ 20,000.00	\$ 20,000.00
2	Surveying and Staking	1	LS	\$ 7,500.00	\$ 7,500.00
3	Remove Existing Asphalt Track	4,790	SY	\$ 7.78	\$ 37,266.20
4	Remove Existing Track Surfacing Over D-zone, high jump and runway concrete surfaces	1,237	SY	\$ 3.96	\$ 4,898.52
5	Remove Existing Track Surfacing Over Curb	1,300	LF	\$ 0.45	\$ 578.50
6	Undercut/Excavation Below Subgrade for Unsuitable Soils	400	CY	\$ 65.00	\$ 26,000.00
7	Install 3" of 1 1/4" Compacted Dense Graded Base	4,790	SY	\$ 8.36	\$ 40,044.40
8	Fine Grading	4,790	SY	\$ 5.56	\$ 26,632.40
9	Install 3 1/2" Asphalt Pavement. Surface layer Mix Design May Not Contain Recycled Material.	4,790	SY	\$ 40.19	\$ 192,510.10
10	Install Base Mat and Structural Spray Track System To the New Track, D-Zone, High Jump and Runways. Include for a black track and Track Line and Event Location Markings per NFHS Standards. Include school lettering.	1	LS	\$ 199,583.00	\$ 199,583.00
11	Chainlink Fence Removal	1,610	LF	\$ 10.00	\$ 16,100.00
12	Remove Existing Asphalt Under Bleachers	185	SY	\$ 7.00	\$ 1,295.00
13	New 4' Chain Link Fencing (Includes gates and footings)	1,610	LF	\$ 45.00	\$ 72,450.00
14	Bleacher Expansion (514 Additional Seats and ADA Ramp)	1	LS	\$ 325,000.00	\$ 325,000.00
15	Concrete Flatwork at Bleachers	3,925	SF	\$ 14.00	\$ 54,950.00
TOTAL ESTIMATED PROJECT COST					\$ 1,024,808.12

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WAUNAKEE HIGH SCHOOL

WAUNAKEE, WI



WAUNAKEE HIGH SCHOOL --- EVENT COLORS AND LABELS

EVENT NAME	START	RE/HUR	FINISH	LABEL	TURN
=====	COLOR	COLOR	COLOR	CODE	STAGGER
FINISH LINE	----	----	WHITE	SEE EVENT	
100 METER DASH	WHITE	----	WHITE	A	
100 METER HURDLES	WHITE	YELLOW	WHITE	A	
110 METER HURDLES	WHITE	BLUE	WHITE	B	
200 METER DASH	WHITE	----	WHITE	C	- IN LANES
300 M HURDLES CRV	WHITE	BLACK	WHITE	D	- IN LANES
400 METER DASH	WHITE	----	WHITE	E	- IN LANES
4X100 METER RELAY	WHITE	YELLOW	WHITE	F	- IN LANES
800 METER RUN	GREEN	----	WHITE	G	- 1
4X200 METER RELAY	BLACK	BLACK	WHITE	H	- 4
4X400 METER RELAY	BLUE	BLUE	WHITE	J	- 3
4X800 METER RELAY	GREEN	GREEN	WHITE	K	- 1
1600 M WF START	WHITE	----	WHITE	M	
3200 M WF START	WHITE	----	WHITE	M	
BREAK LINE @ PC#2	GREEN	----	----	PC #2	

WAUNAKEE HIGH SCHOOL --- TRACK DIMENSION INFORMATION

TOTAL TRACK LENGTH IN LANE ONE	1312.3360 FEET	400.0000 METERS
STRAIGHT AWAY HUB DISTANCE	328.0840 FEET	100.0000 METERS
LANE ONE RADIUS	103.7763 FEET	31.6310 METERS
LANE ONE MEASURE LINE RADIUS	104.4324 FEET	31.8310 METERS
LANE WIDTH	3.5000 FEET	1.0670 METERS
LANE ONE MEASURE LINE TO PAINTED LINE	0.6562 FEET	0.2000 METERS
FINISH LINE FROM PC #1 TOWARD PC #4	0.0000 FEET	0.0000 METERS

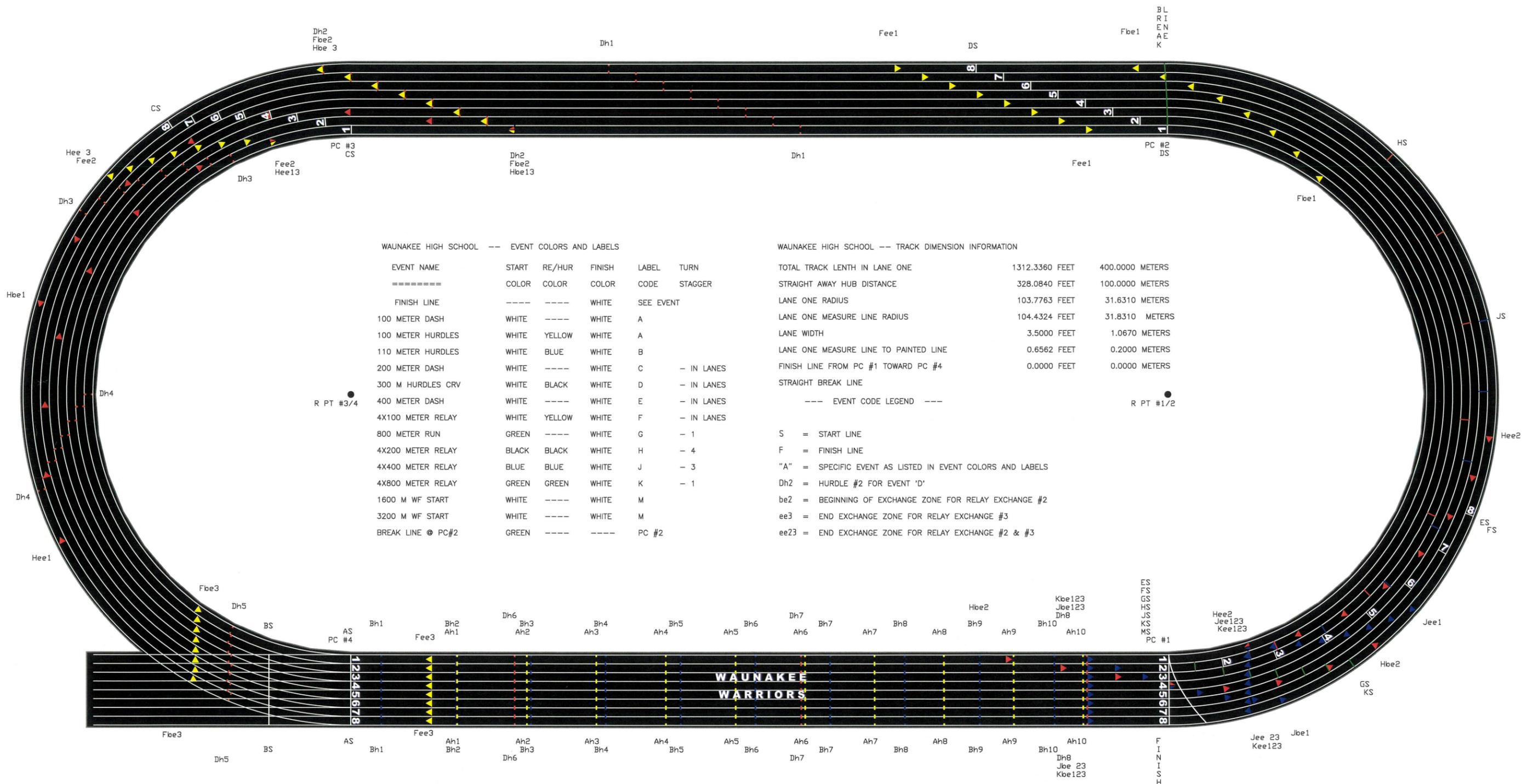
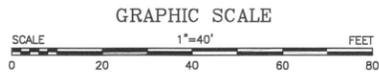
- STRAIGHT BREAK LINE
- EVENT CODE LEGEND ---
- S = START LINE
 - F = FINISH LINE
 - "A" = SPECIFIC EVENT AS LISTED IN EVENT COLORS AND LABELS
 - Dh2 = HURDLE #2 FOR EVENT 'D'
 - be2 = BEGINNING OF EXCHANGE ZONE FOR RELAY EXCHANGE #2
 - ee3 = END EXCHANGE ZONE FOR RELAY EXCHANGE #3
 - ee23 = END EXCHANGE ZONE FOR RELAY EXCHANGE #2 & #3

**WAUNAKEE
WARRIORS**

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WAUNAKEE HIGH SCHOOL

WAUNAKEE, WI



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WAUNAKEE HIGH SCHOOL --- TRACK DIMENSION INFORMATION

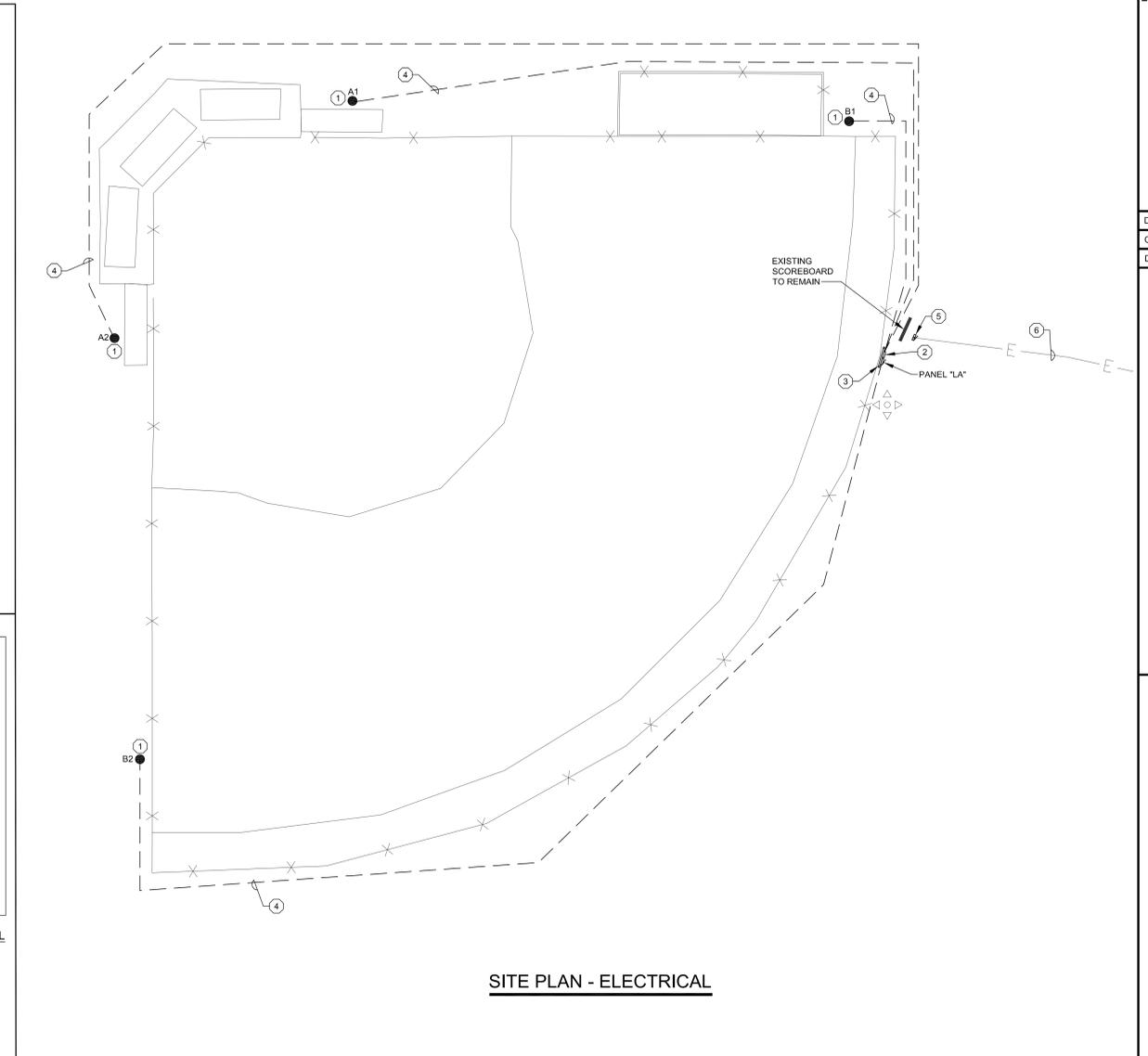
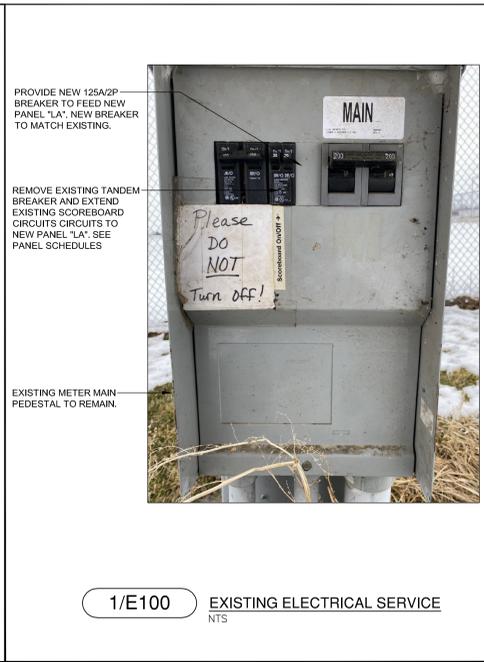
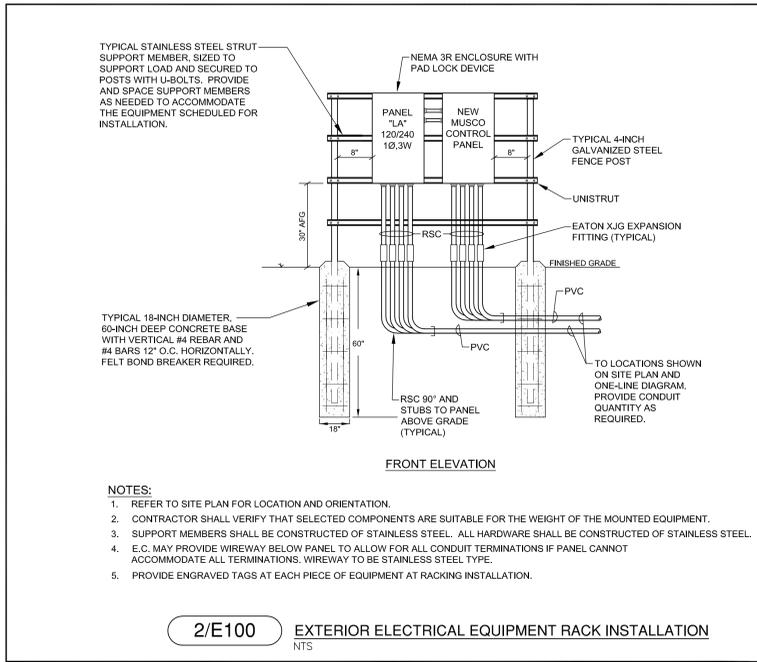
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--- EVENT CODE LEGEND ---

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- ee23 = END EXCHANGE ZONE FOR RELAY EXCHANGE #2 & #3

WAUNAKEE WARRIORS

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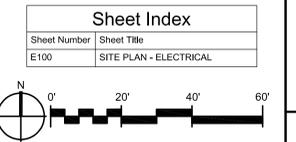
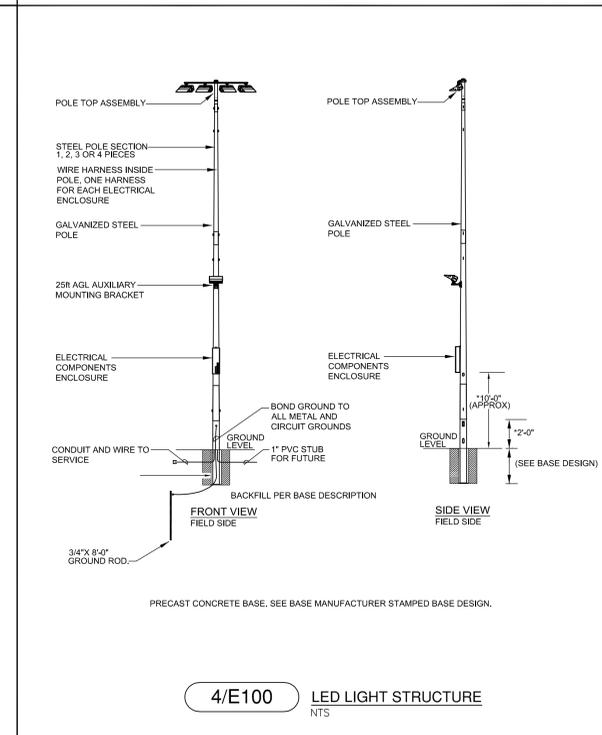
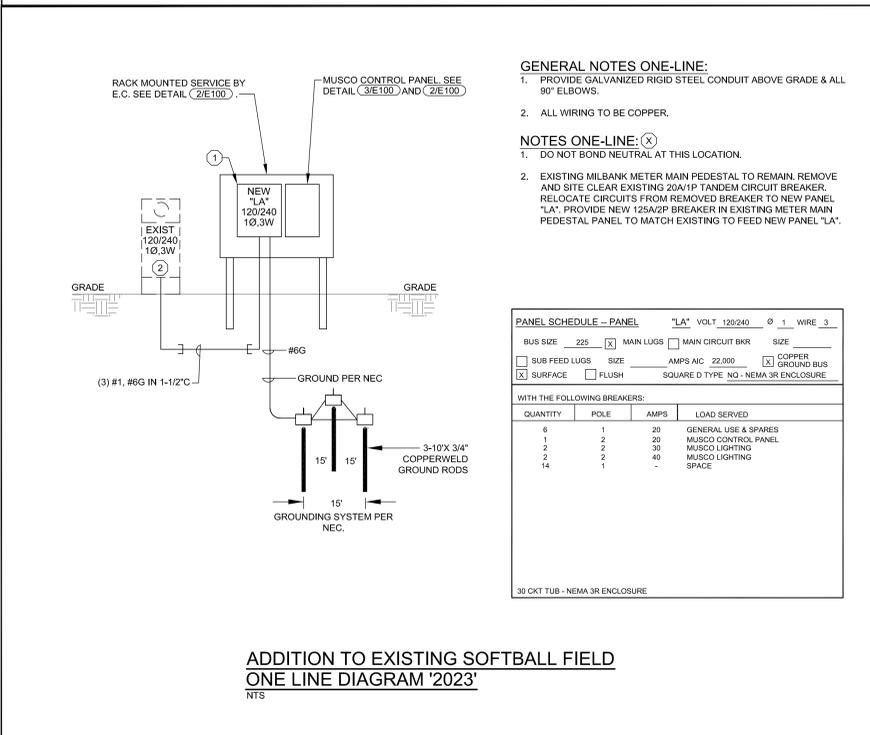
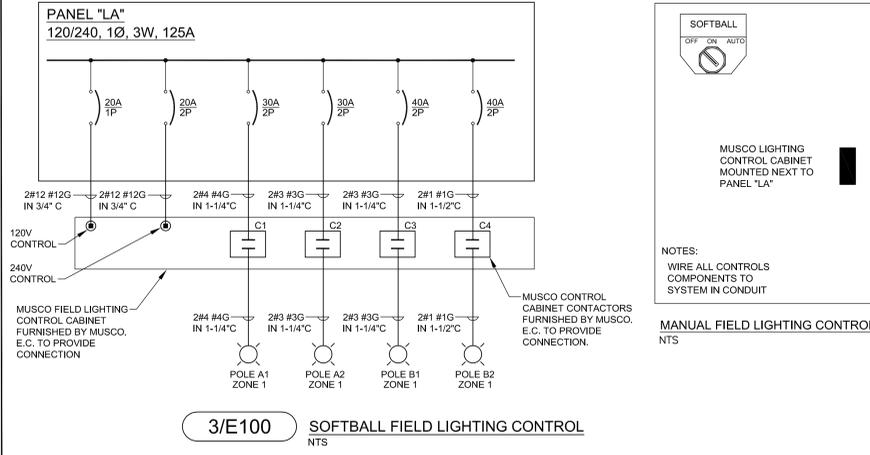


ELECTRICAL SYMBOLS AND ABBREVIATIONS

THIS IS A COMPREHENSIVE SYMBOL AND ABBREVIATION LIST. NOT ALL SYMBOLS ARE APPLICABLE TO THESE DRAWINGS.

- DUPLEX RECEPTACLE C=CEILING MOUNTED
- J=BOX
- HEAVY DUTY DISCONNECT F=FUSIBLE WP=WEATHERPROOF FURNISHED BY E.C.
- NEW SURFACE MOUNTED PANEL. SEE PLANS.
- EXISTING SURFACE MOUNTED PANEL. SEE PLANS.
- REFERS TO NOTE NUMBER
- REFERS TO DETAIL NUMBER
- CIRCUIT HOMERUN TO BREAKER
- SPORTS LIGHT POLE
- REFERS TO DETAIL
- SHEET NO. WHERE DETAIL IS LOCATED

- AFB ABOVE FINISH FLOOR
- AFG ABOVE FINISH GRADE
- C CONDUIT
- CKT CIRCUIT
- CT CURRENT TRANSFORMER
- CON CONTACTOR
- CP CONTROL PANEL
- DIS DISCONNECT
- EC ELECTRICAL CONTRACTOR
- F FUSIBLE
- GC GENERAL CONTRACTOR
- GFI GROUND FAULT INTERRUPTER
- GND GROUND
- LC LIGHTING CONTROL
- NIC NOT IN CONTRACT
- NTS NOT TO SCALE
- PNL PANELBOARD
- SS STAINLESS STEEL
- WP WEATHER PROOF



1 **SECTION 26 05 00 - ELECTRICAL CONTRACT REQUIREMENTS**
2
3

4 **PART ONE - GENERAL**
5

6 **APPLICABLE PROVISIONS**

7 Drawings and general provisions of contract, including general and supplemental conditions and
8 Division 01 specification sections, apply to work under this Section.
9

10 **APPLICABLE PUBLICATIONS**

11 Publications, standards and listing requirements called out in the Sections of this Division of
12 Labor shall form a part of these specifications as if contained herein.
13

14 The requirements of the Contract Documents, including the General Conditions, and
15 Supplementary Conditions, and Division 01 - General Requirements, apply to this section except
16 as modified herein.
17

18 **DESCRIPTION OF WORK**

19 Sections Included:

- 20 Section 26 05 00 - ELECTRICAL CONTRACT REQUIREMENTS
- 21 Section 26 05 04 - DOCUMENTATION
- 22 Section 26 05 19 - WIRE AND CABLE
- 23 Section 26 05 26 - GROUNDING
- 24 Section 26 05 29 - SUPPORTING DEVICES
- 25 Section 26 05 34 - RACEWAYS
- 26 Section 26 05 35 - ELECTRICAL BOXES
- 27 Section 26 05 53 - ELECTRICAL IDENTIFICATION
- 28 Section 26 24 16 - PANELBOARDS
- 29 Section 26 27 26 - WIRING DEVICES
- 30 Section 26 56 00 - ATHLETIC FIELD LIGHTING

31
32 Work Included:

33 The work covered by this Division of the specifications includes the furnishing of all labor,
34 materials, tools, equipment, permits, certificates and temporary protection necessary for
35 or incidental to executing and completing the electrical work, communications work, and
36 work on related systems.
37

38 All work shall be as specified and indicated on the drawings unless specifically excepted
39 on the drawings or herein.
40

41 Read all other Divisions of the Specifications which are applicable to this work, including
42 the General Conditions section applicable to all bidders.
43

44 The Electrical Contract Requirements section is a supplement to and not a replacement
45 for the project General Conditions section.
46

47 In cases of conflict with information in the General Conditions, the more stringent of the
48 contract requirements shall be considered applicable.
49

50 Prior to submitting bid, call to the attention of the Electrical Engineer any material or
51 apparatus believed to be inadequate or any necessary items or work omitted.
52

53 Address any questions regarding the interpretation of the plans and/or specifications at
54 least 12 days before the bid opening.

1
2 The Electrical Engineer reserves the right to interpret his own specifications and plans
3 after bids are received, and to demand that the installation conform to his intent.
4

5 Failure to become acquainted with existing conditions at the site shall in no way relieve
6 the responsibility for making installation in conformance with plans and specifications
7 without additional cost to the owner.
8

9 **Examination of Plans, Specifications and Site:**

10 Before submitting a bid, the bidder shall familiarize himself with all features of the
11 building and site which may affect the execution of his work.
12

13 No extra payment will be allowed for the failure to obtain this information.
14

15 If there are omissions or errors in the plans or specifications, they shall be clarified with
16 the architect prior to submitting bid.
17

18 For all remodeling projects, a site visit to the premises, for the purpose of the noting of all
19 existing conditions which may affect work is required.
20

21 Knowledge of all existing conditions, which may affect work in a renovation project, shall
22 be included in the preparation of bid.
23

24 Lack of information on existing conditions shall not be allowed for a valid cause for
25 additional compensation.
26

27 **Codes, Permits, and Inspection Fees:**

28 All work and materials shall conform in every respect to the current rules and
29 requirements of the National Fire Protection Association, National and State Electrical
30 Codes, Local Codes and Ordinances, Local Utility Regulations and OSHA.
31

32 Give to the proper authorities all required notices relating to the project, obtain all official
33 permits and licenses required, pay all fees incidental thereto, deliver upon completion of
34 the work and without cost to the Owner all required certificates of inspection and
35 approval.
36

37 **RELATED WORK ELSEWHERE**

38 Applicable provisions of Division 01: General Conditions shall govern work in this section.
39

40 All other Divisions of the Specifications which are applicable to or interface with work in Division
41 26 05 00.
42

43 **SHOP DRAWINGS**

44 Submit shop drawings in accordance with Section 26 05 04.
45

46 Submit shop drawings following Section specific Shop drawing submittal guidelines.
47

48 **OPERATION & MAINTENANCE MANUALS**

49 Submit operation and maintenance manuals in accordance with Section 26 05 04.
50

51 Submit operation and maintenance manuals following Section specific shop drawing submittal
52 guidelines.
53

54 **QUALITY ASSURANCE**

1 Provide quality assurance in accordance with Section 26 05 04.
2
3 All materials, equipment and parts are to be new, undamaged and unused of current
4 manufacture.
5
6 Acknowledge acquaintance with the plans and specifications and their respective requirements.
7
8 Guarantee that the electrical system has been installed strictly in accordance with the electrical
9 plans and specifications using only the best of materials available, installed in a substantial
10 manner by experienced labor.
11
12 Various components of the electrical system shall be placed in service prior to completion date as
13 instructed by Owner. This shall not change the guarantee period which shall be one year after
14 acceptance by Owner.
15
16 Replace and/or repair any items failing from causes of faulty workmanship, materials or design
17 without cost to Owner at any time within one year from date of final acceptance.
18

19 **WARRANTY**

20 Equipment shall be warranted for a period of not less than 1 year from the date of commissioning
21 against defects in material and workmanship.
22
23 The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service
24 hours, repair parts cost, etc.
25

26
27 **PART TWO - PRODUCTS**

28
29 **GENERAL**

30 It is the intent of these specifications that all the necessary material, apparatus, and devices to
31 complete the installation as specified herein, except such parts as are specifically excepted, shall
32 be provided.
33

34 If an item is either shown on the plan or called for in these specifications, it shall be considered
35 sufficient of said item in this contract.
36

37 All sizes given are as minimum.
38

39 Material and labor shall be first class and workmanlike and to the satisfaction of the Electrical
40 Engineer and shall be subject to inspection test and approval at all times from commencement
41 until acceptance of completed work.
42

43 Manufacturers shall be responsible for providing material listed by U.L. or other approved
44 agencies, and all governing codes and ordinances.
45

46 All material must bear U.L. and/or other approved labels where possible.
47

48 Items specified by catalog number or brand name and approval of shop drawings will not relieve
49 the manufacturer of this responsibility.
50

51 **MATERIALS: ALTERNATE MATERIALS**

52 Where materials, equipment apparatus, or other products are specified by manufacturer, brand
53 name, and type of catalog number such designation is to establish standards of desired quality
54 and style and shall be the basis of the bid.

1
2 Substitutions shall not be made unless there are "equals" listed in the specifications or on the
3 plan.

4
5 Substitutions may be bid as alternates.

6
7 Burden of proof that materials are equal shall be upon bidder requesting their use; therefore,
8 bidder shall furnish, with their request for approval all supporting data.

9
10 Assume responsibility for substituted material and state name of manufacturer, type or brand or
11 equipment and addition to or deduction from base bid.

12
13 Materials and equipment must meet all requirements as to type, quality, function, appearance and
14 physical dimensions shown.

15
16 Assume responsibility for any costs to other Divisions as a result of the use of alternate materials.

17
18 Submit supporting data to Architect/Electrical Engineer within 15 days after the bid date.

19
20
21 **PART THREE - EXECUTION**

22
23 **EXAMINATION**

24 Equipment Submittal Drawings:

25 Within 45 days after a notice to proceed and prior to ordering equipment, furnish to the
26 Electrical Engineer submittal drawings for review (see section 26 05 04).

27
28 Review of any submittal drawings does not waive any condition of the specifications
29 unless specifically noted thereon.

30
31 No fabrication or ordering of equipment shall be started until reviewed drawings are
32 returned.

33
34 **FIELD MEASUREMENTS**

35 Job Drawings:

36 Maintain, at the job site, one (1) complete set of up-to-date plans and written
37 specifications, complete with all addenda items.

38
39 This complete plan and specification set shall be reserved for all field markings to show
40 minor revisions and detailed construction notes.

41
42 These marked plans shall be returned to the Electrical Engineer prior to contract
43 completion and final payment.

44
45 Assist the Electrical Engineer in transferring applicable field notes to the project drawings
46 for record purposes.

47
48 **DELIVERY, STORAGE AND HANDLING**

49 Material on Site and Storage:

50 Maintain proper care and storage of material and equipment on site.

51
52 Any material damaged by rust corrosion, warping, breakage, finish damage, etc. shall be
53 replaced by the Contractor to the satisfaction of the Engineer.

1 **INSTALLATION**

2 **Field Change Orders:**

3 No revisions to the contract price shall be allowed unless such revisions have been
4 authorized in writing by both Owner and the change order submitter.

5
6 All work completed prior to completion of a written contract change order will not be
7 compensated for by the Owner.

8
9 Any work item that is proposed to perform, on the basis of a proposed contract adder,
10 must be announced in advance such that time is available for the Architect, Owner and
11 the Electrical Engineer to determine if a change in contract price is allowable.

12
13 **Change Orders:**

14 Change orders may be requested as a part of this project.

15
16 Assume the following in regards to change orders:

17 Work and equipment associated with change orders shall be installed per the
18 specified equipment on this project.

19
20 All change orders shall be accounted for on as-built drawings.

21
22 Change order additions to special systems where riser diagrams have been
23 furnished, shall be included as a part of the riser diagram.

24
25 A breakdown of all costs associated with the change order is required.
26 The cost breakdown shall be as follows:

27 Itemized list of all materials.

28
29 Materials shall be priced at Best Column in a national pricing service
30 book.

31
32 Cost for subcontractor services.

33
34 Subcontractor services shall be shown as actual costs from
35 subcontractor.

36
37 Material mark-up.

38
39 Maximum allowed is 8%.

40
41 Number of hours of labor at standard charge out rate.

42
43 Tax on material.

44
45 Total change order cost.

46
47 If equipment or materials are deducted as a part of this change order, credit shall also be
48 shown on change order.

49
50 **Installation: General**

51 **Connections to Equipment Furnished By Others.**

52 Included in Division 26 are electrical connections to equipment provided by
53 others.

1 Refer to final shop drawings for equipment provided by other divisions for exact
2 location of electrical outlets and the connections required.

3
4 Provide energization to the equipment furnished by other Divisions only at the
5 request of the providing party.

6
7 Assume that once the equipment has been started up, that it shall be shut off
8 unless it is requested that it be left on by the providing party.

9
10 Only start up and turn on equipment if requested so by the party providing said
11 equipment.

12
13 If required, power shall not be activated to the equipment until qualified starting
14 personnel are on site.

15
16 After making a permanent power connection, the breaker shall be left in an off
17 position and a "hold" tag or some other device be utilized to keep the power
18 turned off to the equipment.

19
20 **Equipment Access & Location.**

21 All equipment, junction and pull boxes, and accessories shall be installed to
22 permit access to equipment for maintenance.

23
24 Any relocation of conduits, equipment, or accessories required to provide
25 maintenance access shall be accomplished at no additional cost.

26
27 Equipment shall be installed with ample space allowed for removal, repair or
28 changes to the equipment.

29
30 Ready accessibility to equipment and wiring shall be provided without moving
31 other equipment which is to be installed or which is already in place.

32
33 Locate electrical outlets and equipment to fit the details, panels, decorating or
34 finish at the space.

35
36 The Architect shall reserve the right to make minor position changes up to 10' of
37 the outlets before the work has been installed.

38
39 Verify door swings before installing room lighting switch boxes and install boxes
40 on the latch side of door unless noted otherwise.

41
42 Furnish information as to exact location and size of sleeves for openings for new
43 construction.

44
45 Provide and set in place all required sleeves, inserts, forms, etc. and coordinate
46 this work with all other divisions of work.

47
48 **Cutting and patching.**

49 Beams or columns shall not be pierced without permission of the Architect and
50 then only as directed.

51
52 If any openings are required through walls or floors where no sleeve has been
53 provided, the hole for the sleeve shall be core drilled to avoid all unnecessary
54 damage and structural weakening.

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Provide all cutting and patching required for complete installation of systems unless specifically noted elsewhere.

All new or existing work cut or damaged shall be patched and restored to its original condition.

Coordinate the location of sleeves, openings, chases, furred spaces, etc.

Provide during the progress of construction all sleeves, hangers and inserts that are to be built into the structure.

Provide sleeves for cables passing through masonry, concrete or other similar construction.

Sleeves shall be of metal conduit and shall extend completely through the construction.

Conduits or cables penetrating smoke or fire barriers must not destroy the barrier's integrity.

Grout openings between sleeves and concrete or masonry walls and floors.

Pack annular space between sleeves and conduits with fiberglass.

Where penetrations occur through fire rated walls or floors, fill space with fire resistive caulk.

Wherever cables must pass through fire or smoke rated walls or floors, provide approved, sleeved, foam filled fire stops around cables as manufactured by O.Z., Dow, Square D, or equal.

Provide all materials required for patching unless otherwise noted.

Where alterations disturb lawns, paving, walks, etc., the surfaces shall be repaired, refinished and left in the condition existing prior to commencement of work.

Excavation and backfill.

Lines passing under foundation walls shall have a minimum of 1 1/2 inch clearance.

Care shall be taken to insure no disturbance of bearing soil under foundations.

Attachments and supports.

Be responsible for proper fittings and support for each item of equipment and materials installed under Division 26.

Be responsible for the proper application, installation and location of all necessary and required inserts, supports and anchor bolts.

Where same are to be installed by other Divisions of work, supply same to the contractor in whose work they occur with instructions for placement and proper installation.

1 Establish the method and nature and select accessories necessary for proper
2 support appropriate to item and point of attachment with due consideration given
3 to ambient/environmental conditions and service duty.

4
5 Attachments, supporting devices and accessories shall be specifically designed
6 for the application, suitable for the duty imposed in service and acceptable to the
7 Architect.

8
9 Attachments shall be made to structural components of the structure in such
10 manner not to jeopardize the integrity of the structure and otherwise consistent
11 with trade practices.

12
13 Generally, anchors shall be concrete insert type in poured concrete and drilled
14 expansion type in precast concrete.

15
16 Powder actuated anchors shall not be used in concrete work.

17
18 Provide all mounting backboards as required to mount electrical and electronic
19 equipment.

20
21 That equipment which is normally assumed to be mounted on some type of a
22 backboard shall be mounted on backboards provided by Division 26.

23
24 All mounting backboards used by the contractor shall be 3/4" AC grade marine
25 duty plywood.

26
27 All plywood shall be painted on both sides and edges with two coats of fire
28 resistant gray enamel paint.

29
30 Provide back mounting panels to meet this specification.

31
32 Steel channel interior to be painted or galvanized.

33
34 Exterior conduit mounting channel shall be stainless steel.

35
36 All sleeves to be furnished and installed by Division 26.

37
38 Installation: Electrical Service

39 Provide a new three phase, four wire electric service as shown on the contract drawings.
40 The ELECTRICAL CONTRACTOR shall consult with the utility and provide metering
41 equipment, transformer pad, conduit and wiring as required by the utility.

42
43
44 Installation: Temporary Electric Distribution

45 All power consumption costs will be paid for by others

46
47 All single phase receptacle outlet circuits shall have approved ground fault circuit
48 interrupter protection or other OSHA approved protection systems.

49
50 Provide temporary service to one Job Trailer in addition to job site temporary power.
51 Service to be 60 amp single phase.

52
53 Installation: Trial Usage of Electrical Systems

1 The Electrical Engineer has the privilege of the trial usage of electrical systems or parts
2 thereof for the purpose of testing under load the new installation and learning the
3 operational procedures.

4
5 The trial usage shall be continued for a length of time as deemed reasonable by the
6 Electrical Engineer and all related costs shall be included in the bid, with the exception of
7 the electrical power cost which will be paid by the Owner.

8
9 The operations shall be carried out only with the express knowledge and under
10 supervision of the responsible sub-trade who shall not waive any responsibility because
11 of trial usage.

12
13 While trial usage will be kept to a minimum, it shall not be construed as acceptance by
14 the Electrical Engineer.

15
16 Installation: Cooperation/Coordination

17 Coordinate and cooperate with other Divisions of work and Owner by scheduling and
18 installing work to facilitate the construction progresses and the Owners use of the
19 building.

20
21 Any deviation from contract plans shall be approved by the Electrical Engineer before
22 proceeding.

23
24 Study the plans of other trade divisions of work and to fit work into the work of others in a
25 coordinated manner.

26
27 Lay out work and be responsible for measurements.

28
29 Check facilities provided by others which require electrical connections and provide
30 outlets suitably located for them.

31
32 Take such measurements as may be necessary to assure approved fitting and proper
33 installation of his work and all other work depending thereon.

34
35 Cooperate with other contractors to avoid complications between the installation of
36 electrical equipment and equipment installed by others.

37
38 Installation: Finish and Painting

39 Equipment and materials such as transformers, panels and switches, shall be furnished
40 with the manufacturer's standard finishes, consisting of a prime coat and baked enamel
41 finish coat, unless otherwise noted.

42
43 Roof mounted equipment and other exterior materials including support hardware shall
44 have a factory or field applied prime coat and finish coat of color selected by the Owner's
45 Representative.

46
47 In general painting will be done by other trades. Assume responsibility to coordinate work
48 with the painters so that all equipment is installed prior to painting.

49
50 Assume responsibility for additional expense required to paint support channels, panel
51 trims, flush junction box covers, fixture hangers and other electrical devices not in place
52 prior to normal routine painting.

53
54 An undamaged finish is required on all equipment.

1
2 If finish becomes rusted, corroded, scratched, or flaked during storage or installation, be
3 responsible for refinishing the equipment to the satisfaction of the Architect.

4
5 Finish painting on the job site is not required by the electrical contractor, except where
6 noted.

7
8 Refer to other areas of this Division 26 for painting of equipment furnished by the Division
9 26.

10
11 Where painting is required to be done by the electrical contractor, the painting shall be
12 done in accordance with the painting portion of the general specification.

13
14 Installation: Damage to Other Work

15 Assume responsibility for all damages resulting from the execution of work under Section
16 26 05 00.

17
18 Assume responsibility to adequately protect Division 26 work at all times.

19
20 All damages resulting from their operations shall be repaired, or the damaged portions
21 replaced by the party originally performing the work (to the entire satisfaction of the
22 Architect), and all cost thereof shall be borne by those responsible for the damage.

23
24 Installation: Clean-Up

25 At all times, keep the premises free from excessive accumulation of waste materials or
26 rubbish resulting from work, including tools, scaffolding, and surplus materials and leave
27 work room or its equivalent, clean.

28
29 In case of dispute, the Architect may order the removal of such rubbish and charge the
30 cost to the responsible Division of work as determined by the Architect.

31
32 At the time of final clean-up, all fixtures and equipment shall be thoroughly cleaned and
33 left in proper conditions for their intended use.

34
35 Installation: Drawing Schedules and Details

36 The electrical drawings include a number of standard and job specific details.

37
38 These details may or may not be specifically referenced on the drawings and in the
39 specification.

40
41 Assume that even if the detail is not specifically referenced, that it shall apply to this
42 project. (As an example, if a detail is shown for the exterior mounted receptacles, but the
43 detail is not referenced from the plan sheets, the contractor shall assume that all exterior
44 mounted receptacles shall be installed per the detail.)

45
46 Details and schedules are shown as a means to aid the electrical contractor and are not
47 meant to be all inclusive of all devices.

48
49 Assume responsibility for making takeoff of equipment required, (i.e., additional circuit
50 breakers, motor connections, etc.) and ancillary equipment and appurtenances for a
51 complete connection or circuit.

52
53 Verify all sizes of electrical equipment with shop drawings and nameplate rating of the
54 equipment it serves.

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Installation: Coordination Drawings

Prepare coordination drawings to a scale of ¼" = 1'0 or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components.

Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work, including, (but not limited to) the following:

Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:

Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.

Exterior wall and foundation penetrations.

Fire-rated wall and floor penetrations.

Equipment connections and support details.

Sizes and location of required concrete pads and bases.

Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

Locations include, but are not limited to, electrical rooms and other specialty electrical and communication rooms where equipment is being provided.

Installation: Bid Drawings

It must be understood that electrical drawings and details bid drawings are diagrammatic.

Electrical drawings and details bid drawings are not intended to be shop drawings.

It is expected that it may be necessary to move conduit, outlets and/or equipment in some cases to get coordinated installation and such changes are considered a part of the Contract obligation without cost to the Owner.

No outlets or equipment shall be located where the usefulness and/or operation will be affected by the work of other trades, door swing, counter, equipment, etc.

Installation: Contract Termination Requirements

Furnish Owner with service manuals for all items furnished under this Contract.

Service manuals shall be complete with drawings, diagrams, operations and installation instructions and parts lists.

OWNER TRAINING

Provide as outlined per section.

SPARE EQUIPMENT

Provide as outlined per section.

End of Section

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1	ITEM	SUPPLIED TO:	CHECK OFF
2			
3	Accounting of all cash allowances	ENGINEER	_____
4	as detailed in spec section 26 05 01.		
5	Submit invoices from utilities.		
6			
7	Letter stating all specified spare	ENGINEER	_____
8	equipment was delivered to		
9	owner. The letter should list		
10	the equipment supplied.		
11			
12	O&M Manual	ENGINEER	_____
13			
14	Certificate from systems	ENGINEER	_____
15	suppliers stating that the		
16	system was started up, tested		
17	and owner's instructions were		
18	given. Certificate shall have		
19	date of instructions and test		
20	and shall have the owner's		
21	representative's signature.		
22			
23	Copy of marked up record drawing.	ENGINEER	_____
24			
25	Provide warranty for all	ENGINEER	_____
26	equipment.		
27			
28			
29	End of Section		

1 **WARRANTY**

2 Wire and cable shall be warranted for a period of not less than 1 year from the date of
3 commissioning against defects in material and workmanship.

4
5 The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service
6 hours, repair parts cost, etc.

7
8 The warranty shall not deprive the Owner of other rights the Owner may have under other
9 provisions of the Contract Documents and will be in addition to and run concurrent with other
10 warranties made by the Contractor under the requirements of the Contract Documents.

11
12
13 **PART TWO - PRODUCTS**

14
15 **GENERAL**

16 Approved manufacturer:
17 Contractor's option.

18
19 All materials and equipment furnished shall be current production of manufacturers regularly
20 engaged in the manufacture of such items, and for which replacement parts are available. All
21 materials and equipment shall be new (less than 1 year old when turned over to the Owner).

22
23 **WIRE AND CABLE – GENERAL PURPOSE (600V)**

24 General:

25 THWN or THHN general purpose building wire insulated with polyvinyl chloride (PVC)
26 and covered with protective sheath of nylon intended for lighting and power circuits at
27 600 volts or less, in residential, commercial, and industrial buildings.

28
29 The wire shall be suitable for 90°C maximum continuous conductor temperature in dry
30 locations and 75°C in wet locations and listed by Underwriters Laboratories for use in
31 accordance with Article 310 of the National Electrical Code.

32
33 Conductors:

34 Class B or Class C stranded, annealed uncoated copper per UL Standard 83 or 1063.

35
36 Insulation:

37 Each conductor shall be insulated with PVC and sheathed with nylon complying with the
38 requirements of UL Standard 83 for Types THHN or THWN and UL Standard 1063 for
39 Type MTW and CSA C22.2 No. 75 for T90 Nylon.

40
41 Types THWN or THHN shall comply with the optional Gasoline and Oil Resistance rating
42 of UL Standard 83. The insulation shall also comply with UL requirements for 105°C
43 Appliance Wiring Material.

44
45 The average thickness of PVC insulation, for a given conductor size, shall be as specified
46 in UL Standard 83 for THWN or THHN. The minimum thickness at any point, of the PVC
47 insulation, shall be not less than 90 percent of the specified average thickness.

48
49 The minimum thickness at any point of the nylon sheath shall be as specified in UL
50 Standard 83 for Types THWN or THHN.

51
52 The PVC insulation shall be applied tightly to the conductor and shall be free-stripping
53

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Identification:

The wire shall be identified by surface marking indicating manufacturer’s identification, conductor size and metal, voltage rating, UL Symbol, type designations, and optional ratings. The wire shall also be identified as C (UL) Type T90 Nylon or TWN 75, FT1.

Tests:

Wire shall be tested in accordance with the requirements of UL Standard 83 for Types THWN or THHN wire and for the optional Gasoline and Oil Resistance listing; as Type MTW to UL Standard 1063 (stranded items): as AWM to UL Standard 758 (stranded items); and as C(UL) Type T90 Nylon or TWN75.

Usage:

General use power wiring, minimum size No. 12 AWG.
General use control wiring, minimum size No. 14 AWG.

WIRE AND CABLE – UNDERGROUND (600V)

General:

USE-2 or XHHW-2, cross linked, polyethylene insulated cables for use in circuits; not exceeding 600 volts. Cables listed by UL as Type USE-2 and recognized for underground use in wet locations at a maximum continuous conductor temperature of 90°C in accordance with Article 338 of the National Electric Code.

Installed in air, conduit, or other recognized raceways in accordance with Article 310 of the National Electric Code.

Conductors:

Conductors shall be Class B stranded annealed uncoated copper per UL Standard 854 and 44.

A suitable separator over the conductor may be used at the option of the manufacturer.

Insulation:

Each conductor shall be insulated by surface marking indicating manufacturer’s identification, conductor size and metal, voltage rating, UL Symbol, and type designations.

Tests:

Wire shall be tested in accordance with the requirements of UL Standard 8654 for Type USE-2, UL Standard 44 for Types XHHW-2.

Usage:

Underground power wiring, minimum size No. 12 AWG.

WIRING CONNECTORS

Polaris Type Mechanical Connectors:

8 AWG and larger wire for all motor connections.

Spring Wire Connectors:

10 AWG and smaller wire.

Compression Connectors (T&B Sta-Kon or equal):

For those devices that are not rated to accept stranded wire.

1
2
3 **PART THREE - EXECUTION**
4

5 **EXAMINATION**

6 Verify that wire is in compliance with specifications.
7

8 Verify that interior of building has been protected from weather.
9

10 Verify that mechanical work likely to damage wire and cable has been completed.
11

12 Inspect wire for physical damage and proper connection.
13

14 Measure tightness of bolted connections and compare torque measurements with manufacturer's
15 recommended values.
16

17 Verify continuity of each conductor.
18

19 Feeder or branch circuits with ampacity greater than 100 amperes shall be tested after installation
20 to measure insulation resistance of each conductor.

21 All equipment shall be disconnected and the wire ends shall be cleaned and dried.
22

23 Connect Megohmmeter between conductor and a grounded point in the enclosure and
24 energize until the reading stabilizes.
25

26 The Megohmmeter reading for each conductor shall not be less than 10,000 Megohms.
27

28 **FIELD MEASUREMENTS**

29 Field verify all measurements. Do not base on contract drawings.
30

31 Identify conflicts with the work of other trades prior to installation of work.
32

33 Adjust system to satisfy field requirements.
34

35 **DELIVERY, STORAGE AND HANDLING**

36 Receive, sign for and store all equipment in this section.
37

38 Maintain original quality and condition of wire while it is in storage.
39

40 **INSTALLATION**

41 General:

42 The complete installation shall be done in a neat, workmanlike manner in accordance
43 with all applicable codes and the manufacturer's recommendations.
44

45 Install all materials, assemblies and equipment in strict accordance with manufacturer's
46 recommendations and instructions. Consult manufacturer for all wiring diagrams,
47 schematics, sizes, outlets, etc. before installing.
48

49 Pre-Installation:

50 Verify that interior of building has been protected from weather.
51

52 Verify that mechanical work likely to damage wire has been completed.
53

54 Completely and thoroughly swab raceway prior to installation.

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Verify that field measurements are as shown on drawings.

Wire and cable routing shown on drawings is approximate unless dimensioned. Route wire and cable to satisfy project conditions.

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

Determine required separation between cable and other work.

Determine cable routing to avoid interference with other work.

Conductor Sizing:

Conductor sizes are based on copper.

Use conductor not smaller than No.12 AWG for power and lighting circuits.

Use No.10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.

Use No. 10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 200 feet.

Where circuit wiring length exceeds 100 feet, increase wire size as needed to maintain a maximum voltage drop of three percent.

Use conductor not smaller than No.14 AWG for control circuits.

Wire and cable size shall be increased from size indicated or required by code to meet the following voltage drop requirements:

3% drop for branch circuits.

5% drop for motor circuits.

Wire Pulling:

Pull all conductors into raceway at same time.

No.4 AWG and larger wire and power cables shall be lubricated with pulling lubricant to reduce pulling tension and abrasion damage. The lubricant shall be water or wax based containing no oils or greases that may adversely affect cable jackets.

The minimum bend radius and maximum pulling tension ratings of the wire and cable shall not be exceeded.

Splices and Terminations:

Splices and terminations shall not be made within raceways.

Clean conductor surfaces before splicing or terminating.

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

Wire nuts, "ScotchLocks", and similar devices may be used to splice 120V power circuits.

1 Control, communication, and data transmission wire and cable shall not be spliced.

2
3 Support cables above accessible ceiling, using spring metal clips or plastic cable ties to
4 support cables from structure. Do not rest cable on ceiling panels or support for the
5 ceiling suspension system per NEC.

6
7 Neatly train and lace wiring inside boxes, equipment, and panelboards.

8
9 Clean conductor surfaces before installing lugs and connectors.

10
11 Make splices, taps, and terminations to carry full ampacity of conductors with no
12 perceptible temperature rise.

13
14 Use polaris type mechanical connectors for copper conductor splices and taps, 8 AWG
15 and larger. Tape uninsulated conductors and connector with electrical tape to 150
16 percent of insulation rating of conductor.

17
18 Use insulated spring wire connectors with plastic caps for copper conductor splices and
19 taps, 10 AWG and smaller.

20
21 **Motors:**

22 Motor wiring to motors less than 10 horsepower shall be spliced and terminated with fully
23 insulated crimp-on end cap with a layer of self-vulcanizing rubber tape, followed by five
24 layers of vinyl electrical tape. "ScotchLocks" and similar devices shall not be used.

25
26 Motor wiring to motors 10 horsepower or larger shall be spliced and terminated with
27 crimp-on ring terminal lugs, brass nuts, bolts and washers with a layer of self-vulcanizing
28 rubber tape, followed by five layers of vinyl electrical tape. "ScotchLocks" and similar
29 devices shall not be used.

30
31 **Wire Marking:**

32 The ends of each conductor shall be marked with circuit number, motor number, wire or
33 terminal number.

34
35 Labels shall be typed in black lettering with indelible ribbons on a white, heat shrink
36 sleeve. Markers shall be shrunk around the wire to provide a tight, non-slip bond with a
37 compatible heat gun.

38
39 Heat shrink wire markers shall be Brady Bradysleeve Type B-321 or B-322

40
41 **Ground Wire Color Coding:**

42 Provide green insulated ground wire for #8 and smaller. #6 wire shall have green band
43 per code.

44
45
46 End of Section

1 Provide a complete and fully functional grounding system using materials and equipment of
2 types, sizes, and rating as required to meet performance requirements. Use materials and
3 equipment that comply with referenced standards and manufacturer's standard design and
4 construction, in accordance with published product information. Coordinate the features of all
5 materials and equipment so they form an integrated system, with components and
6 interconnections matched for optimum performance of specified functions. Provide all
7 accessories necessary for a fully functioning system.

9 **GROUND RODS**

10 Material: Copper-clad steel.

12 Diameter: 3/4" minimum.

14 Length: 10' minimum. Rod shall be driven at least 9'5" deep.

16 **MECHANICAL CONNECTORS**

17 The mechanical connector bodies shall be manufactured from high strength, high conductivity
18 cast copper alloy material. Bolts, nuts, washers, and lockwashers shall be made of silicon bronze
19 and supplied as a part of the connector body and shall be of the two bolt type.

21 Split bolt connector types are not allowed.

23 The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number,
24 conductor size and manufacturer.

26 **COMPRESSION CONNECTORS**

27 The compression connectors shall be manufactured from pure wrought copper. The conductivity
28 of this material shall be no less than 99 percent.

30 The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

32 The installation of the connectors shall be made with a compression, tool and die system, as
33 recommended by the manufacturer of the connectors.

35 The connectors shall be clearly marked with the manufacturer, catalog number, conductor size,
36 and the required compression tool settings.

38 Each connector shall be factory filled with an oxide-inhibiting compound.

40 **EXOTHERMIC CONNECTIONS**

41 Select the appropriate kit for specific types, sizes, and combinations of conductors and other
42 items to be connected. Field personnel shall be trained in execution of welds.

44 **WIRE**

45 Material: Stranded copper

47 Grounding Electrode Conductor: Size as shown on drawings, specifications, or required by NFPA
48 70, whichever is larger.

51 **PART THREE - EXECUTION**

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EXAMINATION

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

FIELD MEASUREMENTS

Field verify exact routing of all backbone cable.
Adjust grounding system installation to satisfy field requirements.

DELIVERY, STORAGE AND HANDLING

Receive, sign for and store all equipment in this section.

INSTALLATION

General:

Provide a separate, insulated equipment grounding conductor in all raceways.

Receptacle grounding:

For all receptacle circuits, provide separate green ground wire in raceway system.

Standard receptacles may be used and green wire shall be directly connected to receptacle or to pigtail.

Provide #12 pigtail to ground all metal boxes.

Stranded wire twisted on ground terminal on device is not allowed.

Ground Rod Installation:

Install ground rods to be 10'6" deep.

End of Section

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PART TWO - PRODUCTS

GENERAL

All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

SUPPORTING STRUCTURES

Rack supports of galvanized steel channel sections with adequate feet to allow secure mounting.

Weld sections, do not use bolts.

CONDUIT SUPPORTS

1- hole galvanized steel straps for EMT, 2-hole galvanized steel straps for all other conduits. Do not use perforated hanger iron.

PART THREE - EXECUTION

EXAMINATION

Verify locations prior to rough in.

Verify mounting details

FIELD MEASUREMENTS

Verify that field measurements are as shown on Drawings.

DELIVERY, STORAGE AND HANDLING

Receive, sign for and store all equipment in this section.

Accept equipment on site. Inspect for damage.

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

INSTALLATION

General:

The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

Do not fasten supports to pipes, ducts, mechanical equipment, or other conduit.

Do not use spring steel clips on ceiling support wires.

Do not use powder actuated anchors.

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1 All materials, equipment and parts are to be new, undamaged and unused of current
2 manufacture.

3
4 **WARRANTY**

5 Equipment shall be warranted for a period of not less than 1 year from the date of commissioning
6 against defects in material and workmanship.

7
8 The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service
9 hours, repair parts cost, etc.

10
11 The warranty shall not deprive the Owner of other rights the Owner may have under other
12 provisions of the Contract Documents and will be in addition to and run concurrent with other
13 warranties made by the Contractor under the requirements of the Contract Documents.

14
15
16 **PART TWO - PRODUCTS**

17
18 **GENERAL**

19 All materials and equipment furnished shall be current production of manufacturers regularly
20 engaged in the manufacture of such items, and for which replacement parts are available. All
21 materials and equipment shall be new (less than 1 year old when turned over to the Owner).

22
23 **CONDUIT GENERAL REQUIREMENTS**

24 Minimum Size: 1/2 inch.

25
26 Conduit types not listed below are prohibited.

27
28 Rigid heavy wall galvanized steel conduits:

29 Are to be used in the following locations:

30 Outdoors.

31
32 Undergound, unless PVC is shown on drawings or called out in other portions of
33 this specification.

34
35 In and under ALL concrete slabs, except for where PVC is allowed as stated in
36 nonmetallic conduit portion of this specification.

37
38 In areas having moisture, dust or gases.

39
40 Exposed conditions where such mechanical protection is required.

41
42 Manufacturer:

43 CONTRACTOR option.

44
45 Conduit:

46 Impact and crush resistant mild steel tube with an accurate circular cross section,
47 a uniform wall thickness, a defect free interior surface, and a continuous welded
48 seam.

49
50 Interior and exterior surfaces thoroughly and evenly coated with zinc using the
51 hot-dip galvanizing process.

52
53 Top-coated with a compatible organic layer to inhibit white rust and increase
54 corrosion resistance.

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Factory cut threads, 0.75-inch taper per foot, protected after cutting with an application of molten zinc.

Conduit Bodies:

Ferrous metal construction electro-galvanized inside and out and coated with aluminum acrylic paint.

Tapered, threaded hubs with integral bushing.

Stainless steel hardware.

Cover constructed of same material with solid gasket.

Fittings:

Ferrous metal construction electro-galvanized inside and out.

Components critical to performance such as set screws, split rings, and locknuts constructed of hardened steel or adequately designed to insure positive bonds.

Liquid Tight Flexible Metal Conduit:

Use in areas where environment is damp or could become damp or wet.

To contain an equipment grounding conductor with phase conductors. Bond grounding conductor to equipment served and nearest conduit system junction box.

Manufacturer:

CONTRACTOR option.

Usage:

Use in conjunction with galvanized rigid metal conduit.

Use in conjunction with PVC coated galvanized rigid metal conduit.

Conduit:

Single strip, helically wound, galvanized steel core inside and outside with smooth interior surface with sunlight resistant thermoplastic jacket suitable for ambient environmental conditions conforming to applicable UL Standards.

Jacket shall be positively locked to core to prevent sleeving.

All runs of flexible conduit shall be as short as practicable, of the same size as the conduit it extends and with enough slack to reduce the effects of expansion and vibration.

Fittings:

Where used in conjunction with galvanized rigid metal conduit, connectors shall be malleable iron or steel, electro zinc plated, with insulated throat and taper threaded hub.

Where used in conjunction with PVC coated galvanized rigid metal or rigid aluminum conduit connectors shall be malleable iron or steel, electro zinc plated and PVC coated, with insulated throat and taper threaded hub.

1 Particular attention shall be given to maintaining ground bond and firm support
2 through flexible connections.

3
4 All fittings shall be liquid tight.

5
6 **Nonmetallic Conduit (PVC):**

7 Where indicated on drawings.

8
9 **Underground**

10
11 Where PVC conduit penetrates floor, it must be installed per conduit installation detail.

12
13 **Manufacturer:**

14 Carlon.

15
16 Or equal.

17
18 **Conduit:**

19 Made from polyvinyl chloride compound (recognized by UL), which includes inert
20 modifiers to improve weatherability and heat distortion.

21
22 Rated for use with 90 degree C conductors. Material shall comply with NEMA
23 Specification TC-2.

24
25 The conduit and fittings shall be homogeneous plastic material free from visible
26 cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of
27 blisters, nicks or other imperfections, which could mar conductors or cables.

28
29 Conduit, fittings and cement shall be produced by the same manufacturer to
30 assure system integrity.

31
32 **Conduit Bodies:**

33 Made from polyvinyl chloride compound (recognized by UL), which includes inert
34 modifiers to improve weatherability and heat distortion.

35
36 Rated for use with 90 degree C conductors. Material shall comply with NEMA
37 Specification TC-3.

38
39 Stainless steel hardware.

40
41 Cover constructed of same material with solid gasket.

42
43 **Fittings:**

44 Made from polyvinyl chloride compound (recognized by UL), which includes inert
45 modifiers to improve weatherability and heat distortion.

46
47 Rated for use with 90 degree C conductors. Material shall comply with NEMA
48 Specification TC-3.

49
50 **METAL CONDUIT**

51 Rigid Steel Conduit: ANSI C80.1.

52
53 Intermediate Metal Conduit (IMC): Rigid steel.

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

2

3 **FLEXIBLE METAL CONDUIT**

4 Description: Interlocked steel construction.

5

6 Fittings: ANSI/NEMA FB 1.

7

8 **LIQUIDTIGHT FLEXIBLE METAL CONDUIT**

9 Description: Interlocked steel construction with PVC jacket.

10

11 Fittings: ANSI/NEMA FB 1 with insulated throats.

12

13 **ELECTRICAL METALLIC TUBING (EMT)**

14 Description: ANSI C80.3; galvanized tubing.

15

16 Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron, insulated throat
17 connectors.

18

19 **NONMETALLIC CONDUIT**

20 Description: NEMA TC 2; Schedule 40 PVC.

21

22 Fittings and Conduit Bodies: NEMA TC 3.

23

24

25 **PART THREE - EXECUTION**

26

27 **EXAMINATION**

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

29

30 Verify conduit routing. Routing as shown on Drawings is in approximate locations unless
31 dimensioned. Route as required to complete wiring system.

32

33 **FIELD MEASUREMENTS**

34 Field verify all measurements. Do not base conduit rough-in or equipment locations on
35 dimensions obtained from the contract drawings.

36

37 Identify conflicts with the work of other trades prior to installation of electrical equipment and
38 conduit work.

39

40 Adjust conduit system installation to satisfy field requirements.

41

42 **DELIVERY, STORAGE AND HANDLING**

43 Receive, sign for and store all equipment in this section.

44

45 Accept conduit on site. Inspect for damage.

46

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

49

50 Protect PVC conduit from sunlight.

51

52 **INSTALLATION**

53 General:

1 The complete installation shall be done in a neat, workmanlike manner in accordance
2 with all applicable codes and the manufacturer's recommendations.
3
4 Install all materials, assemblies and equipment in strict accordance with manufacturer's
5 recommendations and instructions. Consult manufacturer for all wiring diagrams,
6 schematics, sizes, outlets, etc. before installing.
7
8 All conduit shall be installed in building unless indicated otherwise.
9
10 All conduits stubbed into ceiling shall have end bushings.
11
12 Install conduit in accordance with NECA "Standard of Installation."
13
14 Install nonmetallic conduit in accordance with manufacturer's instructions.
15
16 Arrange supports to prevent misalignment during wiring installation.
17
18 Support conduit using coated steel or malleable iron straps, lay in adjustable hangers,
19 clevis hangers, and split hangers.
20
21 Group related conduits: support using conduit rack. Construct rack using steel channel;
22 provide space on each for 25 percent additional conduits.
23
24 Fasten conduit supports to building structure and surface under provisions of Section 26
25 05 29.
26
27 Do not support conduit with wire or perforated pipe straps. Remove wire used for
28 temporary supports.
29
30 Do not attach conduit to ceiling support wires.
31
32 Arrange conduit to maintain headroom and present neat appearance.
33
34 Route exposed conduit parallel and perpendicular to walls.
35
36 Route conduit in and under slab from point to point.
37
38 Do not cross conduits in slab.
39
40 Maintain adequate clearance between conduit and piping.
41
42 Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding
43 104 degrees F.
44
45 Cut conduit square using saw or pipecutter; de burr cut ends.
46
47 Bring conduit to shoulder of fittings; fasten securely.
48
49 Join nonmetallic conduit using cement as recommended by manufacturer. Wipe
50 nonmetallic conduit dry and clean before joining. Apply full even coat of cleaner and
51 cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
52
53 Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and
54 to cast boxes.

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Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Hydraulic one-shot bender may be used to fabricate factory elbows.

Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

Provide suitable pull string in each empty conduit, except sleeves and nipples.

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

Ground and bond conduit under provisions of Section 26 05 26.

Identify conduit under provisions of Section 26 05 53.

Flexible metal conduit shall be used for connection to equipment subject to vibration and light fixture drops in all removable tile ceilings. Length shall not exceed 36" for equipment connections and 72" for light fixture connections. Minimum size 1/2", except 3/8" may be used for fixture drops. Install flexible conduit drops from independent junction box mounted above ceiling and accessible from below ceiling to recess ceiling mounted equipment. Allow for positioning of equipment to next tile increment.

Seal conduit with oakum or duct seal where they leave heated areas and enter unheated areas.

Surface raceway shall be installed to run parallel of all existing surfaces. Where raceway is used on ceiling, raceway shall be mounted at ceiling wall junction and extended from the junction box out to ceiling mounted device. Raceway shall be routed in corners and along moldings to be as least obtrusive as possible.

Exterior cable and conduit installation.

Layout in trench may be started at either end unless the drawings indicate that it is to pitch for drainage. In which case the layout should be started at the lowest end. The cable and conduit shall be pitched 1" per 100 feet.

Include all excavation and backfill.

Cable and conduit shall be a minimum of 30" deep.

Cable and conduit shall be laid in a 6" sand bed and covered with another 6" of sand before backfilling with earth.

Provide Brady identotape 12" above all buried conduits and cables.

Provide #12 pull wire in all empty or spare conduits.

Restore existing surface back to its original condition.

1 For all excavation, maintain erosion protection per Federal, State, and municipal
2 requirements. All work associated with erosion control for excavation shall be
3 done as per Federal, State and municipal requirements, as well as any plans,
4 meetings, and other special conditions.

5
6 For all trenching that is under paved surfaces, backfill with structural material.
7 Material shall be tamped in layers up to the point of the surface paving material.

8
9 For on-grade slabs, the conduit may be run in or under the slab. Verify with concrete
10 installation prior to running conduits in slab to determine if that conduit coordinates with
11 the slab reinforcing.

12
13 **Exterior Wall Penetrations:**

14 For all exterior wall penetrations, patch the wall with material to match the existing wall
15 finish. The openings shall be as small as possible to minimize the impact on the existing
16 wall finish. Install duct seal within the conduit to prevent air flow.

17
18 When conduits are rising from the ground to penetrate the walls, furnish rigid steel
19 conduit where conduit is exposed, and deep-back LB's condulettes or NEMA 4X stainless
20 steel junction box.

21
22 **Interface with Other Products:**

23 Install conduit to preserve fire resistance rating of partitions and other elements.

24
25 Route conduit through roof openings for piping and ductwork or through suitable roof
26 jack. Coordinate location with roofing installation.

27
28
29

End of Section

1 **PART TWO - PRODUCTS**

2
3 **GENERAL**

4 All materials and equipment furnished shall be current production of manufacturers regularly
5 engaged in the manufacture of such items, and for which replacement parts are available. All
6 materials and equipment shall be new (less than 1 year old when turned over to the Owner).

7
8 **BOXES**

9 Pull boxes and junction boxes: Metal construction, conforming to National Electrical Code, with
10 screw on or hinged cover.

11
12 Flush mounted pull boxes: Provide overlapping covers with flush head cover retaining screws,
13 prime coated.

14
15 Small surface type junction boxes to be used in dry locations only for general purpose lighting
16 and outlets shall conform to the following standard sizes and spec's:

17 All boxes and covers shall be made of stamped steel. (No sectional boxes allowed).

18
19 Minimum sizes:

20 Handy boxes	4 x 2-1/8 x 2-1/8
21 Octagon boxes	4 x 1-1/2
22 4" sq. boxes	4 x 1-1/2 or 4 x 2-1/8
23 4-11/16" sq. boxes	4-11/16 x 2-1/8

24
25 Flush mounted outlet boxes used in dry locations shall conform to the following standards:

26 All boxes and covers shall be made of stamped steel. No sectional boxes allowed.

27
28 Minimum sizes:

29 Note special requirements for flush boxes for outside receptacles. These boxes
30 shall be 4-hole type or other type to properly patch the surface weather tight
31 covers.

32
33 Junction and Splice Boxes:

34 Screw covers, galvanized after fabrication and not less than code dimensions.

35
36 Entry openings in boxes shall be made with knock-out punches or hole saws.

37
38 Burning of entry openings with a torch will not be acceptable.

39
40 Paint exposed ferrous surfaces, 2 coats rust resisting paint.

41
42 Flush interior devices shall utilize 4" square box with raised covers or deep masonry boxes as
43 appropriate.

44
45 Raised covers to have square cut corners.

46 Where existing boxes are reused, provide add-a-depth device rings to devices installed without
47 proper box depth to finish surface.

48
49 Box extensions will not be allowed.

50
51 Junction boxes and pull boxes shall not have knockouts. Enclosure type, material, and
52 dimensions shall be as indicated on the drawings and as stated in these specifications. Where
53 no type or size is indicated for junction boxes and pull boxes, they shall be one size larger than
54 required by NEC.

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For exterior outlets, such as receptacles, use FS type outlet box flush mounted.

Large junction boxes shall be constructed from steel in the following gauges:

Box Size	Minimum Steel Gauge
Up to 24" x 30" x 12"	14
24" x 36" x 8" to 36" x 36" x 16"	12
36" x 42" x 8" and larger	11

PART THREE - EXECUTION

EXAMINATION

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

FIELD MEASUREMENTS

Verify that field measurements are as shown on Drawings.

Mounting heights:

As shown on drawings and details.

Coordinate exact heights with specific manufacturer's recommendations.

All mounting heights of keypads and pushbuttons to be ADA compliant.

DELIVERY, STORAGE AND HANDLING

Receive, sign for and store all equipment in this section.

Maintain original quality and condition of equipment while it is in storage.

INSTALLATION

General:

The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Boxes that are being installed in rough masonry surfaces (such as split face block) shall be installed in such a manner to allow the wiring device or light fixture and the associated device plate to be seated squarely. Have the masonry opening cut to the size of the plate and then box grouted in, or the rough masonry around the box shall be chiseled away and mortar installed around the box to provide a flat finish.

Coordinate with the masonry installation all details of installation on rough masonry surfaces. Without coordination assume responsibility for all costs to provide the flat surface, which will require chiseling the surface of the rough masonry away and providing mortar to obtain this smooth finish.

Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

- 1
2 Install electrical boxes to maintain headroom and to present neat mechanical appearance.
3
4 Install boxes to preserve fire resistance rating of partitions and other elements, using materials
5 and methods compatible with NFPA.
6
7 Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices with each
8 other.
9
10 Use flush mounting outlet boxes in finished areas.
11
12 Support boxes independently of conduit.
13
14 Use gang box where more than one device is mounted together. Do not use sectional box.
15
16 Use cast outlet box in exterior locations exposed to the weather and wet locations.
17
18 Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
19 Interior Dry Locations: Use hinged enclosure.
20
21 Other Locations: Use surface mounted cast metal box.
22
23 Grounding:
24 All equipment shall be grounded in accordance with NEC, these specifications and
25 drawings, and the equipment supplier's recommendations.
26
27 Interface with Other Products:
28 Coordinate masonry cutting to achieve neat opening.
29
30 Coordinate mounting heights and locations of outlets mounted above counters, benches
31 and backsplashes.
32
33 Position outlet boxes to locate luminaires as shown on reflected ceiling plan.
34
35
36

End of Section

1 **ENGRAVED LABELS**

2 Where the words "provide engraved label" appears on the drawings or in the specifications, it
3 shall mean that the label shall be an engraved 3-layer phenolic label with black letters on white
4 material, unless other colors are called out on the drawings or details.
5

6 The label size shall be a minimum of 3/4" high and be 3" long. Labels may be attached with
7 double backed adhesive tape unless indicated otherwise.
8

9 Where references are made on the drawings to provide engraved labels, engraved nameplate or
10 engraved plates, these should be engraved phenolic labels.
11

12 **ENGRAVED PLATES**

13 Where references are made to engraved plates, this shall mean that the normal device plate shall
14 have an engraving on it with black letters so as to indicate what this switch or device is used for.
15

16 **BRANCH CIRCUIT OUTLETS: LABELING**

17 Each branch circuit outlet, receptacles, lighting, and any other device requiring 120/240 volt
18 power, the contractor shall:

19 Provide circuit, written in pencil or non-washable ink, inside of outlet box in an area that
20 can be easily viewed when removing outlet faceplate.
21

22 Write circuit number in ink on device between receptacles under plate.
23

24 Optional: Provide typed label (not dyno label) for each circuit attached to device plate.
25

26 Label each junction box outlet cover in non-washable marker as to circuit number routed
27 through junction box.
28

29 **PANELBOARDS: LABELING**

30 Panelboard Directory:

31 Prepare and affix a typewritten directory to the inside cover of each panelboard indicating
32 loads controlled by each circuit.
33

34 Each distribution and lighting panelboard shall be equipped with a typewritten directory
35 accurately indicating rooms and/or equipment being served.
36

37 Assume that originally directories will have to be developed based on the room numbers
38 on the project drawings.
39

40 Near project completion, all directories will have to be changed to reflect actual room
41 numbers as designated by the building occupant.
42

43 Include the cost of doing the original handwritten directory and revisions to the directory
44 based on occupant room numbers.
45

46 Each existing panelboard that is revised, modified or has had circuits deleted or added to,
47 shall have its directories retyped to reflect existing circuits and all modified circuits.
48

49 Each changed circuit on existing panelboards shall have an asterisk next to the revised
50 or modified circuits.
51

52 Panelboard Identification:

53 Label per NEC 210.5.
54

1 Identify each panel with a suitably engraved nameplate mounted at the top of the front
2 cover.

3
4 The nameplates shall be made of laminated black and white plastic with white on the
5 outside.

6
7 The lettering shall be 1/4 inch high (minimum), engraved by cutting through the white
8 outside layer so that the letters appear black.

9
10 Fasten nameplates with brass or stainless steel panhead screws.

11
12 Nameplate engraving shall match the numbers or letters shown on the drawings or
13 assigned by the Owner's Representative.

14
15 Labels shall be engraved as to the function of the circuit breaker.

16
17 Labels shall also be engraved to indicate the load served by the circuit breaker.

18
19 Identify the source of the feeder circuit serving the panelboard.

20 21 **DISCONNECTS**

22 Each disconnect furnished by this section or furnished by other sections but installed by this
23 section shall have an engraved laminated label indicating which piece of equipment it controls.

24
25 This requirement is waived if the disconnect or starter is attached directly to the piece of
26 equipment that it is controlling or operating.

27 28 **MISCELLANEOUS**

29 Branch Circuits:

30 On branch circuits, use shall be made of all standard wire insulation colors available.

31
32 Where wires of different systems junction in a common box, each cable shall be grouped
33 with its own system and identified using tags or identification strips.

34 35 36 **PART THREE - EXECUTION**

37 38 **EXAMINATION**

39 Verify surfaces are cleaned and ready to receive labels.

40
41 Verify labels are correct.

42
43 Verify that labels are installed as specified, level and plumb.

44 45 **DELIVERY, STORAGE AND HANDLING**

46 Receive, sign for and store all equipment in this section.

47 48 **INSTALLATION**

49 General:

50 Degrease and clean surface prior to installing labels.

51
52 Install nameplate and label parallel to equipment lines.

53

- 1 Secure nameplates to equipment fronts using screws, if so specified on drawings.
- 2
- 3
- 4 End of Section

1 **DESCRIPTION OF WORK**

2 Furnish and install complete and operable Distribution and Branch Circuit Panelboards system as
3 indicated on the drawings and as specified herein.

4
5 **RELATED WORK ELSEWHERE**

6 Division 26, and 27: Electrical

7
8 **SHOP DRAWINGS**

9 Submit shop drawings in accordance with Section 26 05 04.

10
11 The following information shall be submitted in addition to the above:

12 Manufacturer literature sufficient in scope to demonstrate compliance with the
13 requirements of this specification.

14
15 Overall panelboard dimensions, interior mounting dimensions, and wiring gutter
16 dimensions. The location of the main, branches, and solid neutral shall be clearly shown.
17 Illustrate one line diagrams with applicable voltage systems.

18
19 **OPERATION & MAINTENANCE MANUALS**

20 Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

21
22 **QUALITY ASSURANCE**

23 Provide quality assurance in accordance with Section 26 05 04.

24
25 The panelboard manufacturer shall be certified to ISO 9001 International Quality Standard and
26 shall have third party certification verifying quality assurance in design/development, production,
27 installation, and service, in accordance with ISO 9001.

28
29 All panelboards provided under this section shall be the products of a single manufacturer
30 specializing in manufacture of panelboard products with a minimum of fifty years documented
31 experience.

32
33 Provide all necessary accessories required for a complete and operable system.

34
35 **WARRANTY**

36 Panelboards shall be warranted for a period of not less than 1 year from the date of
37 commissioning against defects in material and workmanship.

38
39 The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service
40 hours, repair parts cost, etc.

41
42 The warranty shall not deprive the Owner of other rights the Owner may have under other
43 provisions of the Contract Documents and will be in addition to and run concurrent with other
44 warranties made by the Contractor under the requirements of the Contract Documents.

45
46
47 **PART TWO - PRODUCTS**

48
49 **GENERAL**

50 All materials and equipment furnished shall be current production of manufacturers regularly
51 engaged in the manufacture of such items, and for which replacement parts are available. All
52 materials and equipment shall be new (less than 1 year old when turned over to the Owner).

1 Provide a complete and fully functional distribution system using materials and equipment of
2 types, sizes, and rating as required to meet performance requirements. Use materials and
3 equipment that comply with referenced standards and manufacturer's standard design and
4 construction, in accordance with published product information. Coordinate the features of all
5 materials and equipment so they form an integrated system, with components and
6 interconnections matched for optimum performance of specified functions.

7 8 **LIGHTING AND APPLIANCE PANELBOARDS**

9 Manufacturers:

10 Schneider Square D NQ
11 No Equals
12

13 Interior:

14 Rated 120/240 VAC maximum. Continuous main current ratings, as indicated on
15 drawings, not to exceed 600 amperes maximum for main breaker panelboards and not to
16 exceed 800 amperes for main lug panelboards.

17
18 UL Listed short circuit current ratings as indicated on the drawings with a maximum of
19 200,000 RMS symmetrical amperes.
20

21 Provide one continuous bus bar per phase. Each bus bar shall have sequentially phased
22 branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be
23 fully rated. Panelboard bus current ratings shall be determined by heat-rise tests
24 conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating
25 shall run the entire length of the bus bar.
26

27 All current-carrying parts shall be insulated from ground and phase-to-phase by high
28 dielectric strength thermoplastic.
29

30 A solidly bonded copper equipment ground bar shall be provided. An additional copper
31 isolated/insulated ground bar shall also be provided where indicated on the drawings.
32

33 Split solid neutral shall be plated and located in the mains compartment up to 250
34 amperes so all incoming neutral cable may be of the same length. UL Listed
35 panelboards with 200 percent rated solid neutrals shall have plated copper neutral bus
36 for non-linear load applications where indicated on the drawings.
37

38 Interior trim shall be of dead-front construction to shield user from energized parts.
39 Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
40

41 Nameplates shall contain system information and catalog number or factory order
42 number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit
43 current rating shall be displayed on the interior or in a booklet format.
44

45 Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers
46 shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted.
47 Interior leveling provisions shall be provided for flush mounted applications.
48

49 Interior phase bus shall be pre-drilled to accommodate field installable options such as
50 sub-feed lugs, sub-feed breakers, thru-feed lugs.
51

52 Interiors shall accept 125 ampere breakers in group mounted branch construction.
53

1 Main Circuit Breaker:

2 Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will
3 provide quick-make, quick-break contact action. Circuit breakers shall have a permanent
4 trip unit with thermal and magnetic trip elements in each pole. Each thermal element
5 shall be true rms sensing and be factory calibrated to operate in a 40 degrees C ambient
6 environment. Thermal elements shall be ambient compensating above 40 degrees C.

7
8 Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit
9 breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment
10 located on the front of the breaker that allows the user to simultaneously select the
11 desired trip level of all poles. Circuit breakers shall have a push-to-trip button for
12 maintenance and testing purposes.

13
14 Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction
15 circuit breakers shall be UL Listed for reverse connection without restrictive line or load
16 markings.

17
18 Circuit breaker escutcheon shall have international I/O markings, in addition to standard
19 ON/OFF markings. Circuit breaker handle accessories shall provide provisions for
20 locking handle in the ON or OFF position where indicated on the drawings.

21
22 Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors.
23 Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required
24 by the application. Lug body shall be bolted in place; snap-in designs are not acceptable.

25
26 The circuit breakers shall be UL Listed for use with and provided with the following
27 accessories where indicated on the drawings: Shunt Trip, Under Voltage Trip, Ground
28 Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression
29 Lug Kits.

30
31 Branch Circuit Breakers:

32 Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and
33 number of poles as indicated on the drawings.

34
35 Molded case branch circuit breakers shall have bolt-on type bus connectors.

36
37 Circuit breakers shall have an overcenter toggle mechanism which will provide quick-
38 make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip
39 elements in each pole. Two- and three-pole circuit breakers shall have common tripping
40 of all poles.

41
42 There shall be two forms of visible trip indication. The circuit breaker handle shall reside
43 in a position between ON and OFF. In addition, there shall be a red indicator appearing
44 in the clear window of the circuit breaker housing.

45
46 The exposed faceplates of all branch circuit breakers shall be flush with one another.

47
48 Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors.
49 Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required
50 by the application.

51
52 Breakers shall be UL Listed for use with and provided with the following accessories
53 where indicated on the drawings: Shunt Trip, Auxiliary Switch, and Alarm Switch.

1 Circuit breakers shall be UL Listed with the following ratings where indicated on the
2 drawings: (15-125A) Heating, Air Conditioning, and Refrigeration (HACR), (15-30A)
3 High Intensity Discharge (HID), and (15-20A) Switch Duty (SWD)
4

5 Enclosures:

6 Type 1:

7 Boxes shall be galvanized steel constructed in accordance with UL 50
8 requirements. Galvannealed steel will not be acceptable.
9

10 Boxes shall have removable endwalls with knockouts located on one end. Boxes
11 shall have welded interior mounting studs. Interior mounting brackets are not
12 required.
13

14 Box width shall not exceed 26-inches wide.
15

16 Type 1 Fronts:

17 Front shall meet strength and rigidity requirements per UL 50 standards.
18 Shall have ANSI 49 gray enamel electrodeposited over cleaned
19 phosphatized steel.
20

21 Fronts shall be hinged 1-piece with door. Mounting shall be flush or
22 surface as indicated on the drawings.
23

24 Panelboards rated 250 amperes and below shall have fronts with
25 concealed door hinges and trim screws. Front shall not be removable
26 with the door locked. Panelboards rated above 250 amperes shall have
27 vented fronts with concealed door hinges. Doors on front shall have
28 rounded corners; edges shall be free of burrs.
29

30 Front shall have flat latch type lock with catch and spring loaded
31 stainless steel door pull. All lock assemblies shall be keyed alike. One
32 (1) key shall be provided with each lock. A clear plastic directory card
33 holder shall be mounted on the inside of door.
34

35 Nema 3R where noted on plans
36

37
38 **PART THREE - EXECUTION**
39

40 **EXAMINATION**

41 Verify equipment is in compliance with approved submittal drawings.
42

43 Examine area to receive panelboard to assure adequate clearance for panelboard installation.
44

45 Start work only after unsatisfactory conditions are corrected.
46

47 Inspect completed installation for physical damage, anchorage, and grounding.
48

49 Perform tests according to panelboard manufacturer's instructions.
50

51 Tighten bus connections and mechanical fasteners.
52

53 Touch-up scratched or marred surfaces to match original finish.
54

1 **FIELD MEASUREMENTS**

2 Field verify locations of panelboards with other trades. Adjust as required to meet field conditions
3 and code requirements. Do not base exact panelboard locations on the contract drawings.
4

5 Identify conflicts with the work of other trades prior to installation of electrical equipment.
6

7 Adjust panelboard installation to satisfy field requirements.
8

9 **DELIVERY, STORAGE AND HANDLING**

10 Receive, sign for and store all equipment in this section.
11

12 Do not store exposed to weather.
13

14 Physically protect against damage from work of other trades.
15

16 **INSTALLATION**

17 General:

18 The complete installation shall be done in a neat, workmanlike manner in accordance
19 with all applicable codes and the manufacturer's recommendations.
20

21 Start of installation shall not begin until areas are broom clean, properly lighted, exterior
22 enclosing walls in place, exterior windows glazed, roof completely installed to prevent
23 weather damage to equipment.
24

25 Cleaning:

26 Prior to turning the system over to the Owner, the system shall be physically cleaned.
27

28 All appearance defects shall be carefully and professionally touched up so that the
29 equipment is in "factory new" condition.
30

31 At the completion of the work, remove from the building and the premises all rubbish and
32 debris resulting from the work.
33

34 Grounding:

35 All equipment shall be grounded in accordance with NEC, these specifications and
36 drawings, and the equipment supplier's recommendations.
37

38 Install panelboards so that circuit breakers are not more than 6 feet above the finished floor or
39 grade.
40

41 Selectively connect branch circuits to equally balance currents in the panelboard busses.
42

43 See Section 26 05 29 for equipment mounting.
44

45 Install panelboards plumb and flush with wall finishes.
46

47 Install panelboards such that top of panel is located at an elevation of 6-feet above finished floor
48 elevation.
49

50 Provide filler plates for unused spaces in panelboards.
51

52 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect
53 circuiting changes required to balance phase loads. See Section 26 05 53.
54

- 1 Measure steady state load currents at each panelboard feeder. Should the difference at any
2 panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance
3 the phase loads within 10 percent. Take care to maintain proper phasing for multi wire branch
4 circuits.
5
- 6 Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper
7 installation and tightness of connections for circuit breakers, fusible switches, and fuses.
8
- 9 Verify that bonding jumper is properly installed in service entrance rated panels.
10
- 11 Thoroughly clean and remove construction debris from panelboard interior and exterior.
12
- 13 **OWNER TRAINING**
- 14 Provide complete operator training for the Owner's personnel.
15
- 16 Use submitted Operations & Maintenance manuals as reference during this demonstration and
17 tour.
18
- 19 **SPARE EQUIPMENT**
- 20 As shown on panel schedules.
21
- 22 All spare breakers listed on panel schedules to be mounted in panelboards.
23
24
25
- End of Section

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1 **GENERAL**

2 All materials and equipment furnished shall be current production of manufacturers regularly
3 engaged in the manufacture of such items, and for which replacement parts are available. All
4 materials and equipment shall be new (less than 1 year old when turned over to the Owner).

5
6 **RECEPTACLES**

7 Receptacles shall be:

8 UL listed for current, uses and voltages indicated.

9
10 Shall comply with NEMA standard publication WD-1 and WD-6 standards.

11
12 Receptacles shall be specification grade unless noted.

13
14 Receptacles (with the exception of GFCI) shall have one piece brass strap.

15
16 Receptacles shall have provisions for back and side wiring, screw clamp type suitable for solid or
17 stranded wire with separate green ground screw.

18
19 Receptacles shall be ivory unless noted.

20
21 Modular receptacles with pigtailed terminals are allowed.

22
23 Receptacles shall be made of nylon or high impact resistant material.

24
25 Receptacles installed in wet or damp locations shall be weather resistant.

26
27 Receptacles shall be supplied with non-breakable face plate.

28 Supply the following:

29 Weather Resistant GFCI Duplex NEMA 5-20R receptacles with:
30 20 ampere, 125 volt rating.

31
32 Standard GFCI face.

33
34 GFCI compatible face plate.

35
36 2-pole, 3-wire grounding.

37
38 Color ivory.

39
40 Approved vendors are: Cooper, Hubbell Wiring, Leviton, Pass &
41 Seymour.

42
43 **PLATE COVERS**

44 All plate covers shall be ivory (unless noted) smooth lexan or nylon.

45
46 Cast metal plates: Die cast profile, ribbed for strength, flash removed, primed with gray enamel,
47 furnished complete with four mounting screws.

48
49 Steel plates: Hot dip galvanized 1.25 oz /sq. ft. minimum.

1 Weatherproof receptacle plate shall be heavy duty type, cast aluminum with a deep cover hood to
2 provide weatherproof protection while an attachment plug cap is inserted. Plate shall be code
3 approved as "suitable for wet locations while in use". Weatherproof cover shall be provided with
4 ¼"padlock hole. Plate must meet OSHA lockout/tagout requirements. Provide a padlock for each
5 weatherproof receptacle cover installed on the project. All padlocks shall be keyed alike. Provide
6 twenty spare keys for Owner's use.

7
8 Surface box plates: Beveled, steel, pressure formed for smooth edge to fit box.

9
10 Where two-gang boxes are required for single gang devices, provide special plates with device
11 opening in one gang and second gang blank.

12
13 Approved vendors are: Cooper, Hubbell Wiring, Leviton, and Pass & Seymour.

14 15 16 **PART THREE - EXECUTION**

17 18 **EXAMINATION**

19 Verify outlet boxes are installed at proper height.

20
21 Verify wall openings are neatly cut and will be completely covered by wall plates.

22
23 Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring
24 devices.

25
26 Inspect each wiring device for defects.

27
28 Verify that each receptacle device is energized.

29
30 Test each receptacle device for proper polarity.

31
32 Test each GFCI receptacle device for proper operation.

33
34 Test that each receptacle is properly grounded.

35 36 **FIELD MEASUREMENTS**

37 Field verify proper location of all wiring devices with field conditions and adjust accordingly.

38 39 **DELIVERY, STORAGE AND HANDLING**

40 Receive, sign for and store all equipment in this section.

41
42 Maintain original quality and condition of equipment while it is in storage.

43 44 **INSTALLATION**

45 General:

46 The complete installation shall be done in a neat, workmanlike manner in accordance
47 with all applicable codes and the manufacturer's recommendations.

48
49 Install all materials, assemblies and equipment in strict accordance with manufacturer's
50 recommendations and instructions. Consult manufacturer for all wiring diagrams,
51 schematics, sizes, outlets, etc. before installing.

- 1 Start of installation shall not begin until areas are broom clean, properly lighted, exterior
 - 2 enclosing walls in place, exterior windows glazed, roof completely installed to prevent
 - 3 weather damage to equipment.
 - 4
 - 5 Install products in accordance with manufacturer's instructions.
 - 6
 - 7 Install devices plumb and level.
 - 8
 - 9 Install vertical receptacles with grounding pole on top and horizontal receptacles with grounding
 - 10 pole to left.
 - 11
 - 12 Connect wiring device grounding terminal to outlet box with bonding jumper.
 - 13
 - 14 Connect wiring devices by wrapping solid conductor around screw terminal, or inserting into wire
 - 15 clamp. Wrapping conductor not allowed for stranded wire.
 - 16
 - 17 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above
 - 18 accessible ceilings, and on surface mounted outlets.
 - 19
 - 20
 - 21
- End of Section

Pole design: Pole shaft, base plate (if used), and anchor bolts (if used), and concrete base shall be designed to withstand an isotach wind velocity of 90 MPH ASCE x a 1.3 gust factor with total affected projected area (EPA) and weight of fixtures and cross arm. Manufacturer may use either cast in place concrete base or precast concrete base. Contractor assumes responsibility for design.

The design stresses shall include the additional stresses resulting from eccentricity caused by deflections of all design loads including deflections caused by eccentricity of these loads. Drawings and structural calculations shall be submitted to the engineer for acceptance of design. The calculations shall include pole, base plate (if used), and embedded foundation analysis (precast or cast in place). The pole calculation shall be analyzed at the base of the pole, at every 5' interval up the pole and at the points above and beyond each slip joint splice. At each of these intervals of the pole, the following information shall be given:

The poles diameter, thickness, section modulus, moment of inertia, cross sectional area of each elevation.

The centroid, weight, projected area, drag coefficient, velocity pressure and the wind force of each trapezoid pole segment.

The axial, shear force, primary moment, total moment, axial stress, bending stress, allowable axial stress, allowable bending stress, and the combined stress ratio (CSR) at each elevation.

The poles angular and linear deflection at each elevation.

Cross arms: Cross arms shall be pre-wired. The wires shall be terminated at each fixture with a watertight fitting.

Provide additional hand holes in pole and mounting brackets for speakers where indicated on the plans on home side of field.

Drivers:

Drivers shall be remote mounted from the fixture in a remote mounted enclosure mounted on the pole. Enclosure shall be mounted to pole at distance up from the ground as determined in the field per project to coordinate with stadium seating (approximately 10').

Each Driver shall be individually fused.

LIGHTING PERFORMANCE

Performance Requirements: Playing surfaces shall be lit to an average constant light level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below.

Aiming Requirements:

Area of Lighting	Average Constant Light Levels	Max to Min Uniformity Ratio	No. of Grid Points	Grid Spacing	Mounting Height
Field	49/24 footcandles	2.11/4.07	25/71	30'x30'	60'

1 Aiming diagram: The manufacturer of the luminaries shall provide a computer derived point-by-
2 point and aiming diagram showing the aiming point on the field to facilitate the aiming of fixtures,
3 showing the fixture arrangement as viewed from the rear, facing the playing field and aiming
4 coordinates.
5

6 7 **PART TWO - PRODUCTS**

8 9 **SYSTEM DESCRIPTION**

10 Lighting system shall consist of the following:

11 Galvanized steel poles and crossarm assembly.
12

13 Pre-stressed concrete base embedded in concrete backfill. Alternate base may be a
14 concrete anchor bolt foundation designed such that the steel pole and any exposed steel
15 portion of the foundation be located a minimum of 18 inches above final grade. The
16 concrete shall be allowed to harden for a minimum of 28 days before the pole stress is
17 applied.
18

19 The contractor and his supplier assume all responsibility for providing appropriate
20 concrete base design and burial depth. The contractor shall employ the services of a
21 structural professional engineer and shall provide stamped base drawings to the
22 electrical engineer for review prior to installation.
23

24 Soil boring geo-tech report will be provided for this vendors base design calculations.
25

26 All luminaires shall be constructed with a die-cast aluminum housing or hail shroud to
27 protect the luminaire reflector system.
28

29 Manufacturer will remote all drivers and supporting electrical equipment in aluminum
30 enclosures mounted approximately 10' above grade. The enclosures shall include
31 drivers, and fusing for each luminaire. Safety disconnect per circuit for each pole
32 structure will be located in the enclosure.
33

34 Wire harness complete with an abrasion protection sleeve, strain relief and plug-in
35 connections for fast, trouble-free installation.
36

37 Controls Cabinet to provide on-off control of the lighting system constructed of NEMA
38 Type 4 aluminum. Communication method shall be provided by manufacturer. Cabinet
39 shall contain contactor labeled to match field diagrams and electrical design. Manual Off-
40 On-Auto selector switches shall be provided.
41

42 Manufacturing Requirements: All components shall be designed and manufactured as a system.
43 All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed,
44 wired and tested.
45

46 Durability: All exposed components shall be constructed of corrosion resistant material and/or
47 coated to help prevent corrosion. All exposed steel shall be hot dip galvanized per ASTM A123.
48 All exposed hardware and fasteners shall be stainless steel of at least 18-8 grade, passivated
49 and polymer coated to prevent possible galvanic corrosion to adjoining metals. All exposed
50 aluminum shall be powder coated with high performance polyester. All exterior reflective inserts
51 shall be anodized, coated with a clear, high gloss, durable fluorocarbon, and protected from direct
52 environmental exposure to prevent reflective degradation or corrosion. All wiring shall be
53 enclosed within the cross arm's, pole, or electrical components enclosure.
54

1 Lightning Protection: All structures shall be equipped with lightning protection meeting NFPA 780
2 standards. Contractor shall supply and install a ground rod of not less than 5/8" in diameter and 8'
3 in length, with a minimum of 10' embedment. Ground rod should be connected to the structure by
4 a copper main down conductor with a minimum size of #2 for poles with less than 75' mounting
5 height and 2/0 for poles with more than 75' mounting height.

6
7 Safety: All system components shall be UL Listed for the appropriate application.
8

9 Electric Power Requirements for the Sports Lighting Equipment:

10 Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles
11 shall not exceed three (3) percent of the rated voltage.
12

13 Structural Parameters:

14 Support Structure Wind Load Strength: Pole and other support structures, brackets,
15 arms, bases, anchorages and foundations shall be determined based on the 2009 IBC
16 Building Code or applicable Wisconsin Code, whichever is more strict. Design for wind
17 speed of 90 mph, exposure category C and an importance factor of 1.0. Luminaire, visor,
18 and crossarm shall withstand 150 mph winds and maintain luminaire aiming alignment.
19

20 Structural Design: The stress analysis and safety factor of the poles shall confirm to
21 AASHTO 2009 (LTS-5) Standard Specifications for Structural Supports for Highway
22 Signs, Luminaires and Traffic Signals.
23

24 Soil Conditions: The design criteria for these specifications are based on soil design
25 parameters as outlined in the geotechnical report. If a geotechnical report is not provided
26 by the owner, the foundation design shall be based on soils that meet or exceed those of
27 a Class 5 material as defined by 2009 IBC.
28

29 The fixture manufacturer shall provide certification from a registered engineer showing
30 complete lighting and structural calculations and verifying the lighting structure with base
31 complies with all National, State and local codes and meets the minimum wind load
32 requirements.
33

34 **WARRANTY AND GUARANTEE**

35 25-Year Warranty: Each manufacturer shall supply a signed warranty covering parts and labor
36 for the entire system for 25 years OR for the maximum hours of coverage based on the estimated
37 annual usage, whichever occurs first. Warranty shall guarantee light levels set in the Lighting
38 Performance section; HID replacements; system energy consumption; maintenance and control
39 services, spill light control, and structural integrity. Manufacturer shall maintain specifically-
40 funded financial reserves to assure fulfillment of the warranty for the full term. Warranty may
41 exclude fuses, storm damage, vandalism, abuse and unauthorized repairs or alterations.
42

43 **DELIVERY TIMING**

44 Equipment On-Site: The equipment must be on-site 4-6 weeks from receipt of approved
45 submittals and receipt of complete order information. Contractor to note – this is a tight
46 construction schedule. In an effort to keep on schedule, multiple shipping's of system parts
47 (anchor bolts, etc.), may be necessary in an effort to meet the construction deadline.
48
49

50 **PART THREE - EXECUTION**

51 **INSTALLATION**

52 Install per manufacturer's recommendations.
53
54

1 Coordination with manufacturers: Prior to bid, the electrical contractor shall coordinate the
2 installation requirements with the fixture manufacturers. He shall determine which equipment
3 comes pre-mounted and aimed and which work the contractor will be responsible for.
4
5 Aiming requirements: The aiming shall be done by marking the field with a dimensional grid as
6 indicated in the lighting level chart using a convenient marking system in order to location the
7 fixture aiming points on the playing surface. The grid size shall be the same as shown on the
8 aiming diagram. The aiming point target shall be within a 5' location shown on the aiming diagram
9 to assure acceptable uniformity.
10
11 Verify the aiming of the light fixtures to the grid layout after installation. If any variation exists, re-
12 aim fixtures to their proper locations by adjustment of the aiming hardware.
13
14 Fixture manufacturer may provide pre-aimed fixtures. However, each group of fixtures aiming
15 location shall be as described above in order to comply with IES recommendations.
16
17 Light level confirmation: The manufacturer and contractor shall perform an at-night, on site survey
18 taking foot candle readings taken at 36" above grade at each grid point indicated in lighting
19 performance spec.
20
21 The measured average constant light levels must be within 3% of submitted shop drawing light
22 levels after a 100 hour lamp burn-in period. Contractor shall be fully responsible for any
23 adjustments or additional equipment necessary to meet the light levels listed in these
24 specifications without any additional cost to the owner.

25
26
27

End of Section

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