

ELECTRICAL SYMBOLS AND ABBREVIATIONS

NOTE: NOT ALL SYMBOLS MAY BE USED ON THIS PROJECT. REFER TO SPECIFICATIONS MANUAL FOR ADDITIONAL REQUIREMENTS.

ABBREVIATIONS

A	AMPERE	RECPT	RECEPTACLE
AC	ABOVE COUNTER	REQ'D	REQUIRED
AFF	ABOVE FINISHED FLOOR	REQ'T	REQUIREMENT
AFG	ABOVE FINISHED GRADE	RGS	RIGID GALVANIZED STEEL
AIC	AMPERE INTERRUPTING CAPACITY	SC	SPLIT CIRCUIT
BLDG	BUILDING	SFD	SMOKE FIRE DAMPER
C	CONDUIT	SW	SWITCH
CAB	CABINET	T/D	TELEPHONE & DATA
CKT	CIRCUIT	TTB	TELEPHONE TERMINAL BOARD
CONN	CONNECT OR CONNECTION	TYP	TYPICAL
CT	CURRENT TRANSFORMER	UC	UNDER COUNTER
EA	EACH	UG	UNDERGROUND
EF	EXHAUST FAN	UNO	UNLESS NOTED OTHERWISE
ELEC	ELECTRIC	V	VOLT
EMER	EMERGENCY	W	WATTS
FACP	FIRE ALARM CONTROL PANEL	W/	WITH
FLA	FULL LOAD AMPS	WP	WEATHER PROOF
FLEX	FLEXIBLE CONDUIT	XFMR	TRANSFORMER
GFI	GROUND FAULT INTERRUPTER		
GND	GROUND		
HOA	HAND-OFF-AUTO		
HP	HORSEPOWER		
HPS	HIGH PRESSURE SODIUM		
HTR	HEATER		
IMC	INTERMEDIATE METAL CONDUIT		
J-BOX	JUNCTION BOX		
KVA	KILOVOLT AMPERE		
KVAR	KILOVOLT AMPERE REACTIVE		
LTG	LIGHT OR LIGHTING		
KCM	THOUSAND CIRCULAR MILS		
KW	KILOWATT		
MANUF	MANUFACTURER		
MCB	MAIN CIRCUIT BREAKER		
MCC	MOTOR CONTROL CENTER		
MCP	MOTOR CIRCUIT PROTECTOR		
MIN	MINIMUM		
MH	METAL HALIDE		
MCB	MAIN CIRCUIT BREAKER		
MLO	MAIN LUG ONLY		
MSB	MAIN SWITCHBOARD		
MTD	MOUNTED		
NEC	NATIONAL ELECTRICAL CODE		
NTS	NOT TO SCALE		
Ø	PHASE		
OL	OVERLOAD		
OVD	OVERHEAD		
OHE	OVERHEAD ELECTRIC		
PA	PUBLIC ADDRESS		
PVC	POLYVINYL CHLORIDE		

POWER SYMBOLS

	MOTOR, HP AS INDICATED
	CONTROLLER TO BE FURNISHED UNDER DIVISION 15
	DISCONNECT SWITCH
	MAGNETIC MOTOR STARTER
	COMBINATION MOTOR STARTER
	CONTACTOR
	JUNCTION BOX
	JUNCTION BOX
	RELAY
	EQUIPMENT CONNECTION
	CONNECT TO EXISTING
	OCCUPANCY SENSOR CEILING MOUNTED, DUAL TECHNOLOGY

SWITCH DEVICES

	SINGLE POLE SWITCH, SUBSCRIPT INDICATES ASSOCIATED CIRCUITRY
	DOUBLE POLE SWITCH
	THREE-WAY SWITCH
	FOUR-WAY SWITCH
	KEY OPERATED SWITCH
	SWITCH WITH PILOT LIGHT IN HANDLE (ON=LIGHTED UNLESS OTHERWISE NOTED)
	WEATHERPROOF SWITCH
	MANUAL MOTOR STARTER (T=THERMAL OVERLOAD, SIZED FOR MOTOR)
	DOOR SWITCH
	TIMER SWITCH
	INCANDESCENT DIMMER SWITCH WATTAGE RATING AS SHOWN IN ( ) 6=600, 10=1000, 15=1500
	FLUORESCENT DIMMER SWITCH, NUMBER OF LAMPS AS SHOWN IN ( )
	SPEED CONTROL
	PUSH BUTTON
	OCCUPANCY SENSOR WALL MOUNT
	OCCUPANCY SENSOR CEILING MOUNT, LT = LOW TEMP.

LIGHTING SYMBOLS

	INCANDESCENT OR HID FIXTURE, CEILING MOUNTED
	INCANDESCENT OR HID FIXTURE, WALL MOUNTED
	FLUORESCENT TROFFER, RECESSED OR SURFACE MOUNTED
	EXIT SIGN - SINGLE FACE
	EXIT SIGN - SINGLE FACE WITH ONE-WAY DIRECTIONAL ARROW
	EXIT SIGN - SINGLE FACE WITH TWO-WAY DIRECTIONAL ARROWS
	EXIT SIGN - DOUBLE FACE
	EXIT SIGN - DOUBLE FACE WITH 2 ONE-WAY DIRECTIONAL ARROWS
	EMERGENCY LIGHT, BATTERY TYPE WITH CHARGER
	EXTERIOR FLOOD LIGHT
	POLE MOUNTED LUMINAIRE
	POLE MOUNTED LUMINAIRE (ROUND)
	TRACK LIGHT WITH HEADS AS INDICATED
	LIGHTING CONTACTOR

ELECTRICAL RACEWAYS

	CONDUIT CONCEALED IN WALL OR CEILING
	CONDUIT UNDER FLOOR OR UNDERGROUND
	SWITCH LEG
	SURFACE MOUNTED RACEWAY WITH ALL REQUIRED FITTINGS AND HARDWARE. PROVIDE RECEPTACLES AS INDICATED.
	SURFACE MOUNTED RACEWAY RISER SECTION WITH ALL REQUIRED FITTINGS AND HARDWARE
	BUS DUCT WITH TAKE OFF DEVICE
	UNDERGROUND ELECTRICAL (APPROXIMATE LOCATION, CONTRACTOR TO VERIFY EXACT LOCATION IN FIELD)
	UNDERGROUND TELEPHONE (APPROXIMATE LOCATION, CONTRACTOR TO VERIFY EXACT LOCATION IN FIELD)

OUTLET DEVICES

	SIMPLEX RECEPTACLE - 20A, 120V 3W NEMA 5-20
	DUPLEX RECEPTACLE - 20A, 120V 3W NEMA 5-20
	DUPLEX RECEPTACLE - 20A, 125V 3W NEMA 5-20 GFCI=GROUND FAULT CIRCUIT INTERRUPT WP=WEATHERPROOF IG=ISOLATED GROUND
	QUADRUPLEX RECEPTACLE - 20A, 120V 3W NEMA 5-20
	RECEPTACLE - SUBSCRIPT INDICATES NEMA CONFIGURATION
	FLOOR OUTLET DUPLEX RECEPTACLE - 20A 120V 3W NEMA 5-20
	FLOOR OUTLET SIMPLEX RECEPTACLE - 20A 120V 3W NEMA 5-20
	FLOOR OUTLET QUADRUPLEX RECEPTACLE - 20A 120V 3W NEMA 5-20
	POWER POLE
	DROP CORD RECEPTACLE
	SPECIAL PURPOSE OUTLET AS DESIGNATED
	SINGLE FACE PEDESTAL
	DOUBLE FACE PEDESTAL RECEPTACLE

FIRE ALARM SYMBOLS

	FIRE ALARM CONTROL PANEL
	REMOTE ANNUNCIATOR PANEL
	FIRE ALARM EXPANSION PANEL
	MANUAL PULL STATION (G=VANDAL PROOF GUARD)
	AUDIOVISUAL ANNUNCIATOR (G=VANDAL PROOF GUARD) □ = WALL MOUNT ○ = CEILING MOUNT
	VISUAL ANNUNCIATOR (G=VANDAL PROOF GUARD) □ = WALL MOUNT ○ = CEILING MOUNT
	AUDIBLE ANNUNCIATOR (G=VANDAL PROOF GUARD) □ = WALL MOUNT ○ = CEILING MOUNT
	SMOKE DETECTOR (G=VANDAL PROOF GUARD)
	SMOKE DETECTOR, DUCT MOUNTED
	HEAT DETECTOR (G=VANDAL PROOF GUARD)
	SMOKE FIRE DAMPER
	TEST SWITCH
	FLOW SWITCH
	TAMPER SWITCH
	FIRE SPRINKLER PRESSURE SWITCH
	FIRE ALARM SPEAKER ANNUNCIATOR
	FIRE FIGHTERS PHONE JACK
	FIRE FIGHTERS TELEPHONE
	MAGNETIC DOOR HOLDER
	WALL MOUNTED AUDIBLE ANNUNCIATOR (HORN) (G= VANDAL PROOF GUARD, WP=WEATHERPROOF)

SPECIAL SYSTEMS SYMBOLS

	CEILING MOUNTED CLOCK
	WALL MOUNTED CLOCK HEIGHT AS DESIGNATED BY ARCHITECT
	WALL MOUNTED DOUBLE FACE HEIGHT AS DESIGNATED BY ARCHITECT
	INTERCOM SPEAKER, CEILING MOUNTED (G=VANDAL PROOF GUARD)
	INTERCOM SPEAKER, WALL MOUNTED (G=VANDAL PROOF GUARD)
	INTERCOM SPEAKER, EXTERIOR HORN-TYPE (G=VANDAL PROOF GUARD, WP=WEATHERPROOF)
	INTERCOM PUSHBUTTON (V=VOLUME CONTROL)
	PLYWOOD TELEPHONE BACKBOARD
	TELEPHONE OUTLET IN WALL, ROUGH-IN ONLY, 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING WITH BUSHINGS AND PULL-STRING UNLESS INDICATED OTHERWISE.
	DATA OUTLET IN WALL, ROUGH-IN ONLY, 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING WITH BUSHINGS AND PULL-STRING UNLESS INDICATED OTHERWISE.
	PHONE AND DATA OUTLET IN WALL, ROUGH-IN ONLY, 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING WITH BUSHINGS AND PULL-STRING UNLESS INDICATED OTHERWISE.
	FLOOR TELEPHONE AND DATA OUTLET, POKE-THRU TYPE
	THERMOSTAT
	CABLE TELEVISION OUTLET, ROUGH-IN ONLY. 15" A.F.F. UNLESS INDICATED OTHERWISE.

SPECIAL SYSTEMS (CONT.)

	AMPLIFIER
	INTERCOM SYSTEM TERMINAL CABINET
	SECURITY MAIN CONTROL PANEL
	DURESS ALARM PUSHBUTTON
	CARD READER
	CLOSED CIRCUIT TELEVISION OUTLET
	MAGNETIC DOOR LOCK
	MOTION DETECTOR, ROUGH-IN ONLY, 90" AFF, MAXIMUM 6" FROM NEAREST CORNER TO CENTER OF BOX, 1/2" CONDUIT TO ABOVE, ACCESSIBLE CEILING WITH BUSHINGS AND PULL-STRING UNLESS INDICATED OTHERWISE.
	GLASS BREAK SENSOR ROUGH-IN ONLY, 90" AFF, MAXIMUM 6" FROM NEAREST CORNER TO CENTER OF BOX, 1/2" CONDUIT TO ABOVE, ACCESSIBLE CEILING WITH BUSHINGS AND PULL-STRING UNLESS INDICATED OTHERWISE.

PANELS AND RELATED EQUIPMENT

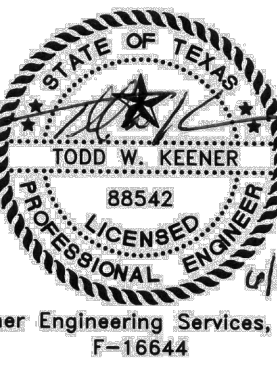
	PANELBOARD SURFACE MOUNTED (REFER TO PANEL SCHEDULE)
	PANELBOARD FLUSH MOUNTED (REFER TO PANEL SCHEDULE)
	TRANSFORMER, WITH CONCRETE HOUSEKEEPING PAD (REFER TO ONE-LINE DIAGRAM)
	AUTOMATIC TRANSFER SWITCH (REFER TO ONE-LINE DIAGRAM)

ONE-LINE DIAGRAM SYMBOLS

	H-O-A SELECTOR SWITCH
	STOP/START PUSHBUTTON STATION
	LIGHTING ARRESTER AND SURGE CAPACITOR
	TRANSFORMER
	TRANSFORMER (SHIELDED)
	MOTOR STARTER RELAY AND CONTACTOR
	ELAPSED (RUNNING) TIME METER
	CONTROL POWER TRANSFORMER
	CIRCUIT BREAKER (MOTOR CIRCUIT PROTECTOR)
	DISCONNECT SWITCH
	BUS STAB
	CURRENT TRANSFORMER
	MOTOR RESISTANCE TYPE WINDING HEATER
	THERMAL OVERLOAD CIRCUIT
	BREAKER (THERMAL MAGNETIC TYPE)
	FUSE
	CONTACT (NORMALLY OPEN)
	CONTACT (NORMALLY CLOSED)
	PUSHBUTTON (NORMALLY OPEN)
	PUSHBUTTON (NORMALLY CLOSED)
	LIMIT SWITCH (NORMALLY OPEN)
	TIME DELAY CONTACT
	PILOT LIGHT W/COLOR INDICATED (A=AMBER ,G=GREEN ,R=RED)
	SOLENOID VALVE
	DIFFERENTIAL PRESSURE SWITCH
	AUTOMATIC TRANSFER SWITCH
	DISCONNECT SWITCH 400/3/400AF/NSR INDICATES FRAME SIZE/POLES/FUSE AMPACITY/ENCLOSURE

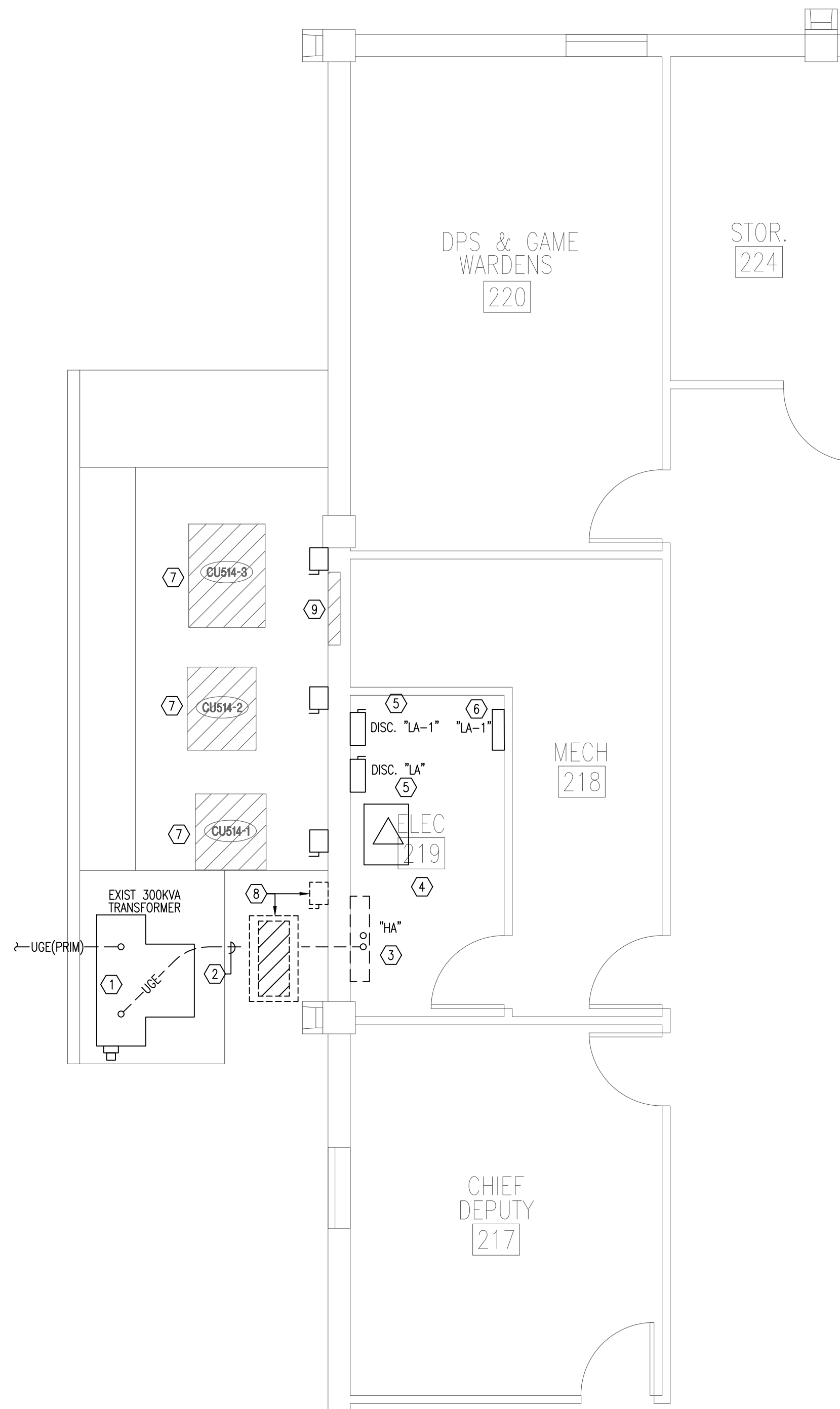
GILLESPIE COUNTY LAW ENFORCEMENT  
CENTER GENERATOR  
FREDERICKSBURG, TEXAS 78624

Keener Engineering Services, LLC  
1220 West Austin Street  
Fredericksburg, Texas 78624  
P: (830) 957-0180  
© 2023 Keener Engineering Services, LLC  
F-16644

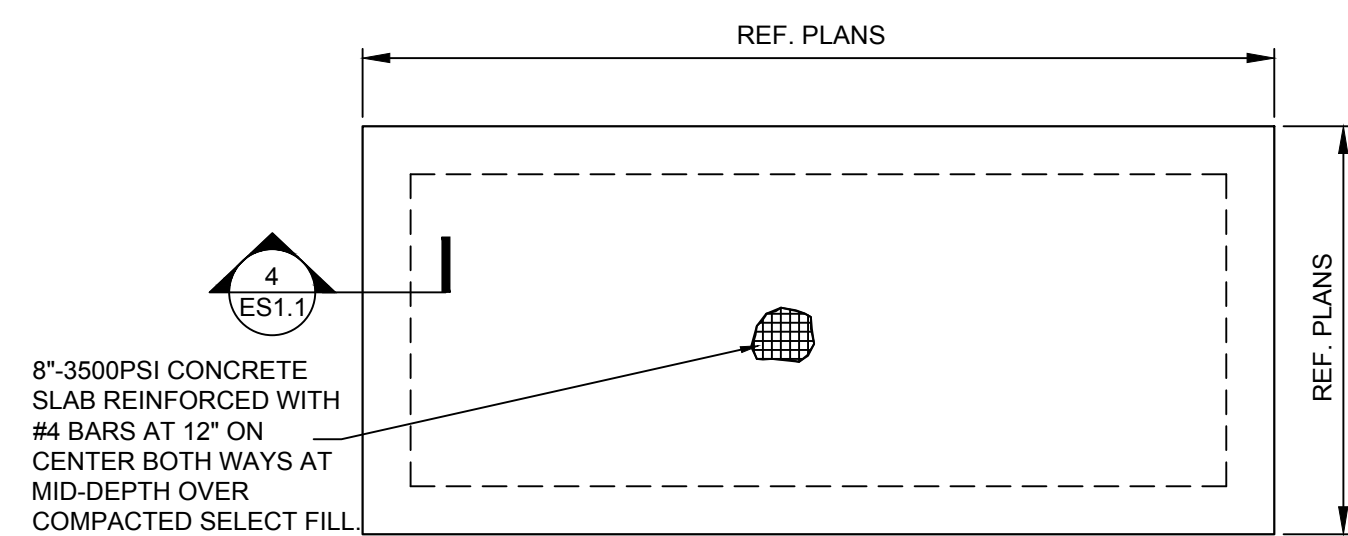


DATE: 06 / 23 / 2023  
REV:

E0.0

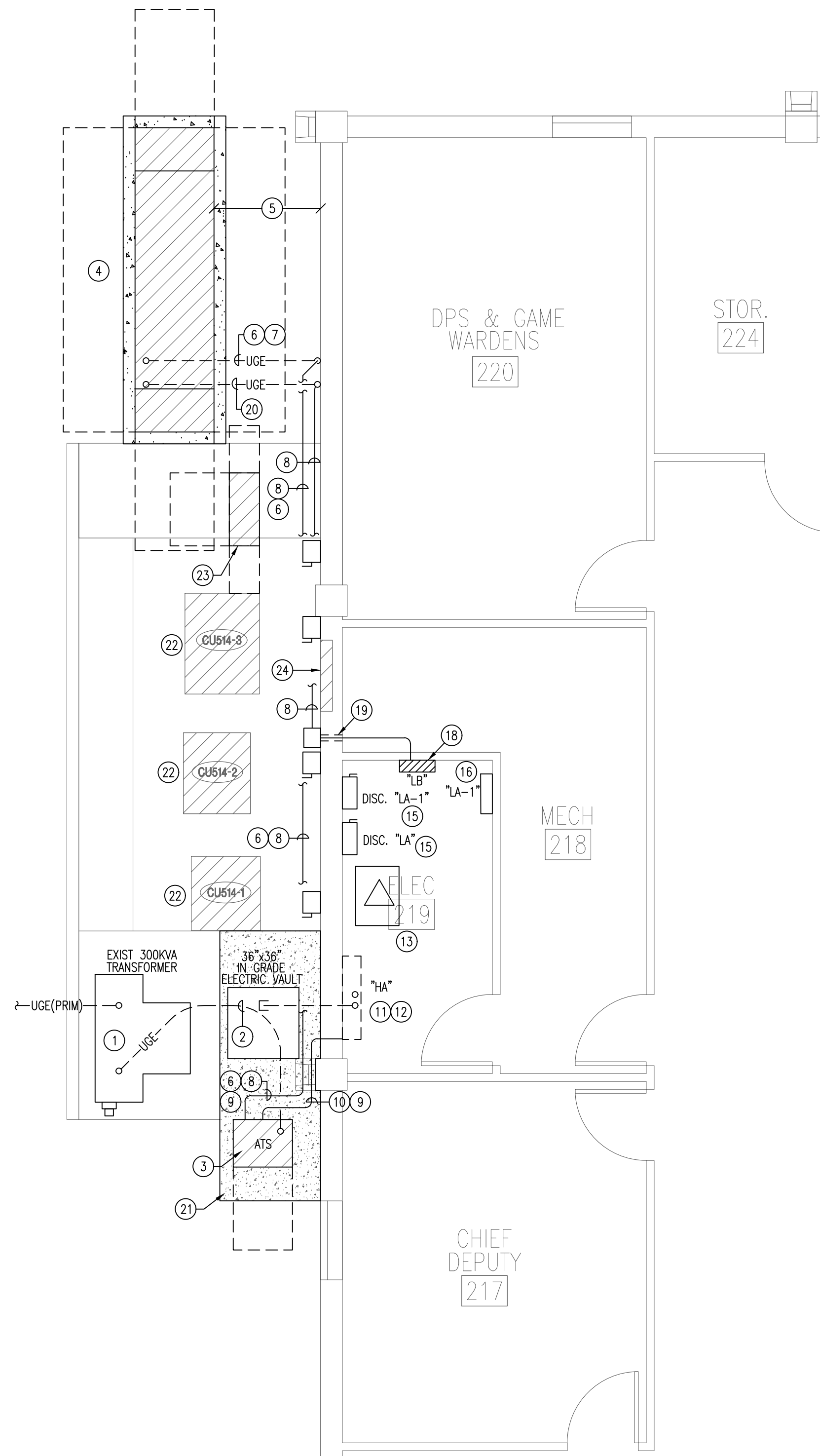


1 ELECTRICAL SITE DEMOLITION PLAN  
SCALE: 1/4" = 1'-0"

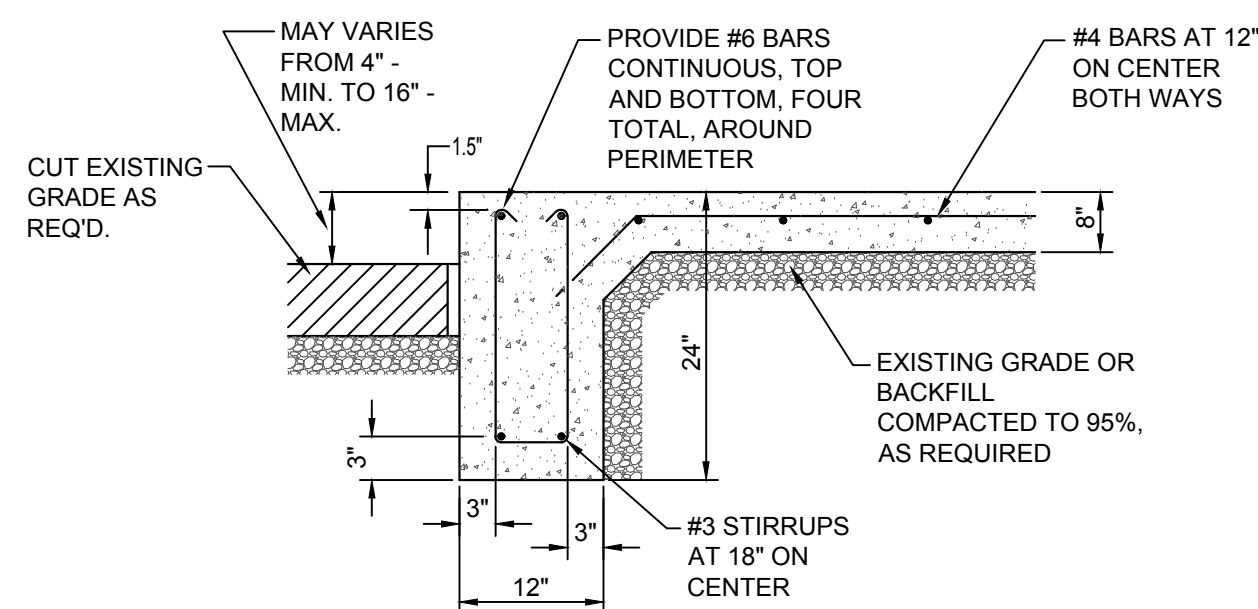


3 GENERATOR PAD  
NOT TO SCALE

- DEMOLITION KEYED NOTES:** (THIS SHEET ONLY) ○
- EXISTING CITY OF FREDERICKSBURG ELECTRIC COMPANY 300KVA PAD MOUNT TRANSFORMER AND METER TO REMAIN. UTILITY POWER.
  - EXISTING UG SECONDARY CONDUIT AND FEEDERS CURRENTLY FEEDING DISTRIBUTION PANEL "HA".
  - EXISTING DISTRIBUTION PANEL "HA". 277/480V, 3PH, 4W WITH 600A MCB LOCATED IN ELECTRICAL ROOM TO REMAIN.
  - EXISTING TRANSFORMER.
  - EXISTING DISCONNECT TO REMAIN.
  - EXISTING PANEL "LA". 120/208V, 3PH, 4W IN ELECTRIC ROOM TO REMAIN.
  - EXISTING CONDENSING UNIT ASSOCIATED REFRIGERANT PIPING, POWER SUPPLY, ELECTRIC DISCONNECT AND CONTROLS TO REMAIN.
  - EXISTING CONDENSING UNIT TO BE RELOCATED, REFERENCE DETAIL 2/ES1.1. REMOVE CONDENSING UNIT AND ELECTRICAL DISCONNECT FROM EXISTING LOCATION AND MOVE TO NEW LOCATION. EXTEND REFRIGERANT PIPING, CONTROLS, AND POWER TO NEW LOCATION.
  - EXISTING WALL LOUVER FOR BUILDING OUTSIDE AIR INTAKE.



2 ELECTRICAL SITE NEW WORK PLAN  
SCALE: 1/4" = 1'-0"



4 SECTION AT GENERATOR PAD  
NOT TO SCALE

- GENERAL NOTES:** (THIS SHEET ONLY)
- ALL WORK TO BE COMPLETED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE, THE CITY OF FREDERICKSBURG ELECTRIC COMPANY AND THE AUTHORITY HAVING JURISDICTION.
  - THE CONTRACTOR SHALL COORDINATE ELECTRICAL SERVICE REQUIREMENTS WITH THE CITY OF FREDERICKSBURG ELECTRIC COMPANY. CONTACT: LEE STUBBLEFIELD, PH: (830) 889-5814.
  - ALL CITY OF FREDERICKSBURG ELECTRIC COMPANY CHARGES SHALL BE PAID BY THE OWNER.
  - THE CONTRACTOR SHALL COORDINATE WITH THE CITY OF FREDERICKSBURG ELECTRIC COMPANY FOR THE INSTALLATION AND COMMISSIONING OF THE NEW ELECTRICAL SERVICE. THE CONTRACTOR SHALL INCLUDE IN HIS BASE BID ALL CONDUIT, CONDUCTORS, TRENCHING, BACKFILL AND ALL OTHER ASSOCIATED EQUIPMENT AND LABOR COSTS. THE CONTRACTOR SHALL ALSO INCLUDE ALL COSTS AS A RESULT OF OVERTIME AND WEEKEND WORK IN HIS BID.
  - CONDUIT ROUTING SHOWN IS FOR DIAGRAMMATICAL PURPOSES ONLY. COORDINATE CONDUIT ROUTING WITH EXISTING CONDITIONS. UNDERGROUND CONDUIT INSTALLATIONS SHALL COMPLY WITH NEC ARTICLE 300.5.
  - THE CONTRACTOR IS TO COORDINATE AND VERIFY ACTUAL LENGTHS AND ROUTES OF CONDUIT AND FEEDER RUNS WITH ENGINEERED DRAWINGS AS WELL AS EXISTING SITE CONDITIONS.
  - THERE ARE EXISTING UNDERGROUND UTILITIES WHICH MAY OR MAY NOT BE INDICATED ON THESE DRAWINGS. CONTRACTOR SHALL FIELD LOCATE ALL EXISTING UNDERGROUND UTILITIES IN AREAS OF NEW WORK AND COORDINATE INSTALLATION OF NEW WORK WITH EXISTING UTILITIES AS REQUIRED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING UNDERGROUND UTILITIES.

- KEYED NOTES:** (THIS SHEET ONLY) ○
- EXISTING CITY OF FREDERICKSBURG ELECTRIC COMPANY 300KVA PAD MOUNT TRANSFORMER AND METER TO REMAIN. UTILITY POWER - SOURCE 1.
  - INTERCEPT EXISTING UG SECONDARY CONDUIT AND FEEDERS CURRENTLY FEEDING DISTRIBUTION PANEL "HA" AND ROUTE INTO NEW "ATS". FURNISH AND INSTALL NEW IN-GRADE ELECTRICAL VAULT TO FACILITATE INSTALLATION. COORDINATE WITH THE CITY OF FREDERICKSBURG ELECTRICAL COMPANY.
  - NEW PAD MOUNT AUTOMATIC TRANSFER SWITCH (ATS), 600A, 277/480V, 3PH, 4W, 4 POLE, N3R, SERVICE ENTRANCE RATED WITH 600A, 3P, SOURCE 1 UTILITY INPUT CIRCUIT BREAKER. REFER TO RISER DIAGRAM FOR ADDITIONAL INFORMATION.
  - NEW 100KW, 125KVA, 60HZ, DIESEL GENERATOR SET, 277/480V, 3PH, 4W, 175A 100% RATED LSI ELECTRONIC TRIP OUTPUT BREAKER WITH LEVEL 1 STEEL ACOUSTIC ENCLOSURE AND 24HOUR UL 142 SUB-BASE FUEL TANK. REFER TO RISER DIAGRAM FOR ADDITIONAL INFORMATION. PROVIDE A CONCRETE EQUIPMENT PAD THAT IS A MINIMUM 6" LARGER ON ALL SIDES LARGER THAN GENERATOR FOOTPRINT. FIELD COORDINATE PAD DIMENSIONS WITH SPECIFIC GENERATOR SUBMITTED. FOR BASIS OF DESIGN, ASSUME PAD DIMENSIONS OF 14'-0" BY 4'-6".
  - MOUNT EDGE OF GENERATOR 4'-6" FROM EDGE OF BUILDING.
  - FEEDER FROM GENERATOR TO ATS - SOURCE 2.
  - ROUTE UNDERGROUND AND UP ON EXTERIOR WALL OF BUILDING.
  - ROUTE SURFACE MOUNTED ON EXTERIOR OF BUILDING.
  - FIELD COORDINATE CONDUIT ROUTING AND FITTINGS REQUIRED TO CONNECT FEEDER TO ATS.
  - NEW LOAD SIDE CONDUIT AND CONDUCTORS FROM LOAD SIDE OF TRANSFER SWITCH TO DISTRIBUTION PANEL "HA". RE: FEEDER SCHEDULE FOR ADDITIONAL INFORMATION. FIELD COORDINATE ROUTING TO PANEL "HA". PROPOSED ROUTING IS ABOVE GRADE, SURFACE MOUNTED TO EXTERIOR WALL AND PENETRATING WALL INTO REAR OF PANEL "HA".
  - EXISTING DISTRIBUTION PANEL "HA". 277/480V, 3PH, 4W WITH 600A MCB LOCATED IN ELECTRICAL ROOM.
  - CONFIRM BONDING AND GROUNDING AT THE PANELBOARD COMPLIES WITH NEC ARTICLE 250. NOTIFY ENGINEER FOR DIRECTION IF COMPLIANCE IS NOT MET.
  - EXISTING TRANSFORMER TO REMAIN.
  - NOT USED.
  - EXISTING DISCONNECT TO REMAIN.
  - EXISTING PANEL "LA" 120/208V, 3PH, 4W IN ELECTRICAL ROOM TO REMAIN.
  - NOT USED.
  - INSTALL NEW PANEL "LB" TO SERVE GENERATOR ACCESSORIES. REFER TO RISER DIAGRAM FOR ADDITIONAL INFORMATION.
  - PENETRATE EXTERIOR WALL, PROVIDE N3R PULL BOX, EXTEND CONDUITS TO GENERATOR FOR GENERATOR ACCESSORIES. FIELD COORDINATE OPTIMUM LOCATION FOR WALL PENETRATION.
  - (5) 3/4" CONDUITS UNDERGROUND FROM PANEL "LB" TO GENERATOR FOR GENERATOR ACCESSORY POWER.
  - PROVIDE CONCRETE PAD/FLATWORK AROUND NEW ELECTRICAL VAULT AND BETWEEN EXISTING PADS AND BUILDING. PAD WILL PROVIDE SUPPORT FOR ATS AND WILL ALSO PROVIDE FOR RAINWATER, FROM DOWN SPOUT, TO FLOW AWAY FROM BUILDING.
  - EXISTING CONDENSING UNIT, ASSOCIATED REFRIGERANT PIPING, POWER SUPPLY, ELECTRICAL DISCONNECT, AND CONTROLS TO REMAIN.
  - EXISTING CONDENSING UNIT TO BE RELOCATED TO THIS POSITION. RELOCATE ELECTRICAL DISCONNECT AS WELL. EXTEND REFRIGERANT PIPING, POWER, AND CONTROLS TO NEW LOCATION. CONTRACTOR SHALL VERIFY HVAC SYSTEM IS FULLY FUNCTIONAL AFTER RELOCATION.
  - EXISTING WALL LOUVER FOR BUILDING OUTSIDE AIR INTAKE. GENERATOR SHALL BE POSITIONED TO MAINTAIN A MINIMUM 10FT DISTANCE FROM INTAKE LOUVER.

1/4"=1'-0" 0 2' 4' 8'

GILLESPIE COUNTY LAW ENFORCEMENT  
CENTER GENERATOR  
FREDERICKSBURG, TEXAS 78624



DATE: 06 / 23 / 2023  
REV:  
ES1.1

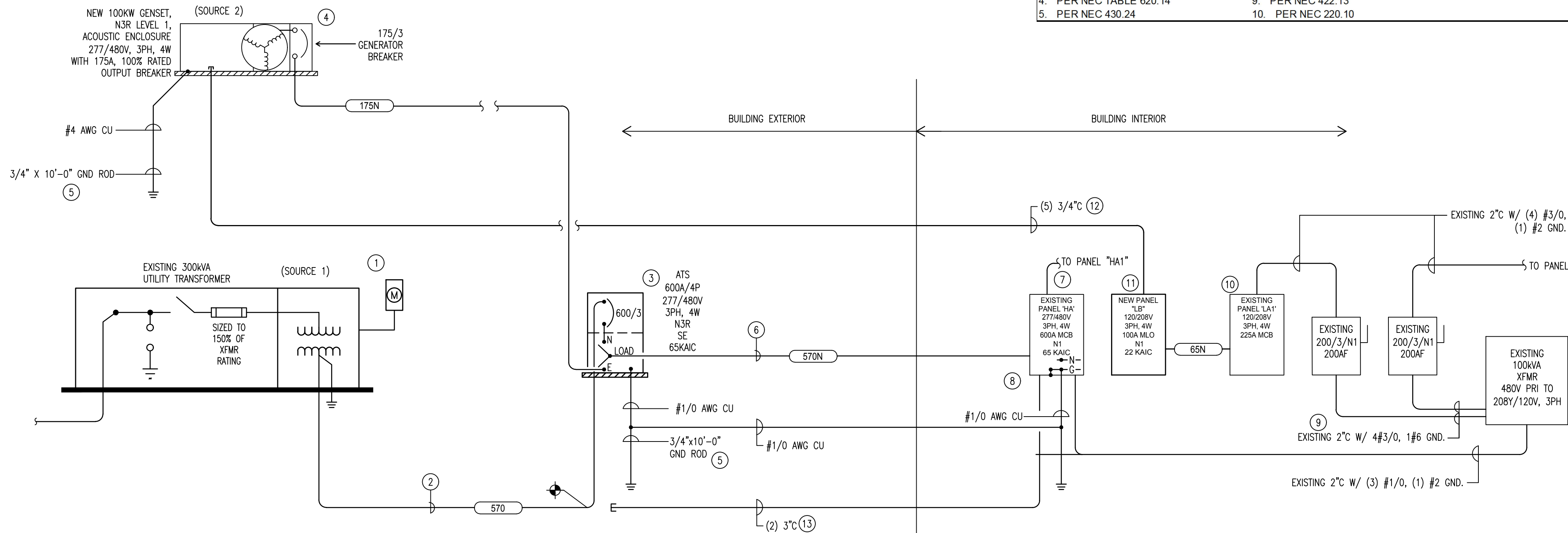


EXISTING PANEL LA1														
PROJECT:		Gillespie CO LEC Generator			ENCLOSURE:		NEMA 1			CODES: 0=RCPT 1=EQPT 2=LTG 3=AC 4=HTG 5=LGST MTR 6=SUBPANEL				
PROJECT#:		2308			VOLTAGE:		208/120V, 3Ph., 4W			BREAKER MTG: BOLT ON				
LOCATION:		ELECTRICAL ROOM			BUSSING:		225A			ACCESSORIES: GND BUS				
MOUNTING:		SURFACE			MAINS:		225A MCB (200A FEEDER)			INTERUPT RATING:		22,000 AIC		
CODE	BRKR	CIRCUIT USE			CKT	LOAD	A	LOAD	CKT	CIRCUIT USE			BRKR	CODE
	20/1	ROOMS 107 & 109			1		A		2	ROOMS 102, 104, 106			20/1	
	20/1	ROOMS 113, 11, 119			3		B		4	ROOMS 106, 108, CORRIDOR			20/1	
	20/1	ROOMS 107 & 111			5		C		6	SPARE			20/1	
	20/1	ROOMS 115 & BREAK ROOM			7		A		8	BREAK ROOM			20/1	
	20/1	ROOMS 118, 120, 122			9		B		10	BREAK ROOM REFRIGERATOR			20/1	
	20/1	ROOMS 118 & 120			11		C		12	FLAG AND SIGN FLOOD LIGHTS			20/1	
	20/1	ROOMS 122, 124, 126			13		A		14	BREAK ROOM			20/1	
	20/1	ROOMS 114 & 116			15		B		16	ROOM 129 & EVIDENCE RMS			20/1	
	20/1	ROOMS 112, 114, 116			17		C		18	ROOMS 107, 129, 133			20/1	
	20/1	LADIES RM, CORRIDOR, EXT GFCI			19		A		20	MENS RM EXHAUST FAN (SEE NOTE 2)			20/1	
	20/1	BREAK ROOM			21		B		22	MECH RM EXHAUST FAN (SEE NOTE 2)			20/1	
	20/1	BREAK ROOM			23		C		24	MECHANICAL ROOM (SEE NOTE 2)			20/1	
	20/1	ROOMS 110 & 112			25		A		26	OUTLETS			20/1	
	20/1	MICROWAVE			27		B		28	EXHAUST FAN			20/1	
	20/2	OUTSIDE HVAC UNIT 3			29		C		30	HEAT STRIP			20/2	
	-				31		A		32					
	35/2	INSIDE HVAC UNIT 3			33		B		34	WATER HEATER			60/2	
	-				35		C		36					
	20/1	TRACK LIGHTS			37		A		38	OVEN			30/2	
	20/2	SECRVER ROOM A/C			39		B		40				-	
	-				41		C		42	UNKNOWN			30/1	
		SUBPNL VA	LTG VA	RCPT VA	EQPT VA		HVAC VA	MTR VA		CONN VA	CONN A	DIVERSIFIED VA	DIV A	
PHASE A	-	-	-	-	-		-	-		-	-	-	-	
PHASE B	-	-	-	-	-		-	-		-	-	-	-	
PHASE C	-	-	-	-	-		-	-		-	-	-	-	
TOTAL	-	-	-	-	-		-	-		N/A		-	N/A	

- NOTES:
- IT IS THE CONTRACTOR AND MANUFACTURERS RESPONSIBILITY TO COORDINATE ALL LUG SIZES AND QUANTITIES, INCLUDING BUS LUGS, MAIN AND BRANCH CIRCUIT BREAKERS WITH FEEDERS INDICATED, SEE SINGLE LINE DIAGRAM.
  - RELOCATE CIRCUIT TO PANEL "LB". REMOVE EXISTING 20/1 BREAKER. REFER TO REVISED PANEL "LA1" FOR ADDITIONAL INFORMATION.

PANEL LB FED FROM PANEL LA1																
PROJECT:		Gillespie CO LEC Generator		ENCLOSURE:		NEMA 1		CODES: 0=RCPT 1-EQPT 2=LTG 3=AC 4=HTG 5=LGST MTR 6=SUBPANEL								
PROJECT #:		2308		VOLTAGE:		208/120V, 3Ph., 4W		BREAKER MTG: STAB IN								
LOCATION:		ELECTRICAL ROOM		BUSSING:		100A CU		ACCESSORIES: GND BUS								
MOUNTING:		SURFACE		MAINS:		100A MLO (60A FEEDER)		INTERUPT RATING:		22,000 AIC						
CODE	BRKR	CIRCUIT USE				CKT	LOAD	A	LOAD	CKT	CIRCUIT USE				BRKR	CODE
1	20/1	GENERATOR BATTERY WARMER				1	420	A		2	MENS RM EXHAUST FAN (SEE NOTE 2)				20/1	
1	20/1	GENERATOR BATTERY CHARGER				3	1,200	B		4	MECH RM EXHAUST FAN (SEE NOTE 2)				20/1	
1	20/1	GENERATOR BLOCK HEATER				5	1,500	C		6	MECHANICAL ROOM (SEE NOTE 2)				20/1	
1	20/1	GENERATOR ALTERNATOR HEATER				7	420	A		8	1 POLE PROVISION				-	
1	20/1	GENERATOR REMOTE ANNUNCIATOR PANEL				9	180	B		10	1 POLE PROVISION				-	
	20/1	SPARE				11		C		12	1 POLE PROVISION				-	
-		1 POLE PROVISION				13		A		14	1 POLE PROVISION				-	
-		1 POLE PROVISION				15		B		16	1 POLE PROVISION				-	
-		1 POLE PROVISION				17		C		18	1 POLE PROVISION				-	
		SUBPNL VA	LTG VA	RCPT VA	EQPT VA		HVAC VA		MTR VA		CONN VA		CONN A		DIVERSIFIED VA	DIV A
PHASE A	-	-	-	-	840		-	-	-		840		7		840	7
PHASE B	-	-	-	-	1,380		-	-	-		1,380		12		1,380	12
PHASE C	-	-	-	-	1,500		-	-	-		1,500		13		1,500	13
TOTAL	-	-	-	-	3,720		-	-	-		3,720		N/A		3,720	N/A

- NOTES:
- IT IS THE CONTRACTOR AND MANUFACTURERS RESPONSIBILITY TO COORDINATE ALL LUG SIZES AND QUANTITIES, INCLUDING BUS LUGS, MAIN AND BRANCH CIRCUIT BREAKERS WITH FEEDERS INDICATED, SEE SINGLE LINE DIAGRAM.
  - CIRCUIT RELOCATED FROM PANEL "LA1".



1 ELECTRICAL ONE LINE RISER  
SCALE: NOT TO SCALE

REVISED PANEL LA1																
PROJECT:		Gillespie CO LEC Generator		ENCLOSURE:		NEMA 1		CODES: 0=RCPT 1=EQPT 2=LTG 3=AC 4=HTG 5=LGST MTR 6=SUBPANEL								
PROJECT #:		2308		VOLTAGE:		208/120V, 3Ph., 4W		BREAKER MTG: BOLT ON								
LOCATION:		ELECTRICAL ROOM		BUSSING:		225A		ACCESSORIES: GND BUS								
MOUNTING:		SURFACE		MAINS:		225A MCB (200A FEEDER)		INTERUPT RATING: 22,000 AIC								
CODE	BRKR	CIRCUIT USE				CKT	LOAD	A	LOAD	CKT	CIRCUIT USE				BRKR	CODE
	20/1	ROOMS 107 & 109				1		A		2	ROOMS 102, 104, 106				20/1	
	20/1	ROOMS 113, 11, 119				3		B		4	ROOMS 106, 108, CORRIDOR				20/1	
	20/1	ROOMS 107 & 111				5		C		6	SPARE				20/1	
	20/1	ROOMS 115 & BREAK ROOM				7		A		8	BREAK ROOM				20/1	
	20/1	ROOMS 118, 120, 122				9		B		10	BREAK ROOM REFRIGERATOR				20/1	
	20/1	ROOMS 118 & 120				11		C		12	FLAG AND SIGN FLOOD LIGHTS				20/1	
	20/1	ROOMS 122, 124, 126				13		A		14	BREAK ROOM				20/1	
	20/1	ROOMS 114 & 116				15		B		16	ROOM 129 & EVIDENCE RMS				20/1	
	20/1	ROOMS 112, 114, 116				17		C		18	ROOMS 107, 128, 133				20/1	
	20/1	LADIES RM, CORRIDOR, EXT GFCI				19		A		20	PANEL LB				60/3	
	20/1	BREAK ROOM				21		B		22	(SEE NOTE 2)				-	
	20/1	BREAK ROOM				23		C		24	-				-	
	20/1	ROOMS 110 & 112				25		A		26	OUTLETS				20/1	
	20/1	MICROWAVE				27		B		28	EXHAUST FAN				20/1	
	20/2	OUTSIDE HVAC UNIT 3				29		C		30	HEAT STRIP				20/2	
						31		A		32						
	35/2	INSIDE HVAC UNIT 3				33		B		34	WATER HEATER				60/2	
	-					35		C		36					-	
	20/1	TRACK LIGHTS				37		A		38	OVEN				30/2	
	20/2	SECRVR ROOM A/C				39		B		40					-	
	-					41		C		42	UNKNOWN				30/1	
		SUBPNL VA	LTG VA	RCPT VA	EQPT VA		HVAC VA		MTR VA		CONN VA	CONN A		DIVERSIFIED VA	DIV A	
PHASE A	-	-	-	-	-		-		-		-	-	-	-		
PHASE B	-	-	-	-	-		-		-		-	-	-	-		
PHASE C	-	-	-	-	-		-		-		-	-	-	-		
TOTAL	-	-	-	-	-		-		-		-	N/A	-	-	N/A	

- NOTES:
- IT IS THE CONTRACTOR AND MANUFACTURERS RESPONSIBILITY TO COORDINATE ALL LUG SIZES AND QUANTITIES, INCLUDING BUS LUGS, MAIN AND BRANCH CIRCUIT BREAKERS WITH FEEDERS INDICATED, SEE SINGLE LINE DIAGRAM.
  - PROVIDE AND INSTALL A 60/3 CIRCUIT BREAKER IN SPACES 20, 22, & 24 TO SERVE NEW PANEL "LB".

Gillespie CO LEC Generator LOAD ANALYSIS					
SYSTEM VOLTAGE - 277/480V, 3 PHASE, 4 WIRE + GND.					
LOAD DESCRIPTION	CONNECTED KVA	DEMAND FACTOR	NEC LOAD		NOTE(S)
			KVA	AMPERES	
EXISTING PEAK DEMAND					
EXISTING PEAK DEMAND LOAD = 77.8 kW @ 0.95 PF (BASED ON UTILITY PEAK DEMAND DATA FOR THE PAST (3) YEARS PER THE CITY OF FREDERICKSBURG ELECTRIC COMPANY)			81.5	98	
EXISTING BUILDING LOAD PLUS 25%			101.9	122.5	8
NEW LOADS					
GENERATOR ACCESSORIES - BATTERY HEATER, BATTERY CHARGER, BLOCK HEATER, ALTERNATOR HEATER, REMOTE ANNUNCIATOR PANEL	3.7	1.00	3.7	4	
NEW BUILDING LOAD			105.6	127	
EXISTING BUILDING MAIN SERVICE SIZE				600	
GENERATOR SIZING	MIN KW	NOMINAL KW	MAIN BRKR		
EXISTING PEAK DEMAND LOAD = 77.8 kW * 1.25 SF=	97.25	100	175 A		
NOTES:					
1. PER NEC TABLE 220.12	6. PER NEC TABLE 220.56	11. PER NEC 600.5			
2. PER NEC 215.2(a)(1)	7. THE GREATER VALUE OF NON-SIMULTANEOUS LOADS.				
3. PER NEC TABLE 220.44	8. PER NEC 220.87				
4. PER NEC TABLE 620.14	9. PER NEC 422.13				
5. PER NEC 430.24	10. PER NEC 220.10				



ELECTRICAL SPECIFICATIONS

SECTION TABLE OF CONTENTS

26 05 00 GENERAL ELECTRICAL REQUIREMENTS  
26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES  
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS  
26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS  
26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS  
26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS  
26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS  
26 04 16 PANELBOARDS  
26 27 28 WIRING DEVICES  
26 28 13 OVERCURRENT PROTECTIVE DEVICES  
26 28 19 ENCLOSED SWITCHES

DIVISION 26 – ELECTRICAL

SECTION 26 05 00 – GENERAL ELECTRICAL REQUIREMENTS

1. SCOPE OF WORK
- 1.1. The work covered by these drawings and specifications shall include the furnishing of all labor, materials, transportation, tools, and appliances required in the performance of all operations required for the installation of the complete and working systems described or required by drawings or specifications. All electrical work performed under this section shall be in accordance with the drawings and specifications and subject to the terms and conditions of the contract.
- 1.2. The approximate location of electrical items is indicated on the electrical drawings. These drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building and will, in all cases, be subject to the approval of the engineer. The engineer reserves the right to make any reasonable changes in the locations indicated without additional cost. Permits and fees: The electrical contractor shall pay for all electrical construction permits and inspection fees required by local ordinance.
2. CODES AND STANDARDS
- 2.1. All work shall comply with the applicable rules of the National Electrical Code, the National Electrical Safety Code, the National Fire Code (published by the National Fire Protection Association), the local electrical codes and ordinances, and the terms and conditions of service of the electrical utility, as well as any other authorities that may have lawful jurisdiction pertaining to the work specified. None of the terms or provisions of this specification shall be construed as waiving any of the rules, regulations, or requirements of these authorities.
- 2.2. All materials, in general, shall conform to the National Electrical Code requirements and shall be tested, inspected, and approved by the Underwriters Laboratories (UL) and shall bear the UL label where labeling service is available.
- 2.3. The contractor shall reference base building specifications for devices, materials, and workmanship requirements not specified on these drawings. There shall be no deviation from specifications without the written approval of the Architect/Engineer.
- 2.4. The contractor shall do all work required to provide temporary electrical service for construction illumination and power for all trades in connection with this project. Connection of temporary electrical service shall be made at such point as determined by the architect.
- 2.5. Upon completion of work, prepare lighting and power 'AS BUILT'S' on a suitably reproducible medium. Present completed drawings to owner and two sets of prints to Architect. 'AS -BUILT' drawings shall include all branch circuit work, any panelboard information available, final switching, etc.

3. WORK IN EXISTING BUILDINGS

- 3.1. Noisy, dusty, fume emitting and/or other construction operations required for work which may disturb or cause complaints by the building occupants is unacceptable.
- 3.2. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and service and in-service maintenance of all electrical services for the existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.
- 3.3. All new work shall be coordinated with existing space constraints. All equipment and material shall be fabricated such that complete systems may be disassembled into sections suitable for fitting through existing passageways without unauthorized modifications of the existing building construction.
- 3.4. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.
- 3.5. Coordinate new work in existing building in a manner that allows proper phasing of the work with a minimum of disruption of Owner's activities in occupied spaces. All work scheduled in occupied areas MUST BE COORDINATED WITH AND APPROVED BY THE OWNER prior to commencement of the work. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two weeks in order to schedule required outages.
- 3.6. The contractor shall use construction methods and materials which shall not adversely affect the indoor air quality of the occupied areas. Contractor shall furnish and install temporary construction where required to isolate areas under construction from surrounding occupied areas to control the migration of dust or fumes
- \*\*\* End of Section \*\*\*

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1. GENERAL
- 1.1. Scope: This section specifies the furnishing and installation of insulated conductors.
- 1.2. REFERENCE STANDARDS
- 1.2.1. ANSI/UL 83 – Thermoplastic-insulated wires.
- 1.2.2. ICEA S-61-402 (NEMA WC 5) – Thermoplastic-insulated wire and cable for the transmission and distribution of electrical energy.
- 1.2.3. ICEA S-68-516 (NEMA WC 8) – Ethylene-propylene-rubber-insulated wire for the transmission and distribution of electrical energy.
2. PRODUCTS
- 2.1. Provide new insulated conductors marked according to NEC Article 310.
- 2.2. 600-VOLT INSULATED CONDUCTORS
- 2.2.1. Size: As shown.
- 2.2.2. Construction:
- 2.2.2.1. Conductor: soft-drawn, annealed copper.
- 2.2.2.2. Alternate Conductor: Aluminum conductors may be utilized for feeders to electrical distribution equipment only if expressly accepted by the owner as a Value Engineering option. It is the responsibility of the contractor to provide for a complete system, including terminations, panel lugs, etc.
- 2.2.2.3. Insulation: Unless otherwise noted on the drawings, use THHN/THWN for all general wiring.
- 2.2.3. For general wiring use No. 12 or No. 10 solid or stranded conductors, minimum. No. 8 and larger: stranded conductors. For field-installed control wiring use No. 14 or larger stranded conductors unless otherwise specified.

2.2.4. LISTING

- 2.2.4.1. Single conductor: UL 83.
- 2.2.4.2. Alternate Conductor: Aluminum conductors may be utilized for electrical distribution feeders only upon to express acceptance by the owner of a Value Engineering option. It is the responsibility of contractor to provide for a complete system including conductor terminations, panel lugs, etc.

3. EXECUTION

3.1. INSTALLATION

- 3.1.1. Protection: Unless otherwise indicated, mechanically protect conductors for systems by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Use an approved wire-pulling compound when pulling large conductors. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of 600-volt insulated conductor. Do not exceed manufacturer's recommended values for maximum pulling tension.
- 3.1.2. Splices and terminations: Use pressure-type lugs or connectors for terminations or splices of all stranded conductors.
- 3.1.3. Appearance: Neatly and securely bundle or cable all conductors in an enclosure using nylon straps with a locking hub or head on one end and a taper on the other.
- 3.2. 600-VOLT INSULATED CONDUCTORS
- 3.2.1. Size: Install conductor sizes as indicated:
- 3.2.2. Color code: Use factory-colored insulated conductors for No. 10 and smaller conductors and color code larger insulated conductors with an approved field-applied tape. Use different colors for control wiring. Follow the color scheme as approved by the local authorities.
- 3.3. WIRE COLOR
- 3.3.1. Phase Conductors – Color code conductors as indicated in the Wire Color Code Table below. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes, with color per the table.
- 3.3.2. Neutral Conductors – Color code conductors as indicated in the Wire Color Code Table below. When two or more neutrals are located in one conduit, individually identify each with proper circuit number. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes, with color per the table.
- 3.3.3. Ground Conductors – Color code conductors as indicated in the Wire Color Code Table below. For wire sizes 8 AWG and larger, identify with colored tape at terminals, splices and boxes, with color code per the table.

WIRE COLOR CODE TABLE											
Phase Conductor	480Y/277 3 Phase	208Y/120 3 Phase	120/240V 1 Phase	240/120V 1 Phase	240/120V 3 Phase	240/120V 3 Phase	240/120V 3 Phase	240/120V 3 Phase	240/120V 3 Phase	240/120V 3 Phase	240/120V 3 Phase
A or L1	Blue	Blue	Black	Black	Black	Black	Black	Black	Black	Black	Black
B or L2	Orange	Orange	Red	Red	Red	Red	Red	Red	Red	Red	Red
C or L3	Yellow	Yellow	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
Neutral	Gray	White	White	White	White	White	White	White	White	White	White
Ground	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Isolated Ground	---	Green with Yellow Tracer	Green with Yellow Tracer	Green with Yellow Tracer	Green with Yellow Tracer	Green with Yellow Tracer	Green with Yellow Tracer	Green with Yellow Tracer	Green with Yellow Tracer	Green with Yellow Tracer	Green with Yellow Tracer
Switch Leg	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor	Same Color as Branch Circuit Conductor

\*\*\* End of Section \*\*\*

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1. GENERAL

- 1.1. SCOPE OF WORK: This section specifies the furnishing and installation of grounding and bonding equipment for electrical systems.
- 1.2. REFERENCE STANDARDS
- 1.2.1. ANSI/IEEE STD 142 – Recommended practice for grounding of industrial and commercial power systems.
- 1.2.2. ANSI/UL 467 – Safety standard for grounding and bonding equipment.

2. PRODUCTS

2.1. WIRING

- 2.1.1. Provide bare conductors for bonding jumpers. Provide 600-volt insulated conductors having a green-colored insulation for grounding electrode and equipment grounding conductors. All branch circuit wiring shall be stranded copper.

2.2. GROUND BUS

- 2.2.1. Where a field-provided ground bus is required, use round-edge copper bar with 98 percent international annealed copper standard (IACS) conductivity. Size the bus for not less than 25 percent of the cross-sectional area of the related feeder. A minimum size of 1/4 inch by 2 inches is required.

3. EXECUTION

3.1. EXAMINATION

- 3.1.1. Examine surfaces, substrates, and other conditions for compliance with requirements of other sections in which that related work is specified, and determine if such conditions affecting performance of the work of this section are satisfactory. Do not proceed with work of this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Starting installation constitutes acceptance of conditions.

3.2. EQUIPMENT GROUND

- 3.2.1. Electrical rooms: Provide a ground bus in all electrical rooms. Mount bus 12 inches above finished floor and 1 inch from wall around perimeter of room. Connect bus by a grounding connector with a cross-sectional area equivalent to the ground bus to an acceptable grounding electrode as described in NEC Article 250. Connect all noncurrent-carrying metallic parts of electrical equipment in the room to the bus.
- 3.2.2. Telephone Terminal Boards: Provide a ground bus at all telephone terminal boards. Mount bus 12 inches above finished floor and 1 inch from wall around perimeter of room. Connect bus by a grounding connector with a cross-sectional area equivalent to the ground bus to an acceptable grounding electrode as described in NEC Article 250. Connect all noncurrent-carrying metallic parts of electrical equipment in the room to the bus. Bond ground bus to building grounding riser as required by communications utility provider.

3.3. RACEWAY SYSTEMS AND EQUIPMENT ENCLOSURES

- 3.3.1. Ground cabinets, junction boxes, outlet boxes, motors, controllers, raceways, fittings, switchgear, transformer enclosures, other equipment and metallic enclosures. Ground equipment and enclosures to the continuous-grounded, metallic raceway system in addition to any other specific grounding shown.
- 3.3.2. Provide bonding jumpers and ground wire throughout to ensure electrical continuity of the grounding system.
- 3.3.3. Provide grounding-type insulated bushings for metal conduits terminating in equipment enclosures containing a ground bus and connect the bushing to the ground bus.
- 3.3.4. Provide a green insulated equipment grounding conductor for each lighting branch circuit supplying fixtures installed less than 6-feet above floor or grade, each receptacle branch circuit, each power branch circuit and each feeder.
- 3.3.5. Provide bonding jumper and bonding bushing on each metallic conduit entering or leaving the enclosure of the service equipment.

- 3.4. Size: When grounding and bonding conductors are not sized on drawings, size the grounding conductors in accordance with NEC Table 250-95. Size bonding jumper so that minimum cross-sectional area is greater than or equal to that of the equivalent grounding conductor as determined from NEC Table 250-95.

\*\*\* End of Section \*\*\*

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1. GENERAL

- 1.1. SCOPE OF WORK: This section specifies the furnishing and installation of conduit supports, sleeves, fire stopping, equipment supports for electrical systems.
- 1.2. REFERENCE STANDARDS
- 1.2.1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- 1.2.2. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
- 1.2.3. ASTM E814 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- 1.2.4. ASTM E1966 – Standard Test Method for Fire-Resistive Joint Systems.
- 1.2.5. FM – Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- 1.2.6. NFPA 70 – National Electrical Code.
- 1.2.7. UL 263 – Fire Tests of Building Construction and Materials.
- 1.2.8. UL 723 – Tests for Surface Burning Characteristics of Building Materials.
- 1.2.9. UL 1479 – Fire Tests of Through-Penetration Firestops.
- 1.2.10. Tests for Fire Resistance of Building Joint Systems.
- 1.2.11. UL – Fire Resistance Directory.

2. PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Allied Tube & Conduit Corp.
- 2.1.2. Electroline Manufacturing Company
- 2.1.3. O-Z Gedney
- 2.1.4. B-Line Systems
- 2.1.5. Unistrut
- 2.1.6. Kindorf
- 2.1.7. Thunderline Link-Seal
- 2.1.8. NMP Corp.
- 2.1.9. Dow Corning
- 2.1.10. Hilti
- 2.1.11. 3M

2.2. CONDUIT SUPPORTS

- 2.2.1. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- 2.2.2. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- 2.2.3. Conduit clamps for trough hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- 2.2.4. Conduit clamps – general purpose: One hole malleable iron for surface mounted conduits.
- 2.2.5. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.
- 2.3. FORMED STEEL CHANNEL
- 2.3.1. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.
- 2.4. SLEEVES
- 2.4.1. Sleeves through Non-Fire Rated Floors: 18 gage thick galvanized steel.
- 2.4.2. Sleeves through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- 2.4.3. Sleeves through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- 2.4.4. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5. MECHANICAL SLEEVES

- 2.5.1 Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6. FIRESTOPPING

- 2.6.1. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

- 2.6.1.1. Silicone Firestopping Elastomeric Firestopping: Silicone elastomeric compound and compatible silicone sealant.
- 2.6.1.2. Foam Firestopping Compounds: Single.
- 2.6.1.3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
- 2.6.1.4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
- 2.6.1.5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
- 2.6.1.6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
- 2.6.1.7. Firestop Pillows: Formed mineral fiber pillows.
- 2.7. FIRESTOPPING ACCESSORIES
- 2.7.1. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- 2.7.2. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- 2.7.3. General:
- 2.7.3.1. Furnish UL listed products.
- 2.7.3.2. Select products with rating not less than rating of wall or floor being penetrated.
- 2.7.4. Non-Rated Surfaces:
- 2.7.4.1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
- 2.7.4.2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cured opening or water-stop type wall sleeve.

3. EXECUTION

3.1. EXAMINATION

- 3.1.1. Examine surfaces, substrates, and other conditions for compliance with requirements of other sections in which that related work is specified, and determine if such conditions affecting performance of the work of this section are satisfactory. Do not proceed with work of this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Starting installation constitutes acceptance of conditions.

3.2. PREPARATION

- 3.2.1. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- 3.2.2. Remove incompatible materials affecting bond.
- 3.2.3. Install backing materials to arrest liquid material leakage.
- 3.2.4. Do not drill or cut structural members.
- 3.3. INSTALLATION – HANGERS AND SUPPORTS
- 3.3.1. ANCHORS AND FASTENERS:
- 3.3.1.1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors and preset inserts.
- 3.3.1.2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
- 3.3.1.3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
- 3.3.1.4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
- 3.3.1.5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
- 3.3.1.6. Sheet Metal: Provide sheet metal screws.
- 3.3.1.7. Wood Elements: Provide wood metal screws.
- 3.3.2. Install conduit and raceway support and spacing in accordance with NEC.
- 3.3.3. Install multiple conduit runs on common hangers.
- 3.3.4. SUPPORTS:
- 3.3.4.1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidly. Install spring lock washers under nuts.
- 3.3.4.2. Install surface mounted cabinets and panelboards with minimum of four anchors.
- 3.3.4.3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
- 3.3.4.4. Support vertical conduit at every other floor.

3.4. INSTALLATION – FIRESTOPPING

- 3.4.1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ducts, conduit and other items requiring firestopping.
- 3.4.2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- 3.4.3. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.
- 3.4.4. Compress fibrous material to maximum 40 percent of its uncompressed size.
- 3.4.5. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- 3.4.6. Place intumescent coating in sufficient coats to achieve rating required.
- 3.4.7. Remove dam material after firestopping material has cured.
- 3.4.8. Fire Rated Surface:
- 3.4.8.1. Seal opening as follows:
- 3.4.8.1.1. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
- 3.4.8.1.2. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
- 3.4.8.1.3. Pack void with backing material.
- 3.4.8.1.4. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
- 3.4.8.2. Where cable tray, bus, cable bus, conduit, wireway, and trough, penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- 3.4.9. Non-Rated Surfaces:
- 3.4.9.1. Seal opening through non-fire rated surface as follows:
- 3.4.9.1.1. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
- 3.4.9.1.2. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
- 3.4.9.1.3. Install type of firestopping material recommended by manufacturer.
- 3.4.9.2. Install escutcheons or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
- 3.4.9.3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
- 3.4.9.4. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5. INSTALLATION – EQUIPMENT BASES AND SUPPORTS

- 3.5.1. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.
- 3.5.2. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- 3.5.3. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

3.6. INSTALLATION – SLEEVES

- 3.6.1. Exterior wall penetrations: Seal with adjustable interlocking rubber links.
- 3.6.2. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- 3.6.3. Set sleeves in position in forms. Provide reinforcing around sleeves.
- 3.6.4. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- 3.6.5. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- 3.6.6. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk. Provide close fitting metal cover or escutcheon covers at both sides of penetration.
- 3.6.7. Install chrome plated steel escutcheons at finished surfaces.
- \*\*\* End of Section \*\*\*

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1. GENERAL

- 1.1. SCOPE: This section specifies the furnishing and installation of conduit. This section specifies the furnishing and installation of outlet boxes, floor boxes, junction boxes and pull boxes.
- 1.2. REFERENCE STANDARDS
- 1.2.1. ANSI C80.1 – Rigid steel conduit, zinc coated.
- 1.2.2. ANSI C80.3 – Electrical metallic conduit, zinc coated.
- 1.2.3. ANSI/NEMA Publication NO. OS 2 – Non-metallic supports.
- 1.2.4. ANSI/UL 514 – Electrical outlet boxes and fittings.
- 1.2.5. ANSI/NEMA FB1 – Fittings, cast metal boxes, and conduit bodies for conduit and cable assemblies.
- 1.2.6. NECA – "Standard Of Installation."
- 1.2.7. NEMA TC3 – PVC fittings for use with rigid PVC conduit and tubing.

2. PRODUCTS

2.1. PRODUCT DATA

- 2.1.1. Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, conduit bodies, submit sealants.

2.2. CONDUIT REQUIREMENTS

- 2.2.1. Acceptable Manufacturers
- 2.2.1.1. Steel conduit: Allied Tube and Conduit Corporation, ITV Conduit, Republic Steel Corporation, Triangle, Wheatland Tube Company.
- 2.2.1.2. Neoprene coated flexible steel conduit: Anaconda, Electri-Flex, Kellems.
- 2.2.1.3. PVC conduit: Carlon Electric Products, ETHYL CORP., CAN-TEX Industries, CONDUX.
- 2.2.2. Minimum size: 1/2 inch unless otherwise specified.
- 2.2.3. Underground Installation
- 2.2.3.1. More than five feet from foundation wall: Use rigid steel conduit or thick wall nonmetallic conduit.
- 2.2.3.2. Within five feet from foundation wall: Use rigid steel conduit or thick wall nonmetallic conduit.
- 2.2.3.3. Under slab on grade: Use PVC conduit.
- 2.2.3.4. Minimum size: 3/4 inch.
- 2.2.4. Outdoor locations, above grade: Use rigid steel conduit.
- 2.2.5. Dry locations – interior: Concealed use electrical metallic tubing. Exposed use electrical metallic tubing.
- 2.2.6. Equipment connections: Use liquid-tight flexible metal conduit for interior and exterior equipment (5'-0" max. length).
- 2.3. METAL CONDUIT
- 2.3.1. Rigid steel conduit: ANSI C80.1, Hot Dipped, Galvanized after fabrication.
- 2.3.2. Intermediate metal conduit (IMC): Galvanized steel.
- 2.3.3. Fittings and conduit bodies: ANSI/NEMA FB1; material to match conduit. All steel fittings.
- 2.3.4. Rigid metal conduit or IMC below grade or exposed to weather shall be wrapped with (20 mils) oil-weather corrosion protection type with 80% overlap. Surfaces of conduit shall be coated with pipe primer prior to wrapping. Utilize 3M "SCOTCHWRAP" 51 With 3M "SCOTCHWRAP" pipe primer or approved equivalent.
- 2.4. LIQUIDTIGHT FLEXIBLE METAL CONDUIT
- 2.4.1. Description: Liquidtight flexible conduit shall be Anaconda "SEALTITE" Type VA, or approved equivalent, flexible galvanized steel core with extruded thermoplastic covering with special watertight connectors, UL listed with ground integral sizes 1/2" to 1-1/4", Type O.R. shall used underfloor, and Type H.C. shall be used for locations with temperatures extreme (above 40 degrees C).
- 2.4.2. Fittings: ANSI/NEMA FB1.
- 2.5. FLEXIBLE METAL CONDUIT
- 2.5.1. Description: Flexible galvanized steel.
- 2.5.2. Fittings: ANSI/NEMA FB1
- 2.6. ELECTRICAL METALLIC TUBING
- 2.6.1. Description: ANSI C80.3; Galvanized tubing.
- 2.6.2. Fittings and conduit bodies: ANSI/NEMA FB1, Galvanized steel compression type outdoors. steel set-screw may be used indoors.

2.7. RIGID PVC CONDUIT

- 2.7.1. High impact polyvinyl chloride, meeting minimum requirements of NEC.
- 2.7.2. Direct burial type: Carlon Electric Products, Type 40.
- 2.7.3. Concrete encased burial type: Carlon Electric Products, Type 40. Mark each length clearly and durably with nominal trade size, type of material, and UL label.
- 2.7.4. Fittings: PVC, solvent weld type, with connectors and threaded adapters as required.

2.8. JUNCTION, PULL AND SPLICE BOXES

- 2.8.1. Construction: Provide boxes conforming to NEC Article 314.
- 2.8.2. Interior spaces: Provide NEMA 1 Type boxes at least 4 inches deep.
- 2.8.3. Exterior spaces: Provide NEMA 3R type boxes at least 4 inches deep.
- 2.8.4. Embedded: Provide NEMA 4 cast iron type with external recessed flanged cover when cast in concrete.
- 2.8.5. Size: Provide boxes sized in accordance with NEC requirements.
- 2.8.6. Listing: UL 514
- 2.8.7. Acceptable manufacturers: Hoffman, Keystone, Oz, Stahlin.

3. EXECUTION

3.1. INSTALLATION

- 3.1.1. Install conduit in accordance with NECA "Standard Of Installation." Install nonmetallic conduit in accordance with manufacturer's instructions. Arrange supports to prevent misalignment, during wiring installation. Support conduit using conduit hangers or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each rack for 25 percent additional conduits. Fasten conduit supports to building structure and surfaces.
- 3.1.2. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- 3.1.3. Arrange conduit to maintain headroom and present neat appearance. Route exposed conduit parallel and perpendicular to structure. Route conduit under slab from point-to-point. In floor slabs, sleeves shall extend 1-1/2 inch above floor slab cemented in a water tight manner. Maintain adequate clearance between conduit and piping.
- 3.1.4. Cut conduit square using saw pipe cutter; de-burr cut ends. Bring conduit to shoulder of fittings; fasten securely. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- 3.1.5. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- 3.1.6. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch size.
- 3.1.7. 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.
- 3.1.8. Provide suitable pull string in each empty conduit except sleeves and nipples.
- 3.1.9. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- 3.1.10. Ground and bond conduit under provisions of section 26 05 26.
- 3.1.11. Install boxes as required to facilitate cable installation in raceway systems. Generally provide boxes in conduit runs of more than 100 feet. Locate boxes strategically and make them of such shape to permit easy pulling of wire or cables.
- 3.1.12. Provide boxes so that covers are readily accessible and easily removable after completion of the installation. Include suitable access doors for boxes above suspended ceilings. Select a practical size for each box and cover.
- \*\*\* End of Section \*\*\*

SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

1. GENERAL

- 1.1. SCOPE OF WORK: This section specifies the furnishing and installation of direct-buried conduit/ducts/duct accessories, concrete-encased conduit/ducts/duct accessories, and handholes/boxes.

2. PRODUCTS

- 2.1. Comply with ANSI C2.
- 2.2. CONDUIT
- 2.2.1. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1
- 2.2.2. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514

2.3. NONMETALLIC DUCTS AND DUCT ACCESSORIES

- 2.3.1. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-60-PVC and Type DB-120 – PVC. ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- 2.3.2. Solvents and Adhesives: As recommended by conduit manufacturer.
- 2.3.3. Duct Accessories:
- 2.3.3.1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
- 2.3.3.2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.4. PRECAST CONCRETE HANDHOLES AND BOXES



SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS (CONTINUED)

3. EXECUTION

3.1 PREPARATION

- 3.1.1 Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- 3.1.2 Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes.

3.2 UNDERGROUND DUCT APPLICATION

- 3.2.1 Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- 3.2.2 Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- 3.2.3 Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- 3.2.4 Underground Ducts Crossing Paved Paths, Driveways, and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.3 UNDERGROUND ENCLOSURE APPLICATION

- 3.3.1 Handholes and Boxes for 600 V and Less, , Including Telephone, Communications, and Data Wiring:
- 3.3.1.1 Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
- 3.3.1.2 Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
- 3.3.1.3 Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
- 3.3.1.4 Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
- 3.3.1.5 Cover design load shall not exceed the design load of the handhole or box.

3.4 DUCT INSTALLATION

- 3.4.1 Install ducts according to NEMA TCB 2.
- 3.4.2 Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.
- 3.4.3 Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends.
- 3.4.4 Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- 3.4.5 Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations.
- 3.4.6 Pulling Cord: Install 100-lbf – test nylon cord in empty ducts.
- 3.4.7 Concrete-Encased Ducts: Support ducts on duct separators.
- 3.4.7.1 Excavate trench bottom to provide firm and uniform support for duct bank.
- 3.4.7.2 Width: Excavate trench 3 inches wider than duct bank on each side.
- 3.4.7.3 Depth: Install top of duct bank at least 24 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
- 3.4.7.4 Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
- 3.4.7.5 Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- 3.4.7.6 Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts.
- 3.4.7.7 Elbows: Use manufactured duct elbows for stub-ups at poles and equipment and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
- 3.4.7.8 Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
- 3.4.7.9 Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
- 3.4.7.10 Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.
- 3.4.7.11 Pouring Concrete: Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces.
- 3.4.8 Direct-Buried Duct Banks:
- 3.4.8.1 Excavate trench bottom to provide firm and uniform support for duct bank.
- 3.4.8.2 Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
- 3.4.8.3 Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes.
- 3.4.8.4 Depth: Install top of duct bank at least 36 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated. Install top of duct bank at least 24 inches below finished grade in non-traffic rated areas unless otherwise indicated.
- 3.4.8.5 Install ducts with a minimum of 3 inches between ducts.
- 3.4.8.6 Elbows: Install manufactured duct elbows for stub-ups at poles and equipment and at changes of direction in duct run unless otherwise indicated.
- 3.4.8.7 Place minimum 3 inches of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.
- 3.4.8.8 Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank.

3.5 INSTALLATION OF CONCRETE HANDHOLES AND BOXES

- 3.5.1 Precast Concrete Handhole and Manhole Installation:
- 3.5.1.1 Comply with ASTM C 891 unless otherwise indicated.
- 3.5.1.2 Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
- 3.5.1.3 Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- 3.5.1.4 Elevations:
- 3.5.1.4.1 Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- 3.5.1.5

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- 3.6.1 Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.
- 3.6.2 Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- 3.6.3 Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- 3.6.4 Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- 3.6.5 Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.7 GROUNDING

- 3.7.1 Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

\*\*\* End of Section \*\*\*

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

1. GENERAL

- 1.1. SCOPE: This section specifies the furnishing and installation of nameplates, labels, wire markers, conduit markers, stencils, underground warning tape, and lockout device.

2. PRODUCTS

2.1. NAMEPLATES

- 2.1.1. Product Description: Laminated three-layer plastic with engraved white letters on black contrasting background color.
- 2.1.2. Letter Size:
- 2.1.2.1. 1/8 inch high letters for identifying individual equipment and loads.
- 2.1.2.2. 1/4 inch high letters for identifying grouped equipment and loads.
- 2.1.3. Minimum nameplate thickness: 1/8 inch:

2.2. WIRE MARKERS

- 2.2.1. Description: Split sleeve or tubing type wire markers.
- 2.2.2. Legend:
- 2.2.2.1. Power and Lighting Circuits: Branch circuit or feeder number.
- 2.2.2.2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams.

2.3. CONDUIT AND RACEWAY MARKERS

- 2.3.1. Description: Nameplate fastened with adhesive. Labels fastened with adhesive.
- 2.3.2. Color:
- 2.3.2.1. Medium Voltage System: Black lettering on white background.
- 2.3.2.2. 480 Volt System: Black lettering on white background.
- 2.3.2.3. 208 Volt System: Black lettering on white background.
- 2.3.3. Legend:
- 2.3.3.1. Medium Voltage System: HIGH VOLTAGE.
- 2.3.3.2. 480 Volt System: 480 VOLTS.
- 2.3.3.3. 208 Volt System: 208 VOLTS.

2.4. STENCILS

- 2.4.1. Stencils: With clean cut symbols and letters of following size:
- 2.4.1.1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
- 2.4.1.2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.
- 2.4.2. Stencil Paint: As specified in Section 09 90 00 semi-gloss enamel, colors conforming to the following:
- 2.4.2.1. Black lettering on white background.
- 2.4.2.2. White lettering on gray background.
- 2.4.2.3. Red lettering on white background.
- 2.4.2.4. Blue lettering on white background.

2.5. UNDERGROUND WARNING TAPE

- 2.5.1. Description: 4 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

2.6. LOCKOUT DEVICES

- 2.6.1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

3. EXECUTION

3.1. PREPARATION

- 3.1.1. Degrease and clean surfaces to receive adhesive for identification materials.
- 3.1.2. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2. EXISTING WORK

- 3.2.1. Install identification on existing equipment to remain in accordance with this section.
- 3.2.2. Install identification on unmarked existing equipment.
- 3.2.3. Replace lost nameplates.
- 3.2.4. Re-stencil existing equipment.

3.3. INSTALLATION

- 3.3.1. Install identifying devices after completion of painting.
- 3.3.2. Nameplate Installation:
- 3.3.2.1. Install nameplate parallel to equipment lines.
- 3.3.2.2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
- 3.3.2.3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
- 3.3.2.4. Secure nameplate to equipment front using screw.
- 3.3.2.5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
- 3.3.2.6. Install nameplates for the following:
- 3.3.2.6.1. Switchboards.
- 3.3.2.6.2. Panelboards.
- 3.3.2.6.3. Transformers.
- 3.3.2.6.4. Service Disconnects.
- 3.3.3. Label Installation:
- 3.3.3.1. Install label parallel to equipment lines.
- 3.3.3.2. Install label for identification of individual control device stations.
- 3.3.3.3. Install labels for permanent adhesion and seal with clear lacquer.
- 3.3.4. Wire Marker Installation:
- 3.3.4.1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and each load connection.
- 3.3.4.2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
- 3.3.4.3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.
- 3.3.5. Conduit Marker Installation:
- 3.3.5.1. Install conduit marker for each conduit longer than 12 feet.
- 3.3.5.2. Conduit Marker Spacing: 20 feet on center.
- 3.3.5.3. Raceway Painting: Identify conduit using field painting in accordance with Section 09 90 00.
- 3.3.5.3.1. Paint colored band on each conduit longer than 6 feet.
- 3.3.5.3.2. Paint bands 20 feet on center.
- 3.3.5.3.3. Color:
- 3.3.5.3.3.1. 480 Volt System: Blue.
- 3.3.5.3.3.2. 208 Volt System: Yellow.

- 3.3.6. Stencil Installation:
- 3.3.6.1. Apply stencil painting in accordance with Section 09 90 00.
- 3.3.7. Underground Warning Tape Installation:
- 3.3.7.1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

\*\*\* End of Section \*\*\*

SECTION 26 24 16 – PANELBOARDS

1. GENERAL

- 1.1. SCOPE: The work covered in this section of the specifications includes fusible and circuit breaker panelboards and accessories as covered by Article 384 of the National Electrical Code and as shown on the drawings.

2. PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS:

- 2.1.1. Cutler-Hammer.
- 2.1.2. General Electric Co.
- 2.1.3. Square D Company.
- 2.1.4. Siemens.

2.2. THE FOLLOWING SCHEDULE DESIGNATES EQUIVALENT PRODUCTS:

Square D	Westinghouse	General Electric Co.	Siemens
NQ00	Pow-R-Line 1	Series A Type AQ	Type S1
N/A	Pow-R-Line 2	N/A	N/A
NEHB	Pow-R-Line 3	Series A Type AE	Type S2
I-LINE	Pow-R-Line 4B	COB	Type S5
QMB	Pow-R-Line 4F	QMR	Type F2

2.3. PANELBOARDS SHALL:

- 2.3.1. Be enclosed in a code gauge steel cabinet.
- 2.3.2. Be dead front construction.
- 2.3.3. Have one-piece trim with no exposed hinges.
- 2.3.4. Have an equipment ground bus.
- 2.3.5. Have bus current and short circuit ratings as called for on the drawings. (Bus rating to be Integrated Equipment Rating established according to UL 67.)
- 2.3.6. Be UL listed.
- 2.3.7. Have bus bars of 98% conductivity copper and minimum cross-sectional area based on UL 67 for heat rise.
- 2.3.8. Have doors which are equipped with:
- 2.3.8.1. Hinges as required for proper support and alignment.
- 2.3.8.2. Spring latch with a key lock. All locks shall be keyed alike.
- 2.3.8.3. Framed directory on inside with 1/16" thick glass or plastic cover and typewritten directory card identifying the load fed by each circuit including room and number. Spares and spaces shall be noted in pencil.

3. EXECUTION

3.1. INSTALLATION

- 3.1.1. Panels shall be installed plumb and level with the highest device handle not more than 6'-6" above finished floor.
- 3.1.2. Flush mounted panels shall be set so as to assure that the panel trim will be flat against the finished wall surface.
- 3.1.3. Flush type panels shall be securely fastened to structural members of the wall. Provide additional supports as required for a secure installation.
- 3.1.4. Surface mounted panels shall be securely bolted to the mounting surface.
- 3.1.5. All wiring in panels shall be neat with rounded corners and shall be tied in bundles with approved ties. (see section 26 05 00).
- 3.1.6. Close all unused openings in enclosures.
- 3.1.7. Torque all lugs to manufacturer's specifications.

\*\*\* End of Section \*\*\*

SECTION 26 27 26 – WIRING DEVICES

1. GENERAL

- 1.1. SCOPE: This section specifies the furnishing and installation of wiring devices and device plates.
- 1.2. REFERENCE STANDARDS

- 1.2.1. ANS/UL 20 – General-use snap switches.
- 1.2.2. ANS/UL498 – Electrical attachment plugs and receptacles.
- 1.2.3. NEMA WD 1 – General-purpose wiring devices.

2. PRODUCTS

2.1. WALL SWITCHES

- 2.1.1. Type: Quiet type, back and side wired switches as shown.
- 2.1.2. Rating: 20 amperes, 120/277 volts.
- 2.1.3. Listing: UL 20 and Federal Specification W-S-896.
- 2.1.4. Acceptable manufacturers:
- 2.1.4.1. Arrow-Hart.
- 2.1.4.2. Bryant.
- 2.1.4.3. General Electric.
- 2.1.4.4. Hubbell.
- 2.1.4.5. Leviton.
- 2.1.4.6. Pass & Seymour.

2.2. RECEPTACLES

- 2.2.1. Type: Back and side wired receptacles, as shown.
- 2.2.2. Rating: Scheduled on drawings.
- 2.2.3. Listing: UL 498 and Federal Specification W-C-596.
- 2.2.4. Acceptable manufacturers:
- 2.2.4.1. Arrow-Hart.
- 2.2.4.2. Bryant.
- 2.2.4.3. General Electric.
- 2.2.4.4. Hubbell.
- 2.2.4.5. Leviton.
- 2.2.4.6. Pass & Seymour.

2.3. DEVICE PLATES

- 2.3.1. Finished spaces in dry interior spaces: Thermoplastic, match device color.
- 2.3.2. Exposed boxes in dry interior spaces: Make plates of heavy cadmium-plated sheet steel. Edges of plate must be flush with edges of boxes.
- 2.3.3. Other areas: Use weatherproof-white-in-use device plates. Provide cast aluminum plates with gasketed spring door covers for protection of device. Use Hubbell 7420 for switches and either 5205 or 5206 for duplex receptacles.

2.4. DEVICE COLOR

- 2.4.1. Supply regular service items in color approved by owner.
- 2.4.2. If device color is not provided by the Architect, default color shall be white.

3. EXECUTION

3.1. EXAMINATION

- 3.1.1. Examine surfaces, substrates, and other conditions for compliance with requirements of other sections in which that related work is specified, and determine if such conditions affecting performance of the work of this section are satisfactory. Do not proceed with work of this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Starting installation constitutes acceptance of conditions.

3.2. DEVICE COORDINATION

- 3.2.1. Where items of equipment are provided under other sections of this specification or by the owner, provide a compatible receptacle for the cap or plug and cord of the equipment.

3.3. WALL SWITCHES

- 3.3.1. Location: Set wall switches in a suitable outlet box centered at the height of 44 inches from the floor, except as otherwise shown. Install switch on the strike side of the door as finally hung.
- 3.3.2. Position: Install wall switches in a uniform position so the same direction of operation will open and close the circuits throughout the job, generally up or to the left for the on position.

3.4. RECEPTACLES

- 3.4.1. Mount receptacles vertically in a suitable steel outlet box centered at the height of 15 inches from the floor or as shown on the drawings. The Architect reserves the right to make any reasonable changes in receptacle locations without change in the contract sum.

3.5. DEVICE PLATES

- 3.5.1. Type: Provide device plates for each outlet box of the type required for service and device involved.
- 3.5.2. Ganged devices: Mount ganged devices under a single, one-piece, device plate.
- 3.5.3. Engraving/Labeling: Engrave or label plates with 1/8 inch-high black letters.
- 3.5.4. Telephones: Provide wall plates for telephone outlets with a nominal 5/8-inch bushed opening in the center

\*\*\* End of Section \*\*\*

SECTION 22 28 13 – OVERCURRENT PROTECTIVE DEVICES

1. GENERAL

- 1.1. SCOPE: This section covers fuses and molded case circuit breakers rated 600 volts or less in panelboards, switchboards, individual enclosures, motor control centers, combination motor starters, busway plug in units, etc.

2. PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS:

- 2.1.1. Fuses:
- 2.1.1.1. Bussman Mfg. Div.
- 2.1.1.2. Gould-Shawmut.
- 2.1.1.3. Little Fuse.
- 2.1.2. Breakers:
- 2.1.2.1. Cutler-Hammer.
- 2.1.2.2. General Electric Co.
- 2.1.2.3. Square D Company.
- 2.1.2.4. Siemens.

2.2. FUSES:

- 2.2.1. Fuses, 600 volts and less, shall meet the following criteria:
- 2.2.1.1. Be of the same manufacturer.
- 2.2.1.2. Fuses rated 1/10 to 600 amperes shall be current limiting UL Class RK1.

2.3. CIRCUIT BREAKERS:

- 2.3.1. All circuit breakers shall:
- 2.3.1.1. Have inverse time tripping characteristics with fixed thermal trip action.
- 2.3.1.2. Have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
- 2.3.1.3. Be calibrated for operation in a minimum ambient temperature of 40°C.
- 2.3.1.4. Indicate their current and voltage rating.
- 2.3.1.5. Have interrupting capacity compatible with the panelboard or switchboard integrated equipment rating.
- 2.3.1.6. Have a minimum AIC of 10,000A on 120/208V Wye systems, and 14,000 on 277/480V Wye systems.
- 2.3.1.7. Be one, two, or three pole molded case circuit breakers as specified on the drawings.
- 2.3.1.8. Be common trip type.

3. EXECUTION

3.1. INSTALLATION

- 3.1.1. Provide overcurrent protection for all wiring and equipment in accordance with the NEC.
- 3.1.2. A label shall be placed inside each fused switch door, the label should indicate the fuse type, ampere rating and interrupting rating, and should indicate that fuses should be replaced only with fuses of the same class, ampacity, and interrupting rating.
- 3.1.3. Breakers must clear panel doors and be mounted on frame allowing outward and inward adjustment. The depth of the panel shall also permit adjustment.
- 3.1.4. The use of tandem "multi", "push-a-matic", or "quicklag" breakers will not be permitted.

\*\*\* End of Section \*\*\*

SECTION 26 28 19 – ENCLOSED SWITCHES

1. GENERAL

- 1.1. SCOPE: Section includes fusible and nonfusible switches.
- 1.2. REFERENCES
- 1.2.1. National Electrical Manufacturers Association:
- 1.2.1.1. NEMA FU 1 – Low Voltage Cartridge Fuses.
- 1.2.1.2. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- 1.2.2. International Electrical Testing Association:
- 1.2.2.1. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

2. PRODUCTS

2.1. NONFUSIBLE SWITCH ASSEMBLIES

- 2.1.1. Manufacturers:
- 2.1.1.1. GE Electrical.
- 2.1.1.2. Cutler Hammer.
- 2.1.1.3. Square D.
- 2.1.1.4. Siemens.
- 2.1.2. Product Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.
- 2.1.3. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
- 2.1.3.1. Interior Dry Locations: Type 1.
- 2.1.3.2. Exterior Locations: Type 3R.
- 2.1.3.3. Industrial Locations: Type 4 or 4X as indicated on drawings.
- 2.1.4. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
- 2.1.5. Furnish switches with entirely copper current carrying part.
- 2.2. SWITCH RATINGS
- 2.2.1. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
- 2.2.2. Short Circuit Current Rating: UL listed for 10,000 RMS symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere). 200,000 RMS symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes). 200,000 RMS symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

3. EXECUTION

3.1. EXISTING WORK

- 3.1.1. Disconnect and remove abandoned enclosed switches.
- 3.1.2. Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.
- 3.1.3. Clean and repair existing enclosed switches to remain or to be reinstalled.

3.2. INSTALLATION

- 3.2.1. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.
- 3.2.2. Height: 5 feet (1500 mm) to operating handle.
- 3.2.3. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.
- 3.2.4. Install engraved plastic nameplates in accordance with Section 26 05 53.
- 3.2.5. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.3. FIELD QUALITY CONTROL

- 3.3.1. Inspect and test in accordance with NETA ATS, except Section 4.
- 3.3.2. Perform inspections and tests listed in NETA ATS, Section 7.5.

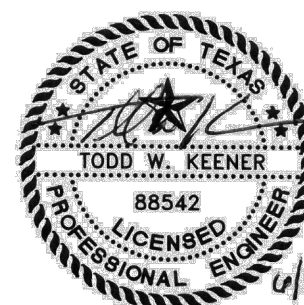
\*\*\* End of Section \*\*\*

GILLESPIE COUNTY LAW ENFORCEMENT

CENTER GENERATOR  
FREDERICKSBURG, TEXAS 78624

Keener Engineering Services, LLC  
1220 West Austin St.  
Fredericksburg, TX 78624  
P: (830) 997-0180  
F: (830) 997-0180  
© 2023 Keener Engineering Services, LLC

KES  
F-16644



Keener Engineering Services, LLC.  
F-16644

DATE: 06 / 23 / 2023

REV:

E2.2