BONDING & GROUND DETAIL

KEY NOTES - GROUNDING DIAGRAM

(A) CONCRETE ENCASED ELECTRODE (UFER) (GROUNDING ELECTRODE #1). REFER TO CHART FOR SIZE. MINIMUM 20'.

(B) MINIMUM 10 MIL ANNEALED COPPER CLAD STEEL GROUND ROD. (GROUNDING ELECTRODE #2). REFER TO CHART FOR SIZE.

(C) GROUNDING ELECTRODE CONDUCTOR. REFER TO CHART FOR SIZE.

(D) INTEGRATED (FACTORY BONDED) BUS BAR MAIN BONDING JUMPER. REFER TO CHART FOR MINIMUM CONDUCTOR SIZE. (AMPACITY SHALL BE 150% RATED)

(E) METALLIC PIPING BOND WIRE, REFER TO CHART FOR MINIMUM SIZE. BOND TO ALL METALLIC PIPING (WATER, SPRINKLER, GAS, PNEUMATIC LINES, ETC.) WITHIN THE FIRST ACCESSIBLE 5' OF PIPES ENTRY INTO BUILDING.

(F) BUILDING STEEL BOND WIRE (IF REQUIRED PER BUILDING CONSTRUCTION TYPE). REFER TO CHART FOR MINIMUM SIZE.

(G) BOND WIRE FOR USE WITH MULTIPLE SERVICE's (WHEN PRESENT). REFER TO CHART FOR MINIMUM SIZE.

(H) INTEGRATED (FACTORY BONDED) BUS BAR CASE BOND. REFER TO CHART FOR MINIMUM CONDUCTOR SIZE.

(J) INTEGRATED (FACTORY INSTALLED) GROUND BUS BAR. SHALL BE SIZED TO ACCOMMODATE GROUND WIRE LUGS AS INDICATED ON THE ONE-LINE DIAGRAM.

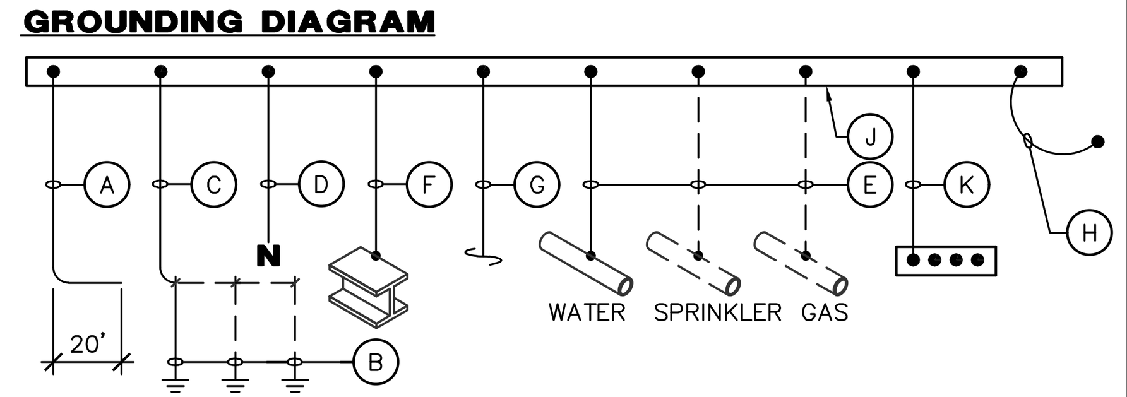
(K) INTERSYSTEM BONDING TERMINATION BAR, W/ MIN. 3 POINTS OF CONNECTION FOR OTHER SYSTEMS. CONDUCTOR SHALL BE MIN. #6 CU, UNLESS SPECIFIED ELSEWHERE.

CONDUCTOR SIZE CHART

SES AMPACITY	(A)	(B)	(C)	(D)	(E)	(F) (G)	(H)
800 AMP	#4	5/8" x 10' (x2)	#4	#3/0	#3/0	#3/0	#3/0
2000 AMP	#4	5/8" x 10' (x2)	#4	#350	#3/0	#3/0	#350

ALL SIZES SHOWN ARE FOR COPPER CONDUCTORS. ALUMINUM IS NOT PERMITTED.

GROUNDING DIAGRAM



GENERAL NOTES - GROUNDING DIAGRAM

1. THIS DETAIL IS PROVIDED IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE ARTICLE 250 PERTAINING TO THE "GROUNDING ELECTRODE SYSTEM".
2. SPLICING OF CONDUCTORS SHALL BE ACCOMPLISHED VIA EXOTHERMIC WELD (CAD WELD) ONLY.
3. ALL CONNECTIONS TO GROUND RODS BELOW GRADE OR IN CONCRETE SHALL BE MADE VIA EXOTHERMIC WELD (CAD WELD) ONLY. CONNECTIONS MADE ABOVE GROUND LEVEL CAN BE ACCOMPLISHED UTILIZING A U.L. LISTED MECHANICAL CLAMP SUITABLE FOR THE PURPOSE.
4. ANY VARIANCE FROM THIS DRAWING AND/OR SPECIFICATION MUST BE REQUESTED AND APPROVED IN WRITING PRIOR TO INSTALLATION.
5. ALL INSTALLATIONS SHALL COMPLY WITH THE LATEST ADOPTED EDITION OF ARTICLE 250 (ALL SUBPARAGRAPHS) OF THE NATIONAL ELECTRICAL CODE AND ALL STATE AND LOCAL CODE REQUIREMENTS.
6. THE GROUNDING SYSTEM SHALL PROVIDE NO GREATER THAN (5) FIVE OHMS RESISTANCE TO GROUND AT THE SERVICE CONNECTION. THE RESULTS SHALL BE VERIFIED BY AN INDEPENDENT TESTING AGENCY VIA GROUND TEST (FALL-OF-POTENTIAL) AND SUBMITTED IN ACCORDANCE WITH THE ELECTRICAL SPECIFICATIONS CONTAINED HEREIN.
7. THE GROUNDING ELECTRODE SYSTEM SHALL CONSIST OF GROUNDING ELECTRODES, ITEMS A (CONCRETE-ENCASED ELECTRODE (A.K.A. UFER), AND GROUND ROD(S) ITEM B. METAL UNDERGROUND WATER PIPE WITH 10' IN CONTACT WITH EARTH, AS DEFINED IN NEC 250.52(A)(1) AND METAL IN-GROUND SUPPORT STRUCTURE IN CONTACT WITH EARTH AS DEFINED IN 2017 NEC 250.52(A)(2) SHALL BE BONDED WITH ITEMS A & B AS PART OF THE GROUNDING ELECTRODE SYSTEM.
8. GROUNDING ELECTRODE CONDUCTORS , ITEMS: A AND C, ((F) CONNECTION TO METAL FRAME AND (E) CONNECTION TO UNDERGROUND WATER PIPE, WHEN CONSIDERED A GROUNDING ELECTRODE), SHALL EACH BE MADE IN SEPARATE CONDUCTORS AND SUITABLY PROTECTED BY CONDUIT WHERE EXPOSED TO DAMAGE OR THEFT. CONDUITS THAT ARE NOT CONTINOUS FROM GROUNDING ELECTRODE TO CABINET/ENCLOSURE SHALL BE BONDED TO THE GEC PER NEC 250.64(E).
9. EXPOSED STRUCTURAL METAL AND METAL PIPING (NOT CONSIDERED A GROUNDING ELECTRODE) SHALL BE BONDED TO THE GROUNDING ELECTRODE SYSTEM AS INDICATED ON DETAIL, CONNECTIONS E AND F, IN ACCORDANCE WITH BONDING REQUIREMENT IN ARTICLE 250 PART V.

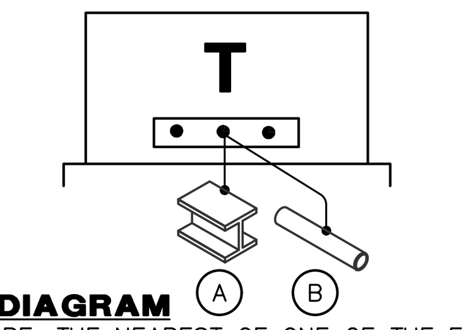
TRANSFORMER GROUND DETAIL

GROUND SIZE CHART

SEE NOTE 6 FOR GEC SIZING.

	TRANSFORMER SIZE (kVA)	GEC SIZE (Cu.)
*	75kVA	#2

GROUNDING DIAGRAM



KEY NOTES - GROUNDING DIAGRAM

WHEN PRESENT AT BUILDING OR STRUCTURE, THE NEAREST OF ONE OF THE FOLLOWING GROUNDING ELECTRODES, AS DEFINED BY 250.52(A)(1),(2), SHALL BE USED AS THE TRANSFORMER GROUND. SEE NOTE 5. BELOW FOR BONDING NOTE. (ADDITIONAL TO GROUNDING REQUIREMENTS OF SEPARATELY DERIVED SYSTEM PER NEC 250.30)

(A) METAL FRAME OF BUILDING OR STRUCTURE. REFER TO CHART FOR MINIMUM GROUNDING ELECTRODE CONDUCTOR SIZE.

(B) METAL UNDERGROUND WATER PIPE. REFER TO CHART FOR MINIMUM GROUNDING ELECTRODE CONDUCTOR SIZE. .

GENERAL NOTES - GROUNDING DIAGRAM

1. ANY OF THE OTHER ELECTRODES IDENTIFIED IN NEC 250.52(A) SHALL BE USED IF THE ELECTRODES SPECIFIED ABOVE ARE NOT AVAILABLE.
2. THIS DETAIL IS PROVIDED IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE ARTICLES 250 AND 450 PERTAINING TO THE "GROUNDING ELECTRODE SYSTEM".
3. ANY VARIANCE FROM THIS DRAWING AND/OR SPECIFICATION MUST BE REQUESTED AND APPROVED IN WRITING PRIOR TO INSTALLATION.
4. ALL INSTALLATIONS SHALL COMPLY WITH THE LATEST ADOPTED EDITION OF ARTICLE 250 AND 450 (ALL SUBPARAGRAPHS) OF THE NATIONAL ELECTRICAL CODE AND ALL STATE AND LOCAL CODE REQUIREMENTS.
5. WHEN ITEMS A AND B ABOVE CANNOT BE USED AS A GROUNDING ELECTRODE, PROVIDE BONDING OF SEPARATELY DERIVED SYSTEMS TO PIPING SYSTEMS AND EXPOSED STRUCTURAL STEEL PER NEC 250.104 IN ADDITION TO GROUNDING REQUIREMENTS.
6. GEC SIZED PER NEC 250.66 BASED ON SECONDARY CONDUCTORS OF TRANSFORMER (SEPARATELY DERIVED SYSTEM 250.30)

SES LOAD SUMMARY

CONNECTED LOAD ON PANEL "HP"	=	15618 VA
CONNECTED LOAD ON PANEL "HSE"	=	172139 VA
CONNECTED LOAD ON PANEL "HSM"	=	120752 VA
CONNECTED LOAD ON PANEL "HSW"	=	128542 VA
FIRE PUMP (124FLA)	=	103044 VA
TOTAL ESTIMATED LOAD ON S.E.S.	=	540095 VA
TOTAL ESTIMATED LOAD ON S.E.S. @ 480V 3ø	=	650 A

FAULT CALCULATIONS

The following calculations are based on the "Point-to-Point" method

Three Phase:

$$f = \frac{\sqrt{3} \times L \times Isc_1}{C \times Vp}$$
$$M = 1/(1+f)$$
$$Isc_2 = Isc_1 \times M$$

Single Phase:

$$f = \frac{2 \times L \times Isc_1}{C \times Vp}$$
$$M = 1/(1+f)$$
$$Isc_2 = Isc_1 \times M$$

Three Phase Xfmr:

$$f = \frac{\sqrt{3} \times Isc_1 \times Vp \times \%Z}{100{,}000 \times kVA}$$
$$Isc_2 = \frac{Vp \times M \times Isc_1}{Vs}$$

Single Phase Xfmr:

$$f = \frac{Isc_1 \times Vp \times \%Z}{100{,}000 \times kVA}$$
$$Isc_2 = \frac{Vp \times M \times Isc_1}{Vs}$$

NOTE: CONDUCTOR LENGTHS SHOWN ARE SHORTEST-PATH FOR USE IN CALCULATIONS ONLY AND ARE NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION. ACTUAL LENGTHS MUST BE MEASURED & VERIFIED BY THE CONTRACTOR, AND **REPORTED TO ENGINEER** IF DESIGN CHANGES ARE REQUIRED.

F#	SOURCE	Isc_1	C.	(SETS) OF WIRE SIZE	TYP.	'C' VALUE	Vp/(Vs)	ø	'L' feet	Xfmr kVA	Xfmr %Z	Isc_2
1	SES	36271	NM	(1) OF #3/0's	Cu.	13923	480	3	40	N/A	N/A	26359
1A	F1	26359	N/A	(-) OF N/A	N/A	N/A	480/208	3	N/A	75	3.4	5563
1B	F1	26359	NM	(1) OF #12's	Cu.	617	277	1	15	N/A	N/A	4685
2	SES	36271	NM	(2) OF #3/0's	Cu.	13923	480	3	260	N/A	N/A	16323
2A	F2	16323	N/A	(-) OF N/A	N/A	N/A	480/208	3	N/A	75	3.4	5267
3	SES	36271	NM	(2) OF #3/0's	Cu.	13923	480	3	35	N/A	N/A	31147
3A	F3	31147	N/A	(-) OF N/A	N/A	N/A	480/208	3	N/A	75	3.4	5642
4	SES	36271	NM	(2) OF #3/0's	Cu.	13923	480	3	260	N/A	N/A	16323
4A	F4	16323	N/A	(-) OF N/A	N/A	N/A	480/208	3	N/A	75	3.4	5267

GENERAL NOTES - ONE-LINE

1. THE ELECTRICAL CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS TO FULLY FAMILIARIZE HIMSELF WITH ALL EXISTING CONDITIONS PRIOR TO BID. NO ADDITIONAL CONSIDERATIONS WILL BE ALLOWED AFTER THE BID.
2. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR INSTALLING ALL INDICATED EQUIPMENT TO CODE COMPLIANT CLEARANCES. PROVIDE SUBMITTALS AS INDICATED IN SPECIFICATIONS TO PROPERLY COORDINATE PHYSICAL LOCATIONS OF NEW AND/OR EXISTING EQUIPMENT.
3. REFER TO ELECTRICAL SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS AND COMPLETE CONTRACTUAL OBLIGATIONS.
4. ALL DASHED LINES ARE INDICATING EXISTING EQUIPMENT.
5. GFP MUST BE ON-SITE TESTED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. ELECTRICAL CONTRACTOR SHALL PROVIDE COPY OF MANUFACTURER'S INSTRUCTIONS AND TEST RESULTS TO AUTHORITY HAVING JURISDICTION.
6. ALL EQUIPMENT RATED @ 1000 AMPS OR MORE SHALL BE TESTED IN CONFORMANCE WITH UL STANDARD 869 OR 891 FOR INSULATION BREAKDOWN PRIOR TO ITS BEING ENERGIZED. THIS TEST SHALL BE PERFORMED BY A TESTING FACILITY APPROVED BY THE BUILDING OFFICIAL. (SEE SECTION 4.6 OF ELECTRICAL SYSTEM SPECIFICATIONS)
7. THE ELECTRICAL CONTRACTOR SHALL PROVIDE FOR AND COORDINATE ALL TESTING AND INSPECTIONS REQUIRED BY THE AUTHORITY HAVING JURISDICTION, AND SHALL PROVIDE WRITTEN REPORTS TO THE ENGINEER OF ALL TEST RESULTS AND INSPECTION REPORTS FOR THIS DISCIPLINE.
8. WHERE SPECIAL INSPECTION/OBERVATION IS REQUIRED, QUALIFIED 3RD PARTY INDIVIDUALS ACCEPTABLE TO THE AUTHORITY HAVING JURSIDICTION SHALL WORK DIRECTLY FOR THE OWNER TO PERFORM ALL REQUIRED TESTING & INSPECTION.
9. UPON SUBSTANTIAL COMPLETION, THE ELECTRICAL CONTRACTOR SHALL NOTIFY THE ENGINEER AND SHALL ALLOW, AT THE ENGINEERS DISCRETION, FOR THE INSPECTION OF NEW WORK PRIOR TO ENERGIZING.
10. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ARC-FLASH HAZARD WARNING FIELD LABELING TO ELECTRICAL EQUIPMENT IN ACCORDANCE WITH NEC 110.16.
11. THE ELECTRICAL CONTRACTOR SHALL PROVIDE MAXIMUM AVAILABLE FAULT CURRENT FIELD LABELING TO SERVICE EQUIPMENT INSTALLED IN OTHER THAN DWELLING UNITS IN ACCORDANCE WITH NEC 110.24.
12. THE ELECTRICAL CONTRACTOR SHALL PROVIDE CIRCUIT DIRECTORY OR CIRCUIT IDENTIFICATION FOR PANELBOARDS AND SOURCE OF SUPPLY FOR SWITCHBOARDS AND PANELBOARDS SUPPLIED BY A FEEDER IN OTHER THAN ONE- TWO-FAMILY DWELLINGS IN ACCORDANCE WITH NEC 408.4(A)&(B).
13. WHERE A RACEWAY ENTERS A BUILDING OR STRUCTURE FROM AN UNDERGROUND DISTRIBUTION SYSTEM, ELECTRICAL CONTRACTOR SHALL PROVIDE RACEWAY SEALS PER NEC 225.27.

KEYED NOTES

(1) UTILITY COMPANY PRIMARY CONDUIT AND CONDUCTORS.

(2) (10) 4" UNDERGROUND SECONDARY CONDUITS TO UTILITY COMPANY PAD MOUNTED TRANSFORMER.

(3) UTILITY PAD MOUNTED TRANSFORMER.

(4) REFER TO SES BONDING AND GROUNDING DETAIL THIS SHEET FOR MORE INFORMATION.

(5) GROUND FAULT PROTECTION (GFP) DEVICE. ELECTRICAL CONTRACTOR SHALL PROVIDE GFP SETTING BASED ON DEVICE COORDINATION STUDY AS NOTED IN ELECTRICAL SPECIFICATIONS SECTION 6.11 PROTECTIVE DEVICE COORDINATION STUDY.

(6) (4) #3/0's Cu., (1) #6 Cu. E.G. – 2" C.

(7) (3) #1's Cu., (1) #6 Cu. E.G. – 1 1/2" C.

(8) 75KVA STEP-DOWN TRANSFORMER 480V, 3ø PRIMARY – 208Y/120V., 3ø, 4W SECONDARY, NEMA 1 5%Z.

(9) (4) #4/0's Cu., (1) #2 Cu. E.G. – 2 1/2" C.

(10) (2) SETS OF (4) #3/0's Cu., (1) #2 Cu. E.G. – 2" C. EACH

(11) PROVIDE (2) 3" EMPTY CONDUITS STUBBED OUT OF S.E.S. REFER TO FLOOR PLAN FOR ADDITIONAL INFORMATION. VERIFY STUB LOCATION WITH OWNER PRIOR TO ROUGH-IN.

(12) PROVIDE (1) 3" AND (2) 3" EMPTY CONDUITS STUBBED OUT OF S.E.S. REFER TO FLOOR PLAN FOR ADDITIONAL INFORMATION. VERIFY STUB LOCATION WITH OWNER PRIOR TO ROUGH-IN.

(13) SERVICE CONDUCTORS FOR FIRE PUMP SHALL BE IN SCHEDULE 40 WITH RIGID RISER AND ROUTED OUTSIDE OF BUILDING PER NEC 695.

(14) PROVIDE 600V., 800A, 3P WITH (3) 800A LPSRK FUSES, BRACED AT 100,000AIC, NEMA 3R SERVICE RATED DISCONNECT SWITCH TO BE SUITABLY REMOTE. PROVIDE MAIN BONDING JUMPER. SEE ITEM "D" IN BONDING AND GROUNDING DETAIL THIS SHEET.

(15) (4) #3/0's Cu.(SERVICE CONDUCTORS), (1) #4 Cu. SUPPLY-SIDE EQUIPMENT BONDING JUMPER (PER NEC 250.92(A)) IN 2 1/2" C.

(16) (3) #3/0's Cu., (1) #1/0 Cu. E.G. – 2" C. E.G. SIZED BASED ON 800A OCPD PER NEC TABLE 250.122.

(17) PROVIDE SEPERATE SECTION FOR FIRE PUMP TAP CONNECTION. PROVIDE PLAQUE ON SECTION STATING "FIRE PUMP TAP CONNECTION LOCATED BEHIND COVER. DISCONNECTING MEANS LOCATED IN FIRE PUMP ROOM."

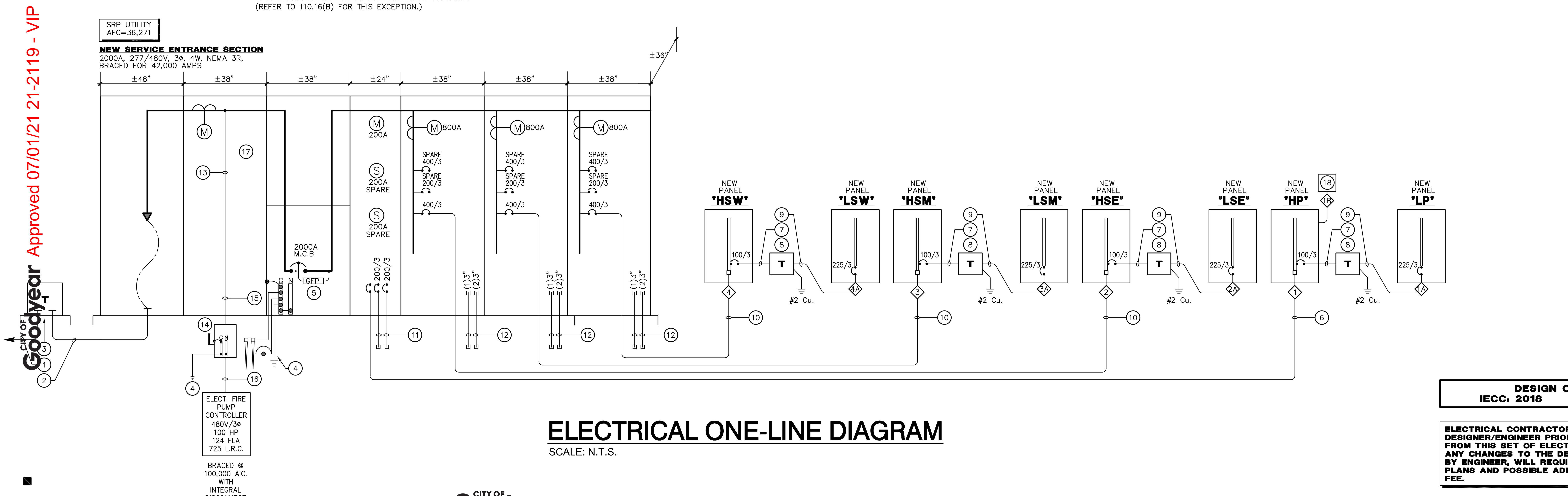
(18) DIMMING LIGHTING RELAY CONTROL PANEL TO COMPLY WITH 2018 IECC EXTERIOR LIGHTING CONTROLS. PROVIDE (1) 20A 277 HID RATED RELAY PER CIRCUIT ROUTED THRU RELAY CONTROL PANEL. PROVIDE A VOLTAGE BARIER AND ALL NECESSARY COMPONENTS FOR A SYSTEM IN COMPLIANCE WITH IECC 405. COORDINATE EXACT PROGRAMMING AND RELAY SWITCH LOCATIONS PRIOR TO ROUGH-IN.

PER NEC 2017 240.87, ELECTRICAL CONTRACTOR SHALL COORDINATE A METHOD TO REDUCE CLEARING TIME FOR ARC ENERGY REDUCTION WITH MANUFACTURER FOR ANY CIRCUIT BREAKER RATED 1200A OR HIGHER. REFER TO NEC 240.17(B) FOR APPROVED METHODS.

PER NEC 2017 110.16(B), ELECTRICAL CONTRACTOR SHALL VERIFY THAT A PERMANENT LABEL HAS BEEN FIELD OR FACTORY APPLIED TO SERVICE EQUIPMENT RATED 1200 AMPS OR MORE. LABEL SHALL MEET THE REQUIREMENTS OF 110.21(B) AND CONTAIN THE FOLLOWING INFORMATION:

1. **NOMINAL VOLTAGE**
2. **AVAILABLE FAULT CURRENT AT THE SERVICE OVERCURRENT PROTECTIVE DEVICES.**
3. **THE CLEARING TIME OF SERVICE OVERCURRENT PROTECTIVE DEVICES BASED ON THE AVAILABLE FAULT CURRENT AT THE SERVICE EQUIPMENT.**
4. **THE DATE LABEL WAS APPLIED.**

NOTES:
1. ITEM #3 SHALL BE VERIFIED BY OCPD MANUFACTURER.
2. THIS LABEL IS NOT REQUIRED IF AN ARC FLASH STUDY IS PROVIDED AND EQUIPMENT HAS ARC FLASH LABEL APPLIED IN ACCORDANCE WITH ACCEPTABLE INDUSTRY PRACTICE. (REFER TO 110.16(B) FOR THIS EXCEPTION.)



ELECTRICAL ONE-LINE DIAGRAM

SCALE: N.T.S.

DESIGN CODES
IECC: 2018 NEC: 2017

ELECTRICAL CONTRACTOR SHALL NOTIFY DESIGNER/ENGINEER PRIOR TO ANY DEVIATION FROM THIS SET OF ELECTRICAL DESIGN PLANS. ANY CHANGES TO THE DESIGN, IF APPROVED BY ENGINEER, WILL REQUIRE REVISIONS TO PLANS AND POSSIBLE ADDITIONAL SERVICE FEE.

Project Contact/Designer: MINDY ADLER
Project # 21058
HAWKINS DESIGN GROUP INC.
ELECTRICAL CONSULTING ENGINEERS
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EMAIL. email@hawkinsdg.com

IF DRAWING IS NOT PLOTTED AT 24 X 36 THEY ARE NOT FULL SIZE

Registered Professional Engineer (Electrical) CERTIFICATE NO. 52649 ARMANDO GARCIA Date Signed 04/13/2021 ARIZONA, U.S.A.

SUN STATE BUILDERS

BALMER architectural group inc

VIP PRODUCTS
GOODYEAR, AZ.
ELECTRICAL ONE-LINE DIAGRAM

E-500
40012.010
24FEB21

CITY OF Goodyear Approved 07/01/21 21-2119 - VIP PRODUCTS
CITY OF Goodyear Approved 07/01/21 21-2119 - VIP PRODUCTS
CITY OF Goodyear Approved 07/01/21 21-2119 - VIP PRODUCTS