

# INSTALL ROOF MOUNTED SOLAR PANEL ARRAY & LED LIGHTING FMS BUILDING- READINESS CENTER CAPE GIRARDEAU, MISSOURI

OWNER: STATE OF MISSOURI  
MICHAEL L. PARSON,  
GOVERNOR

DEPARTMENT OF PUBLIC  
SAFETY OFFICE OF THE  
ADJUTANT GENERAL  
MISSOURI NATIONAL GUARD  
FACILITIES DIVISION

PROJECT  
MANAGEMENT: OFFICE OF ADMINISTRATION  
DIVISION OF FACILITIES MANAGEMENT,  
DESIGN AND CONSTRUCTION

DESIGNER: ETEGRA

PROJECT NUMBER: T2032-01

ASSET NUMBER: 8136308002



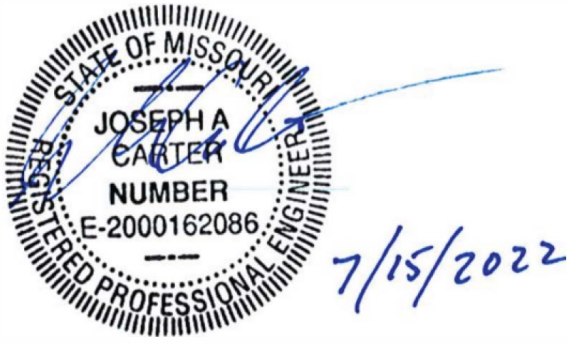
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## DRAWING INDEX

GENERAL  
G-001 COVER SHEET  
ELECTRICAL  
E-001 ELECTRICAL SYMBOLS ABBREVIATIONS AND NOTES  
ED-101 DEMOLITION LIGHTING PLAN  
E-101 LIGHTING PLAN  
E-102 ROOF SOLAR PANEL PLAN  
E-501 DETAILS AND SCHEMATICS  
E-601 LIGHTING FIXTURE SCHEDULE



1 VICINITY MAP  
NTS



SHEET NUMBER:

G-001

1 OF 7 SHEETS  
07/15/2022





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2626 INDEPENDENCE DR.  
CAPE GIRARDEAU, MO 63703

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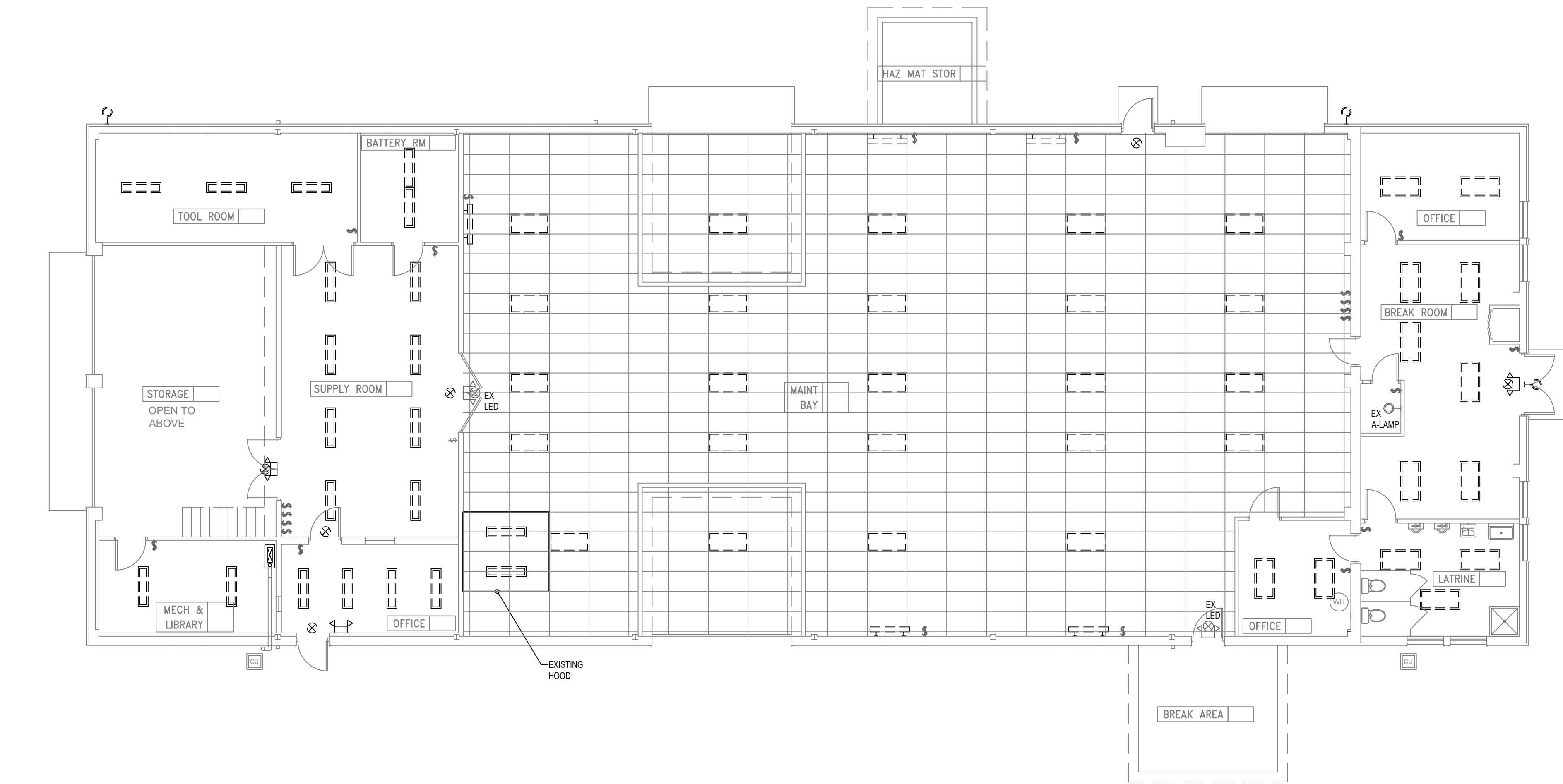
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DRAWN BY: DFP  
CHECKED BY: JCF  
DESIGNED BY: JAC

SHEET TITLE:  
ELECTRICAL  
SYMBOLS  
ABBREVIATIONS  
AND NOTES

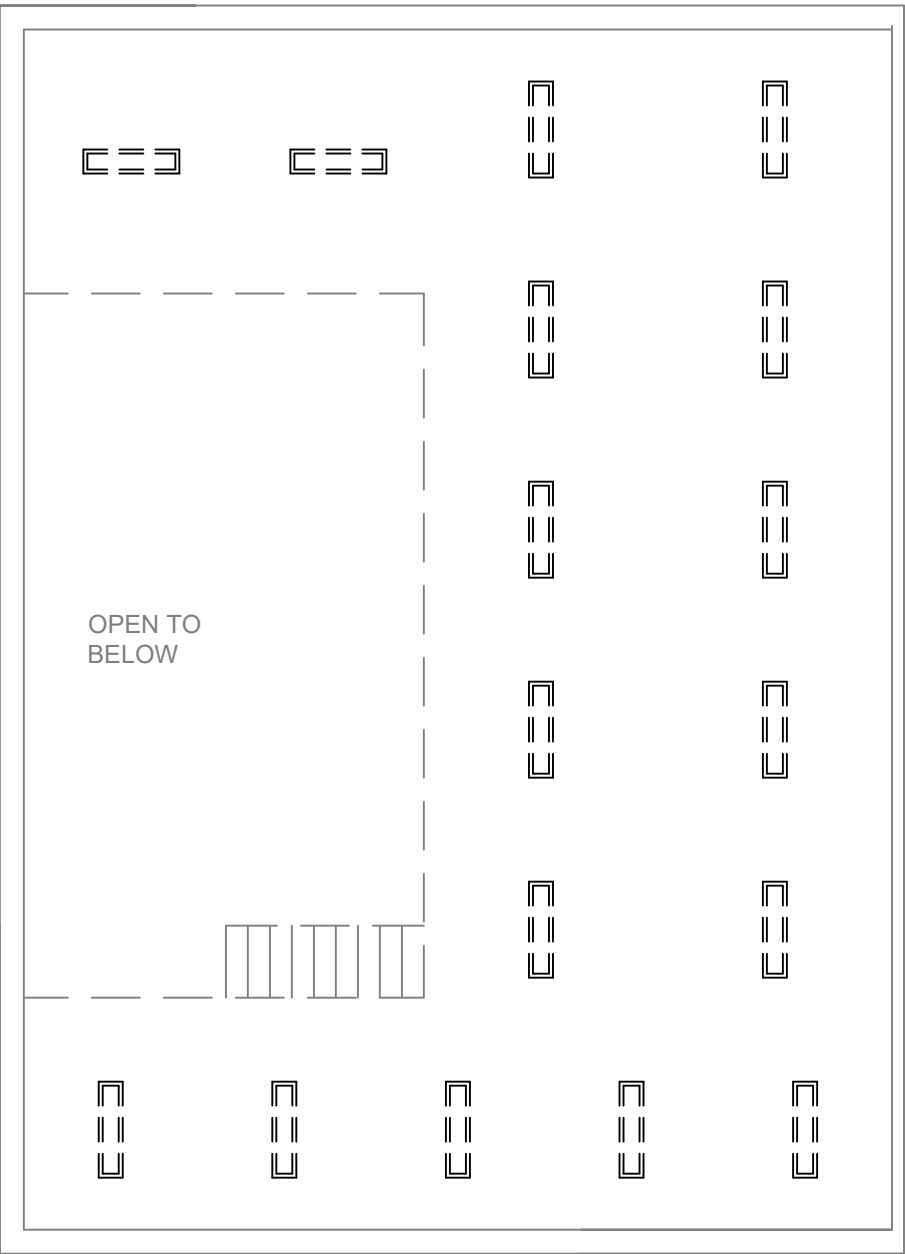
SHEET NUMBER:

E-001

ELECTRICAL SYMBOLS				ABBREVIATIONS		GENERAL NOTES
LIGHTING		POWER		ONE-LINE DIAGRAM		
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	
	LIGHT FIXTURE - 2x4 LED SURFACE MOUNT		CONDUIT ROUTING ABOVE GRADE		MECHANICAL EQUIPMENT TAG	A-AMP
	LIGHT FIXTURE - 2x4 LED RECESSED		CONDUIT ROUTING BELOW GRADE (DIRECT BURIED)		DELTA CONNECTION	AC
	LIGHT FIXTURE - 2x2 LED SURFACE MOUNT		UNDERGROUND DUCT BANK		TRANSFORMER ONE-LINE DIAGRAM	AF
	LIGHT FIXTURE - 2x2 LED RECESSED		CLOCK HANGER RECEPTACLE		WYE CONNECTION	AFB
	LIGHT FIXTURE - 1X4 LED SURFACE MOUNT		DUPLEX RECEPTACLE FLOOR MOUNTED		EARTH GROUND	AFG
	LIGHT FIXTURE - 1X4 LED RECESSED		DUPLEX RECEPTACLE ON EMERGENCY POWER WALL MOUNTED @ 18" A.F.F.		FUSE NUMBER = FUSE RATING	AL
	LIGHT FIXTURE - 1X8 LED SURFACE MOUNT		DUPLEX RECEPTACLE WITH GROUND FAULT CIRCUIT INTERRUPTER WALL MOUNTED @ 18" A.F.F.		NORMALLY CLOSED RELAY CONTACT	
	LIGHT FIXTURE - 1X8 LED RECESSED		QUADRAPLEX RECEPTACLE WALL MOUNTED @ 18" A.F.F.		NORMALLY OPEN RELAY CONTACT	
	LIGHT FIXTURE - LED, PENDANT		QUADRAPLEX RECEPTACLE WALL MOUNTED @ 18" A.F.F.		CIRCUIT BREAKER	
	LIGHT FIXTURE - LED, CAN SURFACE MOUNT		QUADRAPLEX RECEPTACLE FLOOR MOUNTED		BATTERY	
	LIGHT FIXTURE - CAN, RECESSED		EXPLOSION-PROOF SINGLE RECEPTACLE WALL MOUNTED @ 24"A.F.F.		CAPACITOR	
	WALL/CEILING MOUNT SINGLE/DOUBLE FACE EXIT LIGHT		SPECIAL PURPOSE RECEPTACLE WALL MOUNTED @ 18" A.F.F.		LIGHTNING ARRESTOR	
	SINGLE LAMP EMERGENCY LIGHT		SWITCHED DUPLEX RECEPTACLE WALL MOUNTED @ 18" A.F.F.		INVERTER	
	MULTI LAMP EMERGENCY LIGHT		ARC FAULT RECEPTACLE WALL MOUNTED @ 18" AFF		SURGE VOLTAGE PROTECTOR	
	WALL/CEILING MOUNT SINGLE/DOUBLE FACE EXIT LIGHT LETTER DENOTES TYPE		DUPLEX RECEPTACLE W/ (2) USB CHARGING PORTS SURFACE MOUNTED @ 18" AFF		UNINTERRUPTIBLE POWER SUPPLY	
	STREET LIGHT WITH BRACKET		FLOORBOX		CONTROL POWER TRANSFORMER # INDICATES RATIO	
	LIGHTING POST - TWO ARMS, TWO HEADS		CEILING MOUNTED PULL SWITCH		ELECTRICAL METER	
	LIGHT POST WITHOUT ARM		TRANSFORMER		PHOTOVOLTAIC MODULE (SOLAR PANEL), ROOF MOUNTED	
	EXTERIOR BUILDING LIGHTING		UNDERFLOOR DUCT			
	SWITCH - SINGLE POLE WALL MOUNTED @ 48" A.F.F.		JUNCTION BOX			
	SWITCH - DOUBLE POLE WALL MOUNTED @ 48" A.F.F.		CABLE TRAY			
	SWITCH - THREE WAY WALL MOUNTED @ 48" A.F.F.		PULL BOX			
	SWITCH - FOUR WAY WALL MOUNTED @ 48" A.F.F.		WIREWAY			
	SWITCH - KEY OPERATED WALL MOUNTED @ 48" A.F.F.		BUSWAY			
	SWITCH - LOW VOLTAGE MASTER WALL MOUNTED @ 48" A.F.F.		METER			
	SWITCH WITH OCCUPANCY SENSOR WALL MOUNTED @ 48" A.F.F.		SUBSTATION			
	SWITCH - TIMER OPERATED WALL MOUNTED @ 48" A.F.F.		GENERATOR			
	SWITCH WITH VACANCY SENSOR WALL MOUNTED @ 48" A.F.F.		SINGLE OR THREE PHASE MOTOR			
	SWITCH WITH PILOT LIGHT WALL MOUNTED @ 48" A.F.F.		NON-FUSED DISCONNECT SWITCH			
	SWITCH - DIMMER WALL MOUNTED @ 48" A.F.F.		FUSED DISCONNECT SWITCH			
	OCCUPANCY SENSOR - CEILING MOUNTED		COMBINATION STARTER WITH DISCONNECT SWITCH WALL MOUNTED @ 48" A.F.F.			
	DAYLIGHT SENSOR - CEILING MOUNTED		STARTER/MOTOR CONTROLLER WALL MOUNTED @ 48" A.F.F.			
	PHOTO CELL SENSOR		PUSH BUTTON WALL MOUNTED @ 48" A.F.F.			
LIGHT FIXTURE DESIGNATION			CEILING MOUNTED PULL SWITCH			
			TRANSFORMER			
			UNDERFLOOR DUCT			
			JUNCTION BOX			
			CABLE TRAY			
			PULL BOX			
			WIREWAY			
			BUSWAY			
			METER			
			SUBSTATION			
			GENERATOR			
			SINGLE OR THREE PHASE MOTOR			
			NON-FUSED DISCONNECT SWITCH			
			FUSED DISCONNECT SWITCH			
			COMBINATION STARTER WITH DISCONNECT SWITCH WALL MOUNTED @ 48" A.F.F.			
			STARTER/MOTOR CONTROLLER WALL MOUNTED @ 48" A.F.F.			
			PUSH BUTTON WALL MOUNTED @ 48" A.F.F.			
			DISTRIBUTION PANEL - SURFACE MOUNTED			
			DISTRIBUTION PANEL - FLUSH MOUNTED			
			DISTRIBUTION PANEL - FLUSH MOUNTED RP = RECEPTACLE PANEL PP = GENERAL POWER PANEL (MECH LOADS) LP = LIGHTING PANEL TP = TELECOMMUNICATIONS POWER UP = UPS BACKED PANEL			
			DATA ROUGH-IN, PROVIDE 2-GANG BOX AT 24" AFF WITH 1" CONDUIT WITH PULLWIRE ROUTED TO TELECOMMUNICATIONS CABINET. BACKBOX SHALL BE PROVIDED WITH THREADED ENTRIES FOR NPT-THREADED CONDUIT AND FITTINGS			



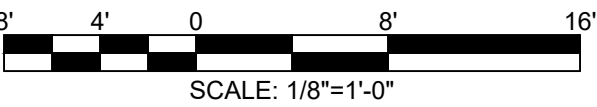
1 DEMOLITION LIGHTING PLAN  
SCALE: 1/8"=1'-0"



2 MEZZANINE DEMOLITION LIGHTING PLAN  
SCALE: 1/8"=1'-0"

GENERAL SHEET NOTES

- 1. EXISTING LIGHT FIXTURES TO BE REPLACED-IN-PLACE. MAINTAIN EXISTING CIRCUITRY FOR REUSE.
- 2. SCREENED DEVICES ARE EXISTING TO REMAIN. DARK, DASHED DEVICES ARE TO BE DEMOLISHED.



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CAD DWG FILE: ED-101.DWG  
DRAWN BY: DFP  
CHECKED BY: JCF  
DESIGNED BY: JAC

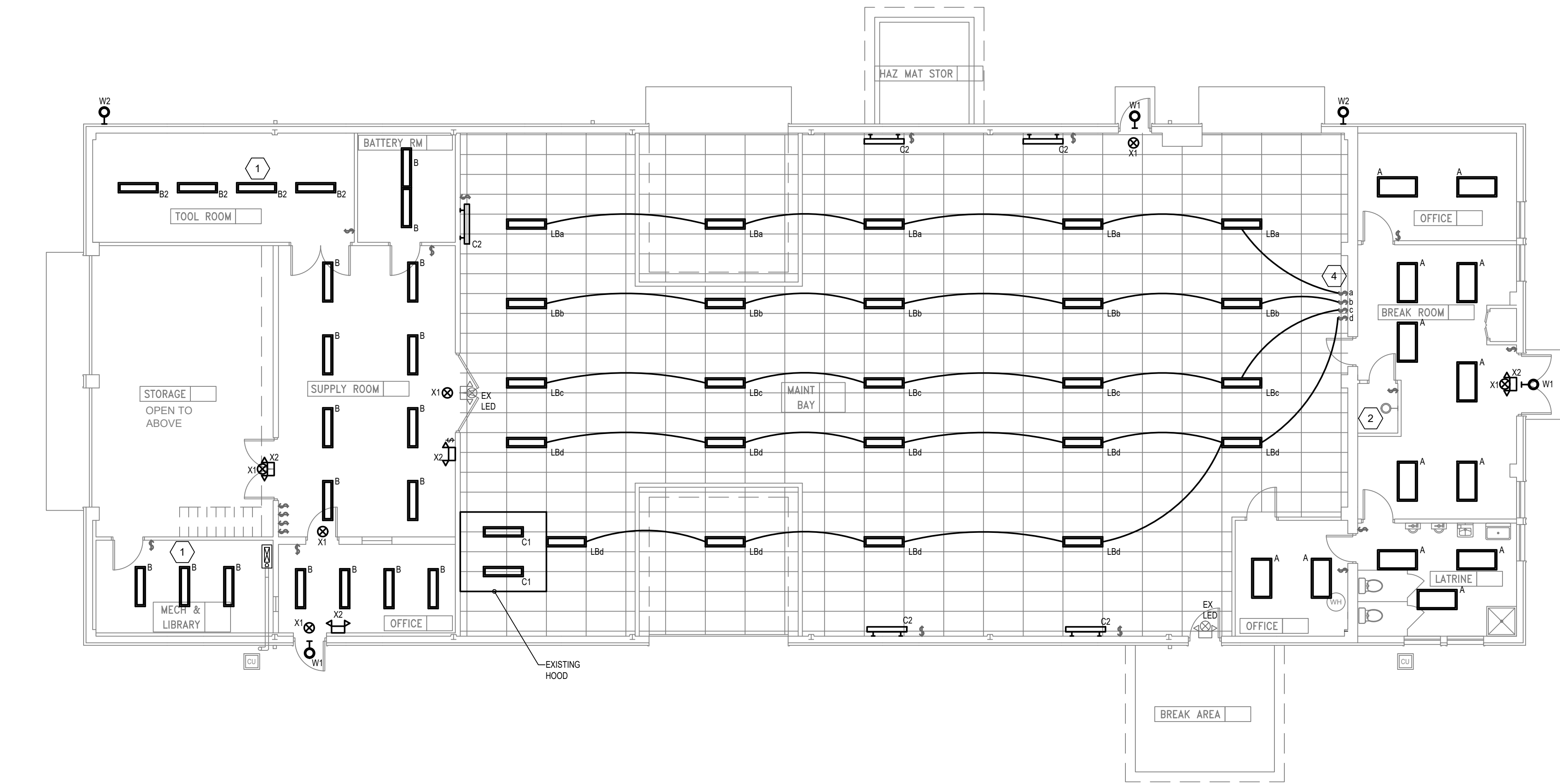
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LIGHTING PLAN

SHEET NUMBER:

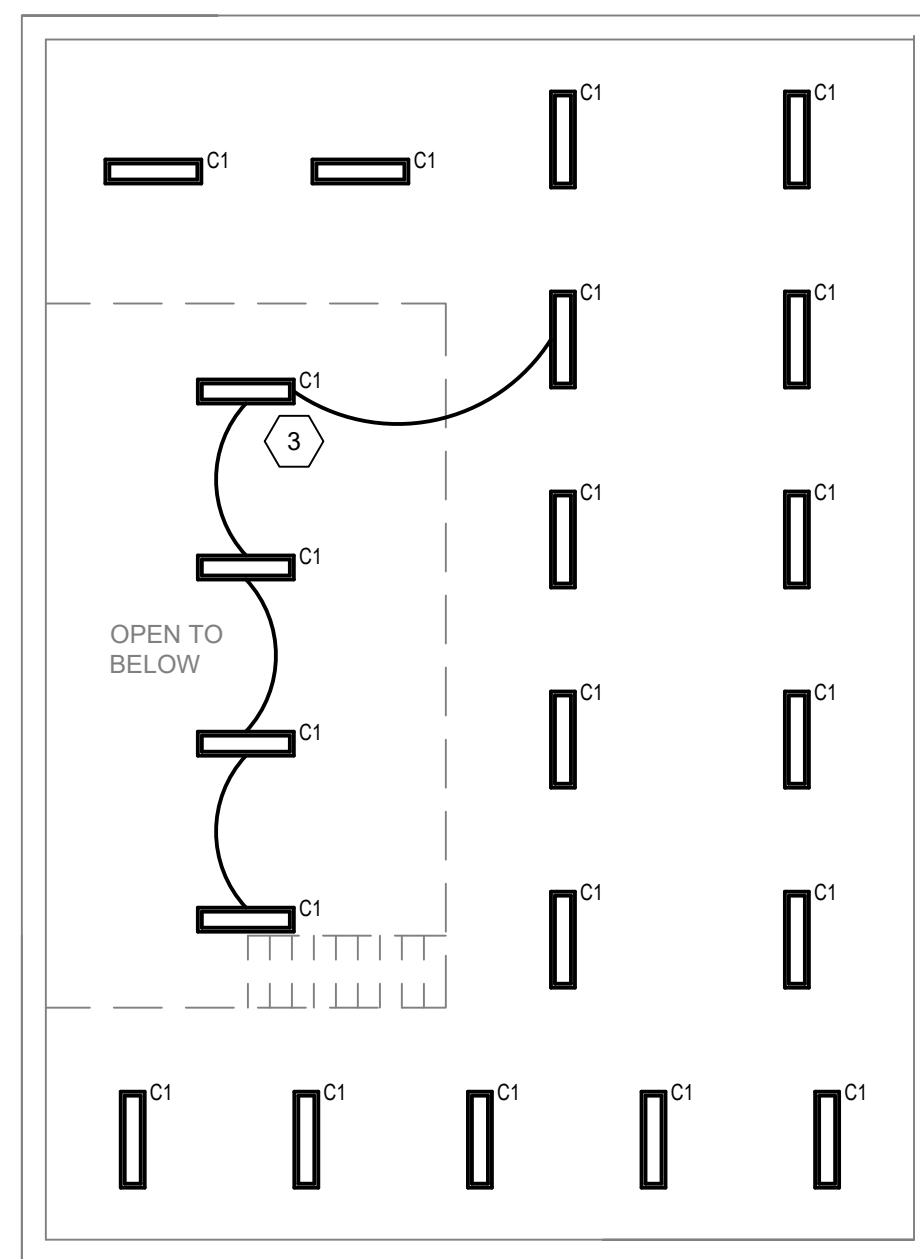
ED-101

3 OF 7 SHEETS  
07/15/2022





1 LIGHTING PLAN  
SCALE: 1/8"=1'-0"



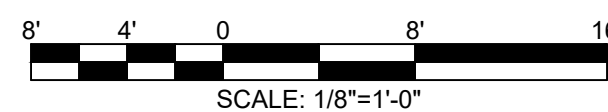
2 MEZZANINE LIGHTING PLAN  
SCALE: 1/8"=1'-0"

## GENERAL SHEET NOTES

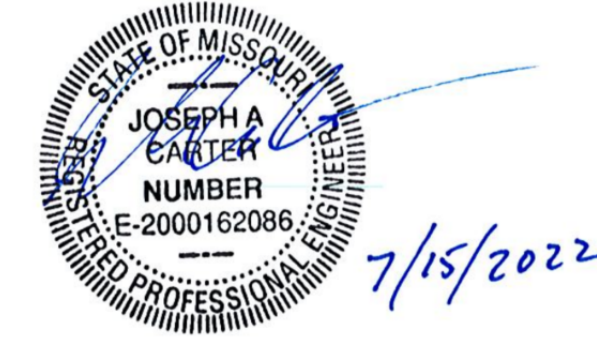
- EXISTING LIGHT FIXTURES TO BE REPLACED-IN-PLACE. REUSE EXISTING CIRCUITRY.
- NEW FIXTURES SHOW DARK, EXISTING FIXTURES ARE LABELED "EX".
- LIGHTING AUTOMATIC CONTROLS ALL NEW LIGHTS SHALL CONTAIN INTEGRAL OCCUPANCY SENSOR. LIGHTING IN VEHICLE MAINTENANCE BAYS SHALL HAVE NO AUTOMATIC CONTROL DUE TO SAFETY OF MECHANIC.

## SHEET KEY NOTES

- ADDITIONAL FIXTURE ADDED TO EXISTING LAYOUT.
- EXISTING A-19 INCANDESCENT LAMP. PROVIDE 60W LED EQUIVALENT.
- EXTEND CIRCUIT TO NEW FIXTURES. NEW LIGHTING SHALL BE CONTROLLED BY SAME SWITCH AS MEZZANINE LIGHTS.
- RE-CIRCUIT LIGHTING SUCH THAT EACH SWITCH CONTROLS A ROW AS SHOWN.



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CAD DWG FILE: E-101.DWG  
DRAWN BY: DFP  
CHECKED BY: JCF  
DESIGNED BY: JAC

SHEET TITLE:  
LIGHTING PLAN

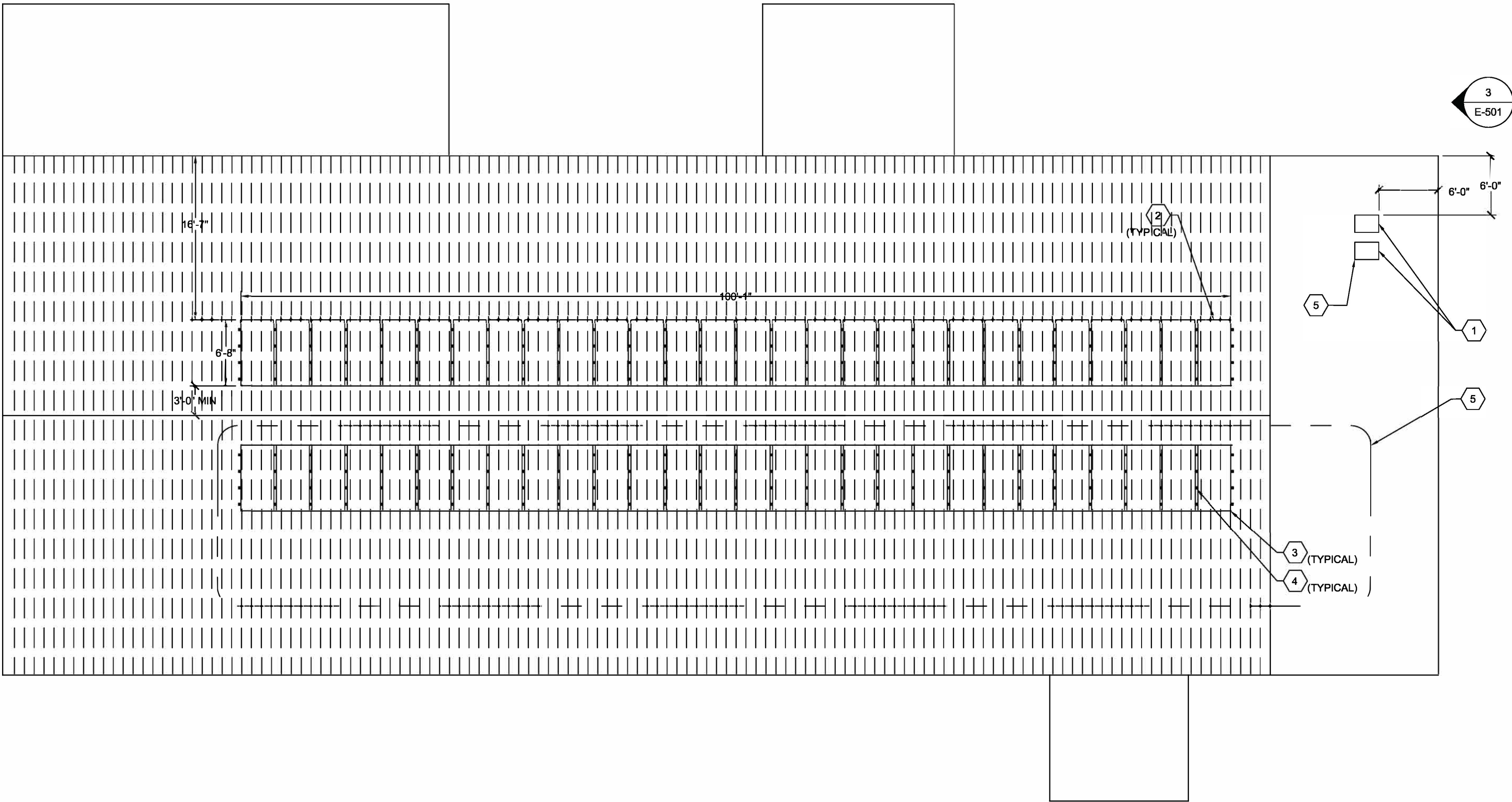
SHEET NUMBER:

E-101

4 OF 7 SHEETS  
07/15/2022



1 ROOF PLAN  
SCALE: 1/8"=1'-0"



**S-5!®**  
The Right Way!

The S-5-PV Kit is a revolutionary new solution to attach solar PV panels to standing seam metal roofs!

The **S-5-PV Kit** is furnished with the hardware shown at right, excluding the attachment clamp, which is supplied separately. (When Proteadbacker™ is used in conjunction with the S-5-PV Kit, an additional nut is required during installation to secure the universal PV stud and mounting disk to Proteadbacker's slanted L-flange.) The S-5-PV Kit is compatible with most common metal roofing materials, including brass. The S-5! **EdgeGrab™** and S-5-PV Kit together accommodate PV frame thicknesses 30-48 mm. (EdgeGrab's serrated L-flange is positioned below the stud's hex nut and 34-51 mm if EdgeGrab's serrated L-flange is positioned above the stud's hex nut.)

The embossed panel guide makes the module placement easier. The mounting disk is multi-directional and rails are not required. Four strategically placed under disk hooks assist in wire management. The PV grab ears that hold the solar panel in place are broader to allow for ease of installation and precise module engagement.

Accommodating module thicknesses between 30 and 51 mm, the S-5-PV Kit fits the majority of solar panels on the market. Using the S-5! mini clamps, it fits most standing seam metal roofs. When paired with other S-5! products, the S-5-PV Kit and EdgeGrab will work on most exposed-fastened and corrugated metal roofs. The standard grab is designed to fit field conditions (two adjacent panels), while the new EdgeGrab is designed specifically for end conditions.

Wind dynamics are complex; thus, each system should be reviewed by a qualified licensed professional who understands wind effects on metal roof design and construction prior to purchase and installation. For more detailed information including specifications, installation instructions, and CAD drawings, visit [www.S-5.com](http://www.S-5.com) or your S-5-PV Kit distributor.

The S-5-PV Kit continues to be the easiest, most cost-effective way to install solar panels directly to standing seam metal roofs, remaining the most popular choice worldwide.

**UL** **ETL** **LISTED**  
Listed to UL subject 7703, ETL Listed to UL 1703.\*

**S-5-PV Kit**  
(UL and ETL Listed)

**EdgeGrab™**  
(Not UL or ETL Listed)

**Please Note:** Dimensions of both the Universal PV Stud and the Mounting Disk are identical between these two iterations.

**Please Note:** The assembly shown in the diagram is the final assembly. The L-flange is positioned below the stud's hex nut.

**Please Note:** All measurements are rounded to the second decimal place.

\* Patents pending. Certain components featured in illustration may not be UL Listed.

Due to the variety of attachment needs, S-5-PV Kit are sold separately from S-5! mini clamps. The S-5-PV Kit fits only S-5! mini clamps, NOT standard clamps.

**1** **2** **3**

**S-5! Warning! Please use this product responsibly!**

Products are provided as a guide only. All components must be installed in accordance with the manufacturer's instructions. The manufacturer is not responsible for any damage or injury resulting from the use of these products. The manufacturer is not responsible for any damage or injury resulting from the use of these products. The manufacturer is not responsible for any damage or injury resulting from the use of these products.

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2 CLIP DETAIL  
SCALE: N.T.S.

GENERAL SHEET NOTES

1. THE SOLAR ARRAY IS ASSUMED TO ADD 2% OF THE STRUCTURE WEIGHT WHICH IS BELOW THE 5% MAXIMUM ALLOWED BY CODE. THE SPACING OF THE PANELS TO STRADDLE THE ROOF PEAK WILL PROVIDE EVEN WEIGHT DISTRIBUTION ACROSS THE ROOF TRUSSES. IT IS ASSUMED THERE IS NO SIGNIFICANT DETERIORATION OF THE BUILDING STRUCTURE AND THE ROOF IS IN RELATIVELY GOOD CONDITION. IF THE CONTRACTOR DISCOVERS THIS TO BE INCORRECT, SOLAR PANEL INSTALLATION SHALL CEASE AND THE CONTRACTOR SHOULD REACH OUT TO THE ARCHITECT FOR FURTHER DIRECTION. LIMITED BUILDING STRUCTURAL INFORMATION OBTAINED FROM ORIGINAL DRAWINGS DATED MAY 28, 1953. BASIS OF DESIGN SHOWS (28) 50.3 LB PANELS PER ROW, TOTALING 1,408 LBS. ACTUAL ROW SHALL NOT EXCEED 1,500 LBS.
2. CONTRACTOR SHALL REVIEW NEC 890 SOLAR PHOTOVOLTAIC (PV) SYSTEMS AND PROVIDE PROPER GROUNDING, RAPID SHUTDOWN, ETC. FOR SAFE, RELIABLE, AND COMPLETE SYSTEM.
3. DESIGN IS PERFORMANCE BASED. PHOTOVOLTAIC SYSTEM TO PROVIDE 20KW OF TOTAL AC POWER. EACH DC MODULE STRING SHALL BE A MINIMUM OF 115% OF INVERTER RATING. BASIS OF DESIGN SHOWS (28) 410W MODULES PER STRING, TOTALING 11.5KW WHICH FEEDS A 10KW INVERTER.

SHEET KEY NOTES

1. MOUNT INVERTER ON ROOF. BASIS OF DESIGN IS FRONIUS SYMO 10.0-3 208-240, 10 KW, 208V/3-PHASE. SEE SPECIFICATIONS FOR APPROVED MANUFACTURERS.
2. MOUNT SOLAR MODULES ON ROOF. PROVIDE PV CLIPS TO STANDING SEAMS OF ROOF. BASIS OF DESIGN IS TRINASOLAR TALLMAX TSM-410 DE15M(I), 410W, (28) PER 10 KW INVERTER. STRING DESIGN FOR DC INPUT KW TO BE 115% MINIMUM OF INVERTER RATING. SEE SPECIFICATIONS FOR APPROVED MANUFACTURERS.
3. PROVIDE CLIPS ATTACHING SOLAR MODULES TO STANDING SEAM ROOF. PROVIDE QUANTITY AND PLACEMENT AS DIRECTED BY MANUFACTURER. SEE DETAIL 2/E-102 FOR REFERENCE INFORMATION. BASIS OF DESIGN IS S-5! S-5-PV KIT AND EDGE GRAB. SEE SPECIFICATIONS FOR APPROVED MANUFACTURERS.
4. PROVIDE CLIPS ATTACHING SOLAR MODULES TO EACH OTHER. PROVIDE QUANTITY AND PLACEMENT AS DIRECTED BY MANUFACTURER. SEE DETAIL 2/E-102 FOR REFERENCE INFORMATION. BASIS OF DESIGN IS S-5! S-5-PV KIT AND EDGE GRAB. SEE SPECIFICATIONS FOR APPROVED MANUFACTURERS.
5. ALTERNATE BID PROVIDE AN ALTERNATE BID FOR (28) SOLAR MODULES ON THE WEST SIDE OF THE ROOF AND INVERTER.



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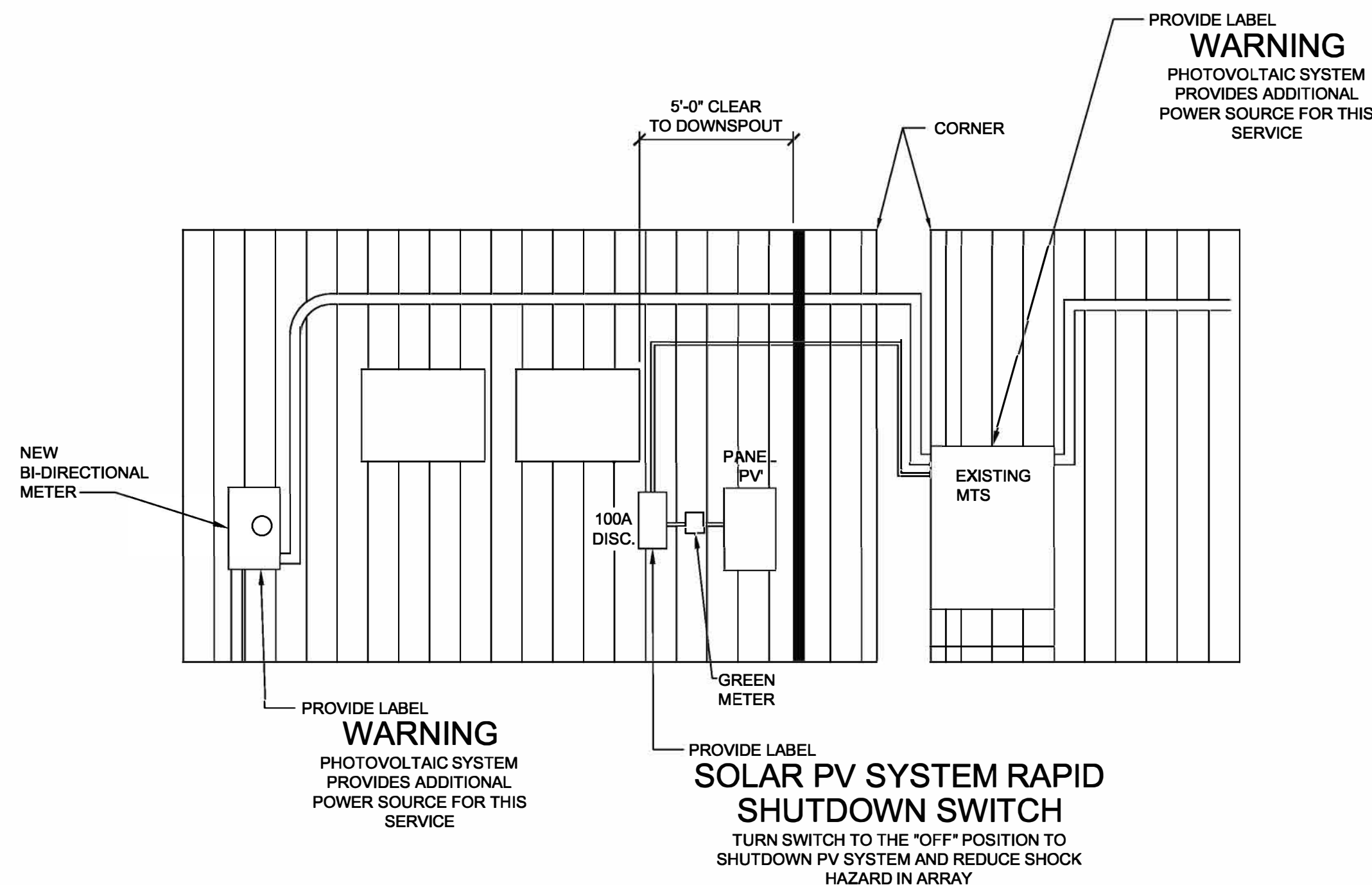
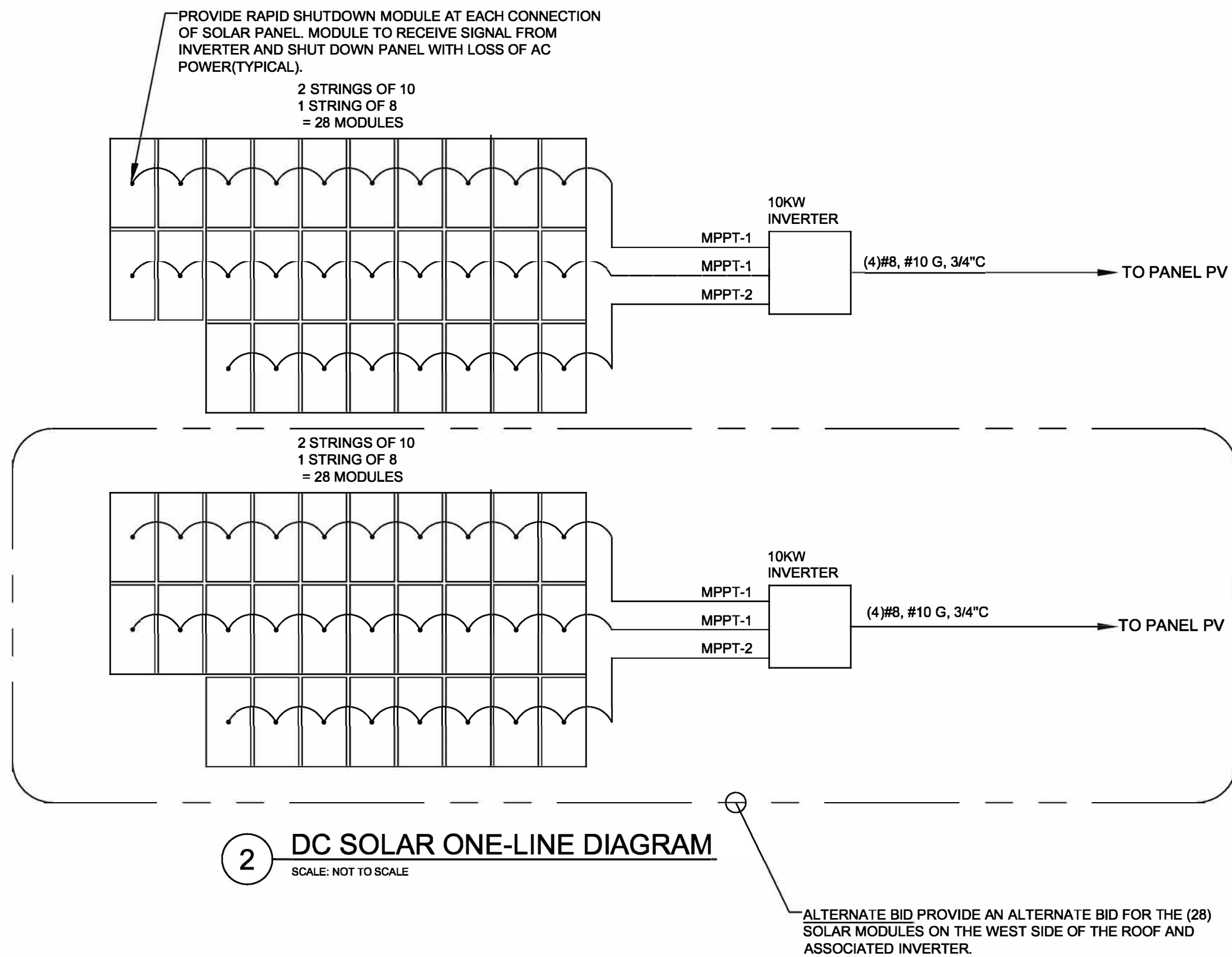
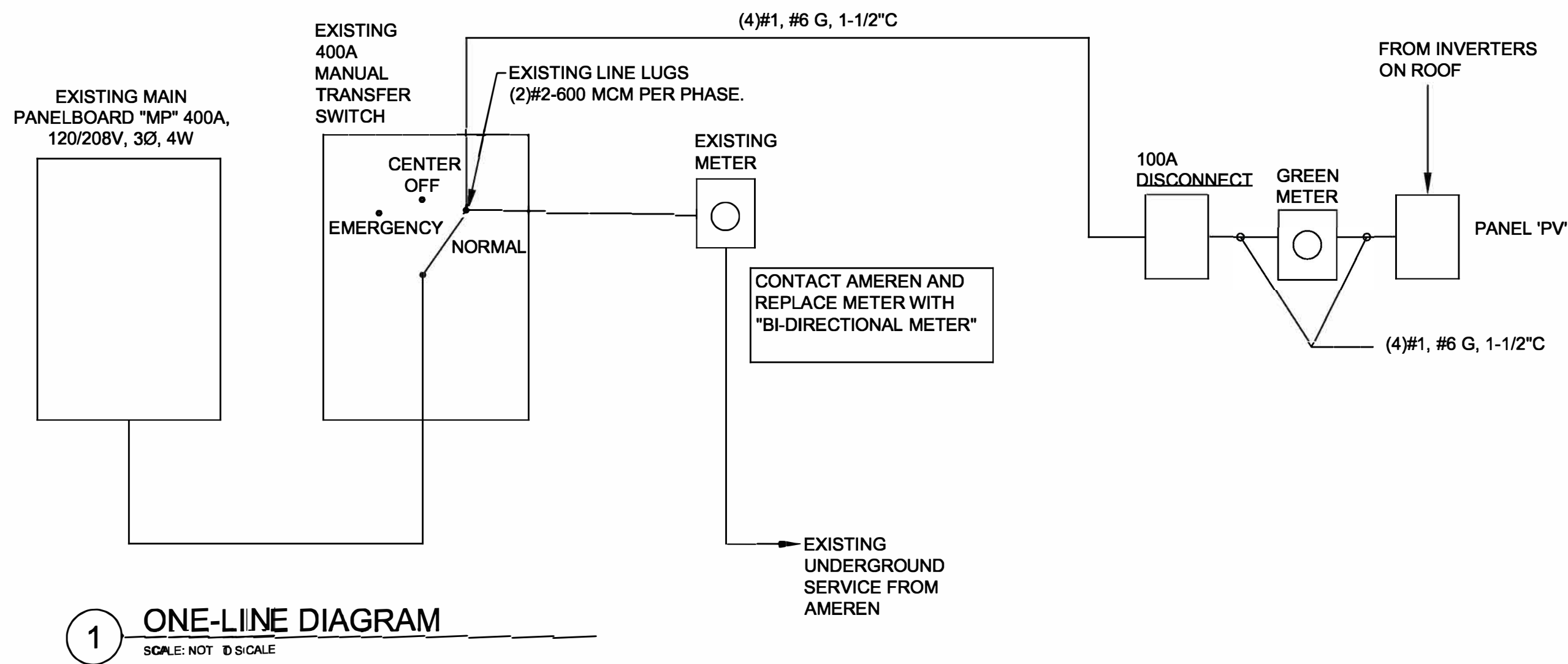
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DRAWN BY: DFP  
CHECKED BY: JCF  
DESIGNED BY: JAC

SHEET TITLE:  
ROOF SOLAR  
PANEL PLAN

SHEET NUMBER:

E-102  
5 OF 7 SHEETS  
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DETAILS AND  
SCHEMATICS

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E-501

6 OF 7 SHEETS  
07/15/2022

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DRAWN BY: DFP  
CHECKED BY: JCF  
DESIGNED BY: JAC

**SHEET NUMBER:**

7 OF 7 SHEETS  
07/ 15/ 2022

PANEL SCHEDULE																				
MOUNT: SURFACE					120/208	3-PHASE, 4W		PANEL		PV		CAPACITY: 100A					INT CAP: 10KA			
LOCATION: EXTERIOR WALL					NEMA 4X		LUGS:		MLO											
CKT	LTG	REC	HVAC	MISC	NP	DESCRIPTION	AMP	POLE	A	AMP	POLE	DESCRIPTION	LTG	REC	HVAC	MISC	NP	CKT		
1				3333		INVERTER 1	35	3	A	35	3	INVERTER 2				3333				
3				3333					B			NOTE B				3333				4
5				3333					C							3333				6
7						PROVISIONS			1	A	1	PROVISIONS						8		
9						PROVISIONS			1	B	1	PROVISIONS						10		
11						PROVISIONS			1	C	1	PROVISIONS						12		
13						PROVISIONS			1	A	1	PROVISIONS						14		
15						PROVISIONS			1	B	1	PROVISIONS						16		
17						PROVISIONS			1	C	1	PROVISIONS						18		
PHASE BALANCE				LOAD TYPE	CONNECTED	DEMAND		DEMAND FORMULA								TOTAL LOAD				
				LIGHTING	0VA	0VA		LOAD X 125% NEC 210.19 CONTINUOUS								CONNECTED	DEMAND			
⊖	LOAD			RECEPTACLE	0VA	0VA		10KVA + 50% REMAINDER NEC 220.44								20,000VA	20,000VA			
A	6666.7 KVA			HVAC	0VA	0VA		LOAD X 80% (USED MCA IN CALCULATION)								55.5A	55.5A			
B	6666.7 KVA			MISC	20,000VA	20,000VA		LOAD X 100% NEC 210.19 NON-CONT.								FILENAME:				
C	6666.7 KVA			NP	0VA	0VA		0 NONCONCIDENTAL LOADS NEC 220.60								PACE Cape Girardeau.xlsm				
NOTES:																				
A. LOAD REPRESENTS POWER PROVIDED BY PHOTOVOLTAIC SYSTEM																				
B. <u>ALTERNATE BID</u> 35A/3P CIRCUIT BREAKER WILL BE "SPARE" IN BASE BID.																				