ROOFTOP PHOTOVOLTAIC INSTALLATION

SPEECH AND HEARING CLINIC
BUILDING NO. 0209
901 SOUTH SIXTH STREET, CHAMPAIGN, IL 61820

LEGEND [ ] - Not included in Sheet Set [/] - Included in Issued Set [X] - Issued with Changes		12.22.2017	
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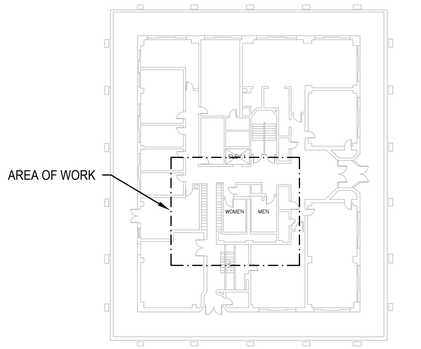
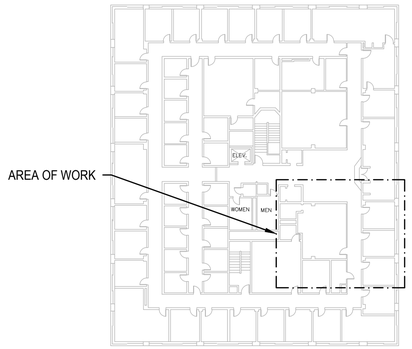
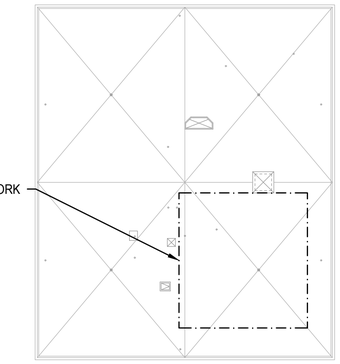


KEY PLAN - 1ST FLOOR
NOT TO SCALE
NORTH



KEY PLAN - 2ND FLOOR
NOT TO SCALE
NORTH



KEY PLAN - ROOF
NOT TO SCALE
NORTH

Facilities & Services
ENGINEERING AND CONSTRUCTION SERVICES / ENGINEERING DESIGN
Physical Plant Service Building
1501 S. Oak St., Champaign, IL
MC-800
General Information: 217.333.0697

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AIM Proj. No. 4791	
ES W/O: 10519389	Date: 22 DEC 2017
Reviewed: BCF	Drawn: WDB/BCF

COVER SHEET

G-001
of 1 sheets

ELECTRICAL SYMBOLS

(NOTE: ALL SYMBOLS MAY NOT BE USED)

- F1 — FIXTURE TYPE
- 23 — CIRCUIT
- a — CONTROL DEVICE
- SURFACE MOUNTED FLUORESCENT TROFFER, NORMAL POWER
- SURFACE MOUNTED FLUORESCENT TROFFER, EMERGENCY POWER
- RECESSED MOUNTED FLUORESCENT TROFFER, NORMAL POWER
- RECESSED MOUNTED FLUORESCENT TROFFER, EMERGENCY POWER
- SUSPENDED MOUNTED FLUORESCENT STRIP OR LINEAR, NORMAL POWER
- SUSPENDED MOUNTED FLUORESCENT STRIP OR LINEAR, EMERGENCY POWER
- SURFACE MOUNTED INCANDESCENT OR HID, NORMAL POWER
- SURFACE MOUNTED INCANDESCENT OR HID, EMERGENCY POWER
- RECESSED MOUNTED INCANDESCENT OR HID, NORMAL POWER
- RECESSED MOUNTED INCANDESCENT OR HID, EMERGENCY POWER
- EXIT SIGN - FACES AND ARROWS AS SHOWN
- BATTERY PACK EMERGENCY LIGHTING
- EMERGENCY LIGHTING
- TRACK LIGHTING - HEADS AS SHOWN
- DIRECTIONAL SPOT LIGHT
- DENOTES WALL MOUNTING
- S A — OCCUPANCY SENSOR
- PP — LOW VOLTAGE POWER PACK
- PC — PHOTOCELL; SWITCHED ONLY
- AAR — ADD-A-RELAY
- PCD — PHOTOCELL; FOR DIMMING CONTROL
- S1 — SPEAKER CLG MOUNTED
- SIMPLEX RECEPTACLE
- DUPLEX RECEPTACLE
- QUADRUPLEX RECEPTACLE
- SPLIT WIRE DUPLEX RECEPTACLE
- EWC — ELECTRIC WATER COOLER
- GFCI — GROUND FAULT CIRCUIT INTERRUPTER
- I — ISOLATED GROUND
- S — TRANSIENT VOLTAGE SURGE SUPPRESSOR
- T — TAMPER RESISTANT
- WP — WEATHER PROOF
- XR — X-RAY VIEWER
- DUPLEX RECEPTACLE ABOVE COUNTER
- DUPLEX RECEPTACLE ON EMERGENCY POWER
- QUADRUPLEX RECEPTACLE ON EMERGENCY POWER
- FLOOR MOUNTED DUPLEX RECEPTACLE
- CEILING MOUNTED DUPLEX RECEPTACLE
- WALL MOUNTED SIMPLEX SPECIAL RECEPTACLE
- FLOOR MOUNTED SPECIAL RECEPTACLE
- CEILING MOUNTED SPECIAL RECEPTACLE
- RECEPTACLES GROUPED IN COMMON FLOOR BOX
- RECEPTACLES IN SURFACE RACEWAY
- SWBD 1 — LARGE ELECTRICAL EQUIPMENT WITH DESIGNATION - DRAWN TO SCALE
- DISTRIBUTION PANEL WITH DESIGNATION
- BRANCH PANEL WITH DESIGNATION
- EF 3 — MECHANICAL EQUIPMENT CONNECTION WITH DESIGNATION
- MOTOR WITH DESIGNATION
- G — GENERATOR SYSTEM WITH DESIGNATION
- T — TRANSFORMER WITH DESIGNATION - DRAWN TO SCALE
- DISCONNECT SWITCH
- MOTOR STARTER
- COMBINATION MOTOR STARTER / DISCONNECT SWITCH
- J — JUNCTION BOX
- P — PULL BOX
- C — CONTACTOR
- K 7 — KITCHEN EQUIPMENT ITEM & NO. (SEE ARCH. PLANS)
- M 5 — MISC. EQUIPMENT ITEM & NO. (SEE ARCH. PLANS)
- VIDEO SURVEILLANCE CAMERA - FIXED MOUNT
- VIDEO SURVEILLANCE CAMERA - PAN, TILT & ZOOM
- S — SOUND REINFORCEMENT LOUDSPEAKER
- TV — TELEVISION SYSTEM OUTLET

- EXPOSED CONDUIT OR CONDUCTOR
- CONCEALED CONDUIT OR CONDUCTOR
- CONCEALED CONDUIT OR CONDUCTOR BELOW FLOOR
- CONDUIT HOMERUN
- B — BUSWAY DUCT OR TRAY
- C — CABLE TRAY
- P — PLUG-IN BUSWAY
- CONDUIT ELBOW UP
- CONDUIT ELBOW DOWN
- CONDUIT BREAK
- LIGHTNING PROTECTION AIR TERMINAL
- LIGHTNING PROTECTION DOWN CONDUCTOR TO GROUND
- LIGHTNING PROTECTION HORIZONTAL CONDUCTOR
- TV — TELEVISION CABLE OUTLET, WALL MOUNTED
- TELEPHONE OUTLET, WALL MOUNTED
- EXISTING TELEPHONE OUTLET, WALL MOUNTED
- P — PAY TELEPHONE OUTLET, WALL MOUNTED
- E — EMERGENCY TELEPHONE OUTLET
- TELEPHONE OUTLET, FLOOR MOUNTED
- DATA OUTLET, WALL MOUNTED
- DATA OUTLET, FLOOR MOUNTED
- DATA OUTLET, CEILING MOUNTED
- COMBINATION TELEPHONE/DATA OUTLET, WALL MOUNTED
- OUTLETS GROUPED IN COMMON FLOOR BOX
- WAP — WIRELESS ACCESS POINT, WALL MOUNTED
- WAP — WIRELESS ACCESS POINT, CEILING MOUNTED
- SINGLE POLE (LOWER CASE LETTER INDICATES SWITCH LEG)
- 2 — DOUBLE POLE
- 3 — THREE WAY
- 4 — FOUR WAY
- B — START-STOP PUSH BUTTON
- D — DIMMER WITH ON/OFF CAPABILITY
- J — DOOR JAMB
- K — KEY OPERATED
- L — LOW VOLTAGE
- P — PILOT LIGHT
- T — TIMER
- S — INFRARED SENSOR
- S C — OCCUPANCY SENSOR, CEILING MOUNTED
- S D — DUAL TECHNOLOGY SENSOR
- S P — PHOTO SENSOR
- S U — ULTRASONIC SENSOR
- MCC-1 — ELECTRICAL EQUIPMENT WITH DESIGNATION
- AUTOMATIC TRANSFER SWITCH
- MANUAL TRANSFER SWITCH
- CIRCUIT BREAKER
- DRAW-OUT POWER CIRCUIT BREAKER
- CIRCUIT BREAKER
- CONTACTOR
- SWITCH
- FUSE
- FUSED SWITCH
- POTENTIAL TRANSFORMER
- CURRENT TRANSFORMER
- TRANSFORMER
- M — METER
- INCOMING SERVICE
- BUS BAR
- 100/4 — FEEDER DESIGNATION
- DELTA
- WYE
- GROUND

ELECTRICAL ABBREVIATIONS

(NOTE: ALL ABBREVIATIONS MAY NOT BE USED)

#	POUND OR NUMBER
&	AND
@	AT
°	DEGREE
ø	DIAMETER
Δ	DIFFERENCE OR DELTA
A, AMP	AMPERE
AC	ABOVE COUNTER
ACCU	AIR COOLED CONDITIONING UNIT
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CAPACITY
AL	ALUMINUM
ALT	ALTERNATE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
AP	ACCESS PANEL
ARCH	ARCHITECT, ARCHITECTURE
ATS	AUTOMATIC TRANSFER SWITCH
AUX	AUXILIARY
AV	AUDIO - VISUAL
AWG	AMERICAN WIRE GAUGE
BC	BELOW COUNTER
BHP	BRAKE HORSEPOWER
BOM	BILL OF MATERIAL
BP	BRANCH PANEL
BTM	BOTTOM
BTU	BRITISH THERMAL UNIT
°C	CELSIUS
C	CONDUIT
CAP	CAPACITY
CB	CIRCUIT BREAKER
CCTV	CLOSED CIRCUIT TELEVISION
CKT	CIRCUIT
CLR	CLEARANCE
CRT	CATHODE-RAY TUBE
C/T	CURRENT TRANSFORMER
CTR	COUNTER
CU	COPPER
CUH	CABINET UNIT HEATER
DC	DIRECT CURRENT
DEG	DEGREE
DIA	DIAMETER
DIFF	DIFFERENCE OR DELTA
DISC	DISCONNECT
DIST	DISTRIBUTION
DN	DOWN
DP	DISTRIBUTION PANEL
DW	DISH WASHER
DWG	DRAWING
EC	ELECTRICAL CONTRACTOR
ECB	ENCLOSED CIRCUIT BREAKER
EF	EXHAUST FAN
EL	ELEVATION
ELEC	ELECTRIC, ELECTRICAL
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
EP	EMERGENCY POWER
EPO	EMERGENCY POWER OFF
EQ	EQUIPMENT
ES	ENGINEERING SERVICES
EWC	ELECTRIC WATER COOLER
EX	EXISTING
EXP	EXPLOSION PROOF
EXT	EXTERIOR
°F	FAHRENHEIT
F	FUSE
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FBO	FURNISHED BY OWNER/ OTHERS
FFA	FROM FLOOR ABOVE
FFB	FROM FLOOR BELOW
FLR	FLOOR
FT	FOOT, FEET
FVNR	FULL VOLTAGE NON-REVERSING
FVR	FULL VOLTAGE REVERSING
GA	GAUGE
GC	GENERAL CONTRACTOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
GWH	GAS WATER HEATER
HC	HEATING CONTRACTOR
HGT	HEIGHT
HOA	HAND-OFF-AUTOMATIC SWITCH
HP	HORSEPOWER
HR	HOUR
HV	HIGH VOLTAGE
HVAC	HEATING, VENTILATING, AIR CONDITIONING
HZ	HERTZ, FREQUENCY
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
IN	INCH
IMC	INTERMEDIATE METALLIC CONDUIT
JB	JUNCTION BOX
KV	KILOVOLT
KVA	KILOVOLT-AMPERE
KVAR	KILOVOLT-AMPERE REACTIVE
KW	KILOWATT
KWH	KILOWATT HOUR
L	LENGTH
LAN	LOCAL AREA NETWORK
LED	LIGHT EMITTING DIODES
LTG	LIGHTING
LV	LOW VOLTAGE
MAX	MAXIMUM
MC	MECHANICAL CONTRACTOR
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCM	THOUSANDS OF CIRCULAR MILLS
MCP	MOTOR CIRCUIT PROTECTOR
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MMC	MANUAL MOTOR CONTROLLER
MOA	MULTI-OUTLET ASSEMBLY
MSS	MANUAL STARTER SWITCH
MTD	MOUNTED
MTR	MOTOR
N/A	NOT APPLICABLE
NAC	NOTIFICATION APPLIANCE CIRCUIT
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MFR'S ASSOC.
NFSS	NON- FUSED SAFETY SWITCH
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
NTS	NOT TO SCALE
OC	ON CENTER
OE	OVERHEAD ELECTRICAL
OL	OVERLOADS
OT	OVERHEAD TELEPHONE
P	POLE
PB	PUSH BUTTON, PULL BOX
PC	PLUMBING CONTRACTOR
PF	POWER FACTOR
PH	PHASE
PLBG	PLUMBING
PNL	PANEL
PP	POWER POLE
PR	PAIR
PRI	PRIMARY
PROJ	PROJECT
P/T	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
PWR	POWER
QTY	QUANTITY
REQ'D	REQUIRED
RF	RETURN FAN
RMC	RIGID METALLIC CONDUIT
RPM	REVOLUTIONS PER MINUTE
RTU	ROOF TOP UNIT
RVT	REDUCED VOLTAGE TRANSFORMER
SC	SECURITY CONTRACTOR
SF	SUPPLY FAN
SHT	SHEET
S/N	SOLID NEUTRAL
SPEC	SPECIFICATION
SPKR	SPEAKER
SP	SPARE
SQFT	SQUARE FOOT
SS	STAINLESS STEEL
STD	STANDARD
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
T-STAT	THERMOSTAT
TEL	TELEPHONE
TEMP	TEMPERATURE
TERM	TERMINAL
TFA	TO FLOOR ABOVE
TFB	TO FLOOR BELOW
TV	TELEVISION
TYP	TYPICAL
UE	UNDERGROUND ELECTRICAL
UG	UNDERGROUND
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORY
UT	UNDERGROUND TELEPHONE
UOD	UNLESS OTHERWISE DENOTED
V	VOLT
VA	VOLT AMPERES
VAV	VARIABLE AIR VOLUME
VC	VENTILATION CONTRACTOR
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
VSD	VARIABLE SPEED DRIVE
W	WATT
W/	WITH
W/O	WITHOUT
WAC	WINDOW AIR CONDITIONER
WAN	WIDE AREA NETWORK
WAP	WIRELESS ACCESS POINT
WG	WIRE GUARD/PROTECTIVE SHIELDING
WH	WATER HEATER
WP	WEATHERPROOF
WT	WEIGHT
WTR	WATER
XFMR	TRANSFORMER
YR	YEAR
Z	ZONE
2S1W	2 SPEED SINGLE WINDING
2S2W	2 SPEED DOUBLE WINDING

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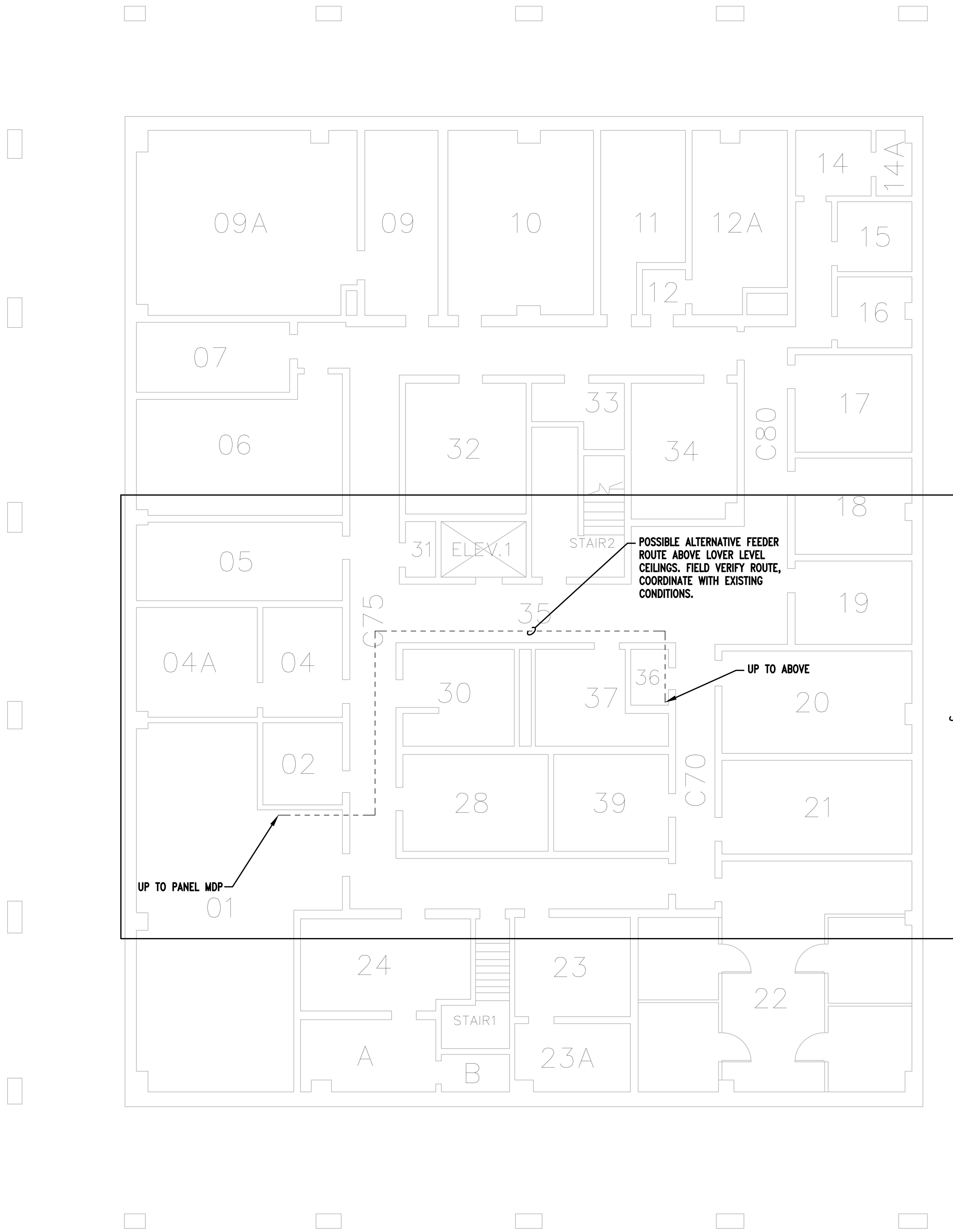
ELECTRICAL SYMBOLS & ABBREVIATIONS

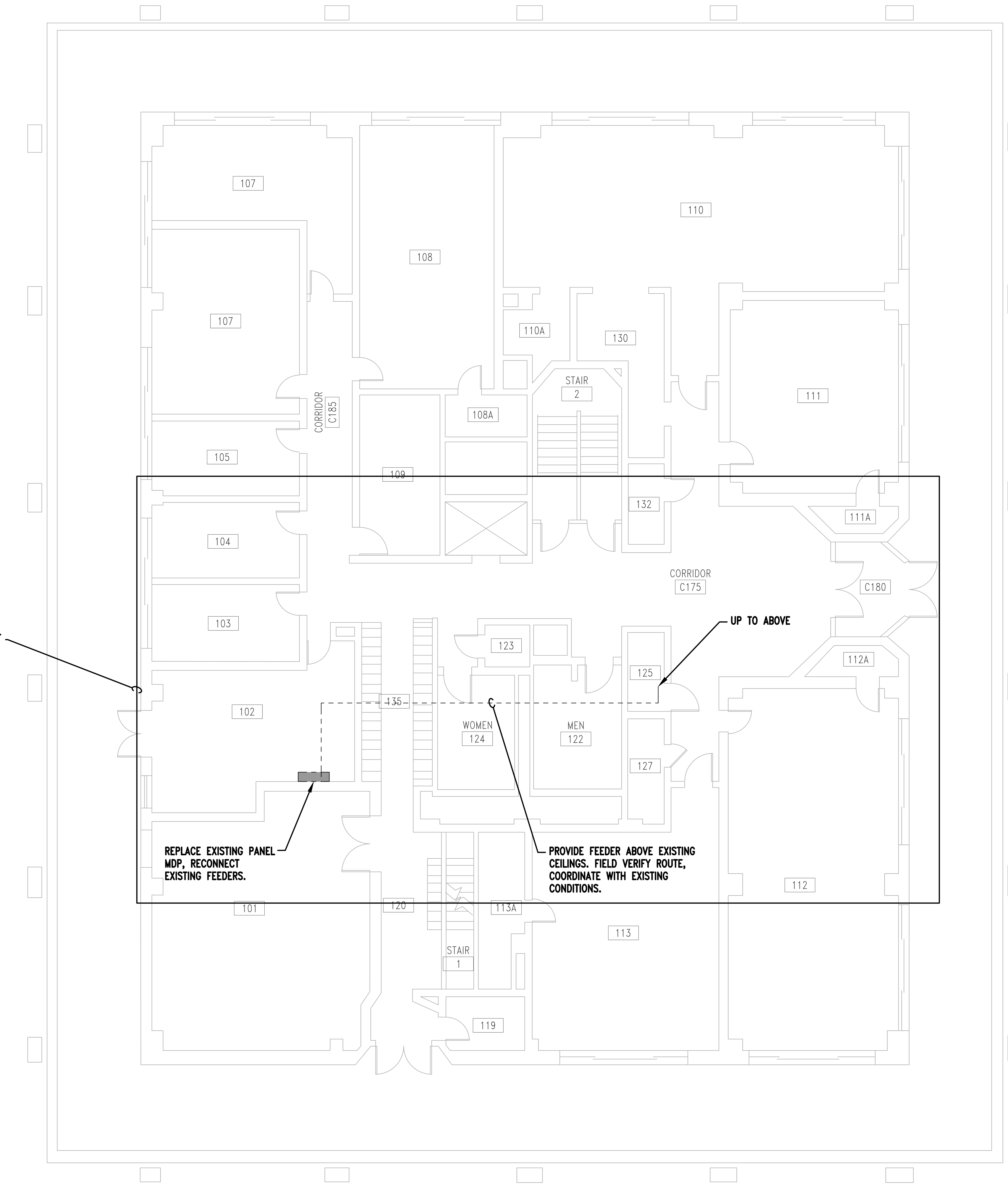


A LOWER LEVEL PLAN - ELECTRICAL - NEW WORK

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

NORTH

BASE BID, CURRENT WORK



B FIRST FLOOR PLAN - ELECTRICAL - NEW WORK

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

NORTH

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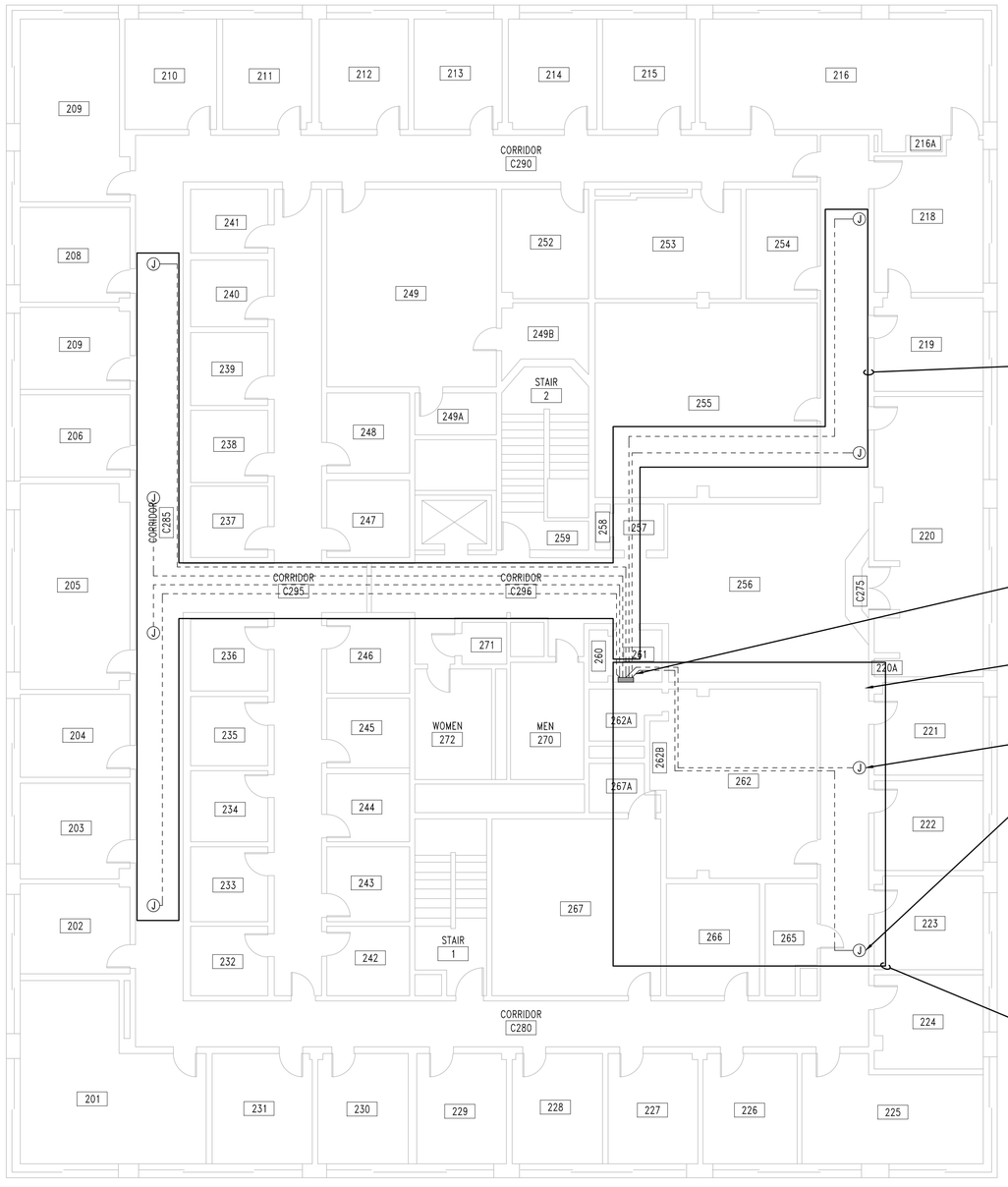
LOWER LEVEL AND FIRST FLOOR ELECTRICAL PLANS

E-100

of 6 sheets



A SECOND FLOOR PLAN - ELECTRICAL - NEW WORK

0 4' 8' 16'

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

NORTH

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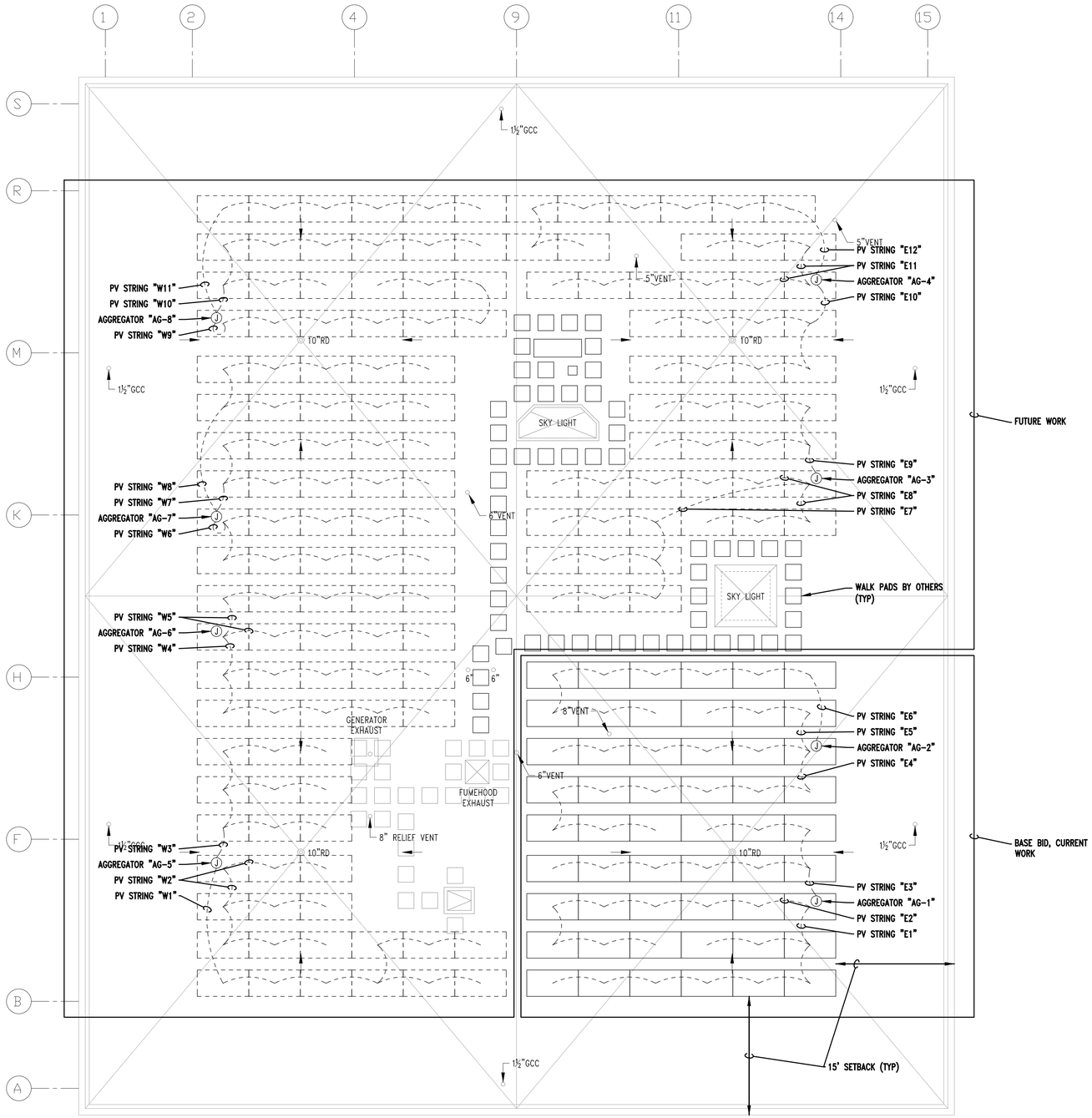
SECOND FLOOR ELECTRCAL PLAN

E-101

of 6 sheets



A ROOF PLAN - ELECTRICAL - NEW WORK

0 4' 8' 16'

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

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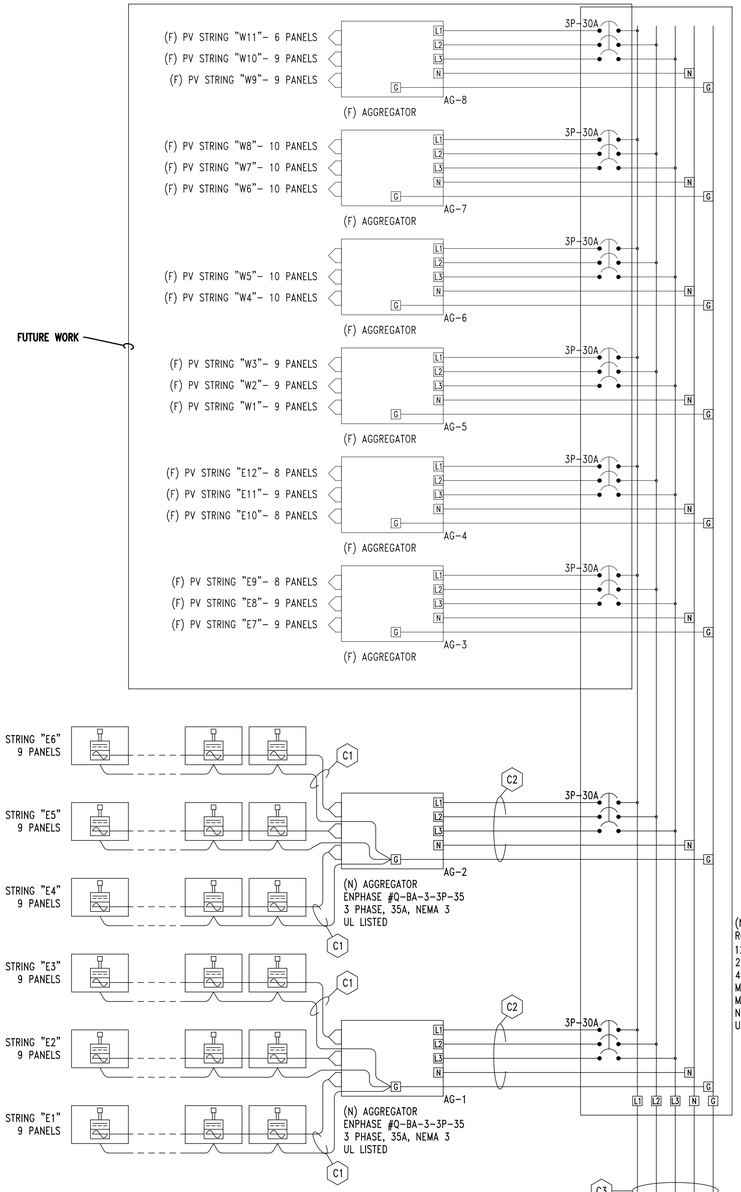
ROOF
ELECTRCAL PLAN

E-102

of 6 sheets



CIRCUIT CALLOUT	CIRCUIT TYPE	CONDUCTOR SIZE	TYPE	TEMP. RATING	AMPACITY @30C PER TABLE 310.15(B)(16)	REQIRED MINIMUM CIRCUIT AMPACITY
C1	PV STRING	12 AWG	COPPER	90	30	18.6
C2	AGGREGATOR CIRCUIT	8 AWG	COPPER	75	50	32.2
C3	FEEDER	4/0 AWG	COPPER	75	230	200.7

CIRCUIT CALLOUT	CIRCUIT TYPE	CONDUCTOR SPECIFICATIONS
C1	PV STRING	ENPHASE Q-12- 250VOLT CABLE & #6 GND
C2	AGGREGATOR CIRCUIT	4 #8 & #10 GND THWN IN 3/4" CONDUIT
C3	FEEDER	4 #4/0 & #4 GND IN 2 1/2" CONDUIT

AGGREGATOR SPECIFICATIONS			
MODEL NO: ENPHASE Q-BA-3-3P-35			
250 VOLT THREE PHASE 35AMP			
NEMA 3 ENCLOSURE			
MAX AGGREGATOR CIRCUIT			
	NO. OF PANELS/ INVERTERS	BRANCH FLA 1PH	BRANCH MCA @125%
STRING A (MAX)	11	14.9	18.6
STRING B (MAX)	11	14.9	18.6
STRING C (MAX)	11	14.9	18.6
	NO. OF PANELS/ INVERTERS	CIRCUIT FLA 3PH	CIRCUIT MCA @125%
MAX AGGREGATOR CIRCUIT	33	25.7	32.2
DESIGN AGGREGATOR CIRCUIT			
	NO. OF PANELS/ INVERTERS	BRANCH FLA 1PH	BRANCH MCA @125%
STRING A (DESIGN)	10	13.5	16.9
STRING B (DESIGN)	10	13.5	16.9
STRING C (DESIGN)	10	13.5	16.9
	NO. OF PANELS/ INVERTERS	CIRCUIT FLA 3PH	CIRCUIT MCA @125%
DESIGN AGGREGATOR CIRCUIT	30	23.4	29.2

CIRCUIT CALLOUT	AMBIENT TEMPERATURE ADJUSTMENT: ENVIRONMENT	HIGH AMBIENT TEMP C	HEIGHT ABOVE ROOF TOP	ADDER PER TABLE 310.15(B)(3)C	ADJUSTED TEMP C	AMPACITY CORRECTION 310.15(B)(2)(A)	CONDUIT FILL ADJUSTMENT: NUMBER UNGROUNDED CONDUCTORS IN CONDUIT	AMPACITY CORRECTION 310.15(B)(3)(A)
C1	ROOF TOP IN FREE AIR	33	1	22	55	0.76	NA	1
C2	ROOF TOP IN CONDUIT	33	1	22	55	0.67	3	1
C3	INTERIOR OF BUILLDING	35	NA	0	35	0.94	3	1

CIRCUIT CALLOUT	ADJUSTED AMPACITY	CONDUCTOR AMPACITY	x	AMBIENT TEMP ADJUST	x	CONDUIT FILL ADJUST	=	ADJUSTED AMPACITY
C1		30	x	0.76	x	1	=	22.8
C2		50	x	0.67	x	1	=	33.5
C3		230	x	0.94	x	1	=	216.2

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PV MODULE SPECIFICATIONS	
MODEL NO:	SOLAR WORLD SW340 XL MONO
WEIGHT:	47.6 LBS
DIMENSIONS:	78.46 X 39.4 X 1.3 INCHES
POWER @ STC:	340 VOLT AMPS
Voc:	47 VOLTS DC
Vmp:	37.1 VOLTS DC
Isc:	9.81 AMPS
Imp:	9.26 AMPS
Voc TEMP COEFF:	-0.29 %/C

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INVERTER SPECIFICATIONS	
MODEL NO:	ENPHASE IQ7PLUS-72-2-US
POWER RATING:	290 VOLT AMPS
NOMINAL VOLTAGE:	208 VOLTS AC
NOMINAL OUTPUT CURRENT:	1.35 AMPS
MAX OUTPUT CURRENT:	1.39 AMPS
CEC WEIGHTED EFF:	96.5 PERCENT
MAX INVERTERS PER BRANCH:	11 208V SINGLE PHASE
MAX DC VOLTAGE:	60 VOLTS
MAX PV POWER:	400

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ARRAY CONFIGURATION			
TOTAL NUMBER OF PANELS	206		
ARRAY POWER (@STC)	70.04 KW		
NUMBER OF BRANCH CIRCUITS	12		
TOTAL NUMBER OF INVERTERS	206		
	NO. OF PANELS/ INVERTERS	BRANCH FLA 1PH	BRANCH MCA @125%
MAX STRING	11	14.9	18.6
BRANCH E1	9	12.2	15.2
BRANCH E2	9	12.2	15.2
BRANCH E3	9	12.2	15.2
BRANCH E4	9	12.2	15.2
BRANCH E5	9	12.2	15.2
BRANCH E6	9	12.2	15.2
BRANCH E7	9	12.2	15.2
BRANCH E8	9	12.2	15.2
BRANCH E9	8	10.8	13.5
BRANCH E10	8	10.8	13.5
BRANCH E11	9	12.2	15.2
BRANCH E12	8	10.8	13.5
BRANCH W1	9	12.2	15.2
BRANCH W2	9	12.2	15.2
BRANCH W3	9	12.2	15.2
BRANCH W4	10	13.5	16.9
BRANCH W5	10	13.5	16.9
BRANCH W6	10	13.5	16.9
BRANCH W7	10	13.5	16.9
BRANCH W8	10	13.5	16.9
BRANCH W9	9	12.2	15.2
BRANCH W10	9	12.2	15.2
BRANCH W11	6	8.1	10.1
BRANCH W12	0	0.0	0.0
	NO. OF PANELS/ INVERTERS	FEEDER FLA 3PH	FEEDER MCA @125%
TOTAL ARRAY	206	160.6	200.7

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1 SPEECH AND HEARING ROOF TOP PV - ELECTRICAL DIAGRAM

NO SCALE

Facilities & Services
ENGINEERING AND CONSTRUCTION SERVICES / ENGINEERING DESIGN
Physical Plant Service Building
1501 S. Oak St., Champaign, IL
MC-800
General Information: 217.333.0697

ROOFTOP PHOTOVOLTAIC INSTALLATION

SPEECH AND HEARING CLINIC
BUILDING NO. 0209
901 SOUTH SIXTH STREET, CHAMPAIGN, IL 61820

FOR PRICING

#	Date	Revision Description

AIM Proj. No. 4791
ES W/O: 10519389
Date: 22 DEC 2017
Reviewed: BCF
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ELECTRICAL DIAGRAMS AND DETAILS

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SYSTEM DESCRIPTION

Provide the initial portion of a complete grid-tie photovoltaic system rated 70 kW DC at STC including photovoltaic panels, microinverters, combiner panel, wiring, mounting system, metering, and reporting equipment.

System shall be configured to produce 120/208 volt 3 phase 4 wire 60 Hz power.

The photovoltaic system shall include a metering system for total system power production and a reporting system to monitor individual components.

The photovoltaic system and inverter shall be configured as a grid inter-tie solar photovoltaic system. The individual inverters shall automatically de-energize their output to the building electrical system and disconnect from the photovoltaic panels upon loss of the utility electrical service. The photovoltaic inverter system shall remain disconnected until the electrical utility voltage has been restored.

Equipment shall be identified for use in solar photovoltaic systems.

Equipment including wiring, fuses, circuit breakers, etc. used in any DC portion of the photovoltaic power system shall be listed for use in DC circuits.

PHOTOVOLTAIC PANELS

Manufacturer, model, and array configuration must have been tested and be compatible with photovoltaic microinverter model. The equipment ratings shown on the drawings describe the basis of design. The photovoltaic inverter capacities may change the required panel rating and array configuration and will be agreed to during submittals. Acceptable Photovoltaic Panel: SolarWorld SW340 MONO XL or owner approved equal.

PHOTOVOLTAIC INVERTERS

Manufacturer and model must have been tested and be compatible with photovoltaic panel model. Model capacities may change and shall be agreed to during submittals. Acceptable Inverter: Enphase EQ7PLUS-72-2-US with Enphase Q-BA-3-3P-35 string aggregators or owner approved equal.

ARRAY MOUNTING

Manufacturer and model must be compatible with photovoltaic panels and microinverter models provided. Basis of design is given so contractor can provide design and installation of an equivalent system that is compatible with the provided modules and structure. Subject to compliance with requirements, provide the named product or a comparable product by one of the following: UNIRAC or owner approved equal.

Mounting system requirements: roof mounted non-penetrating ballasted aluminum frame mounting system:
1. 10 degree tilt angle.
2. Wind load requirements: [As indicated on structural general notes].
3. Snow Load: [As indicated on structural general notes].
4. Total System Weight: [5] lbs/sf
5. Seismic Requirements: [As indicated on structural general notes].
6. Provides four mounting supports for each panel in accordance with manufacturer's requirements.
7. Coordinate final dimensions with architectural drawings and existing conditions.
8. Structural aluminum members to be mill finish. All brackets and connections to be stainless steel.
9. Connect mounting system to electrode grounding system.

Provide complete solar array mounting system including rails, splices, fasteners, legs, clamps, standoffs, feet, and anchors.

INSTALLATION

Photovoltaic cabling shall be installed in raceways separate from other building system cabling. Photovoltaic cabling shall be installed in conduit when located interior to the building.

The photovoltaic panels and arrays shall be configured in an open circuit, short circuit, or provided with an opaque covering to disable the array from producing electrical power during installation. Refer to the manufacturer's information for additional disabling requirements during installation.

Install fuses in all fuse holders and disconnects. Provide a label on the inside of each disconnect identifying the size, type, and model of each fuse installed.

Provide provisions to seal all exterior penetrations. All photovoltaic system roof penetrations shall be sealed by a certified roofing contractor at the expense of the photovoltaic system contractor.

Wire and Cable Schedule:
a. Exterior: Photovoltaic panel manufacturer-supplied cabling with quick connects.
b. Interior: Copper, stranded conductor, 600 volt insulation, THHN/THWN-2.
c. Wet Locations: Copper, stranded conductor 600 volt insulation THWN-2.
d. Conductors shall be color coded as follows:
1. PV-: Black
2. PV+: Red
3. Ground Bond: Green
4. AC Phase A: Black
5. AC Phase B: Red
6. AC Phase C: Blue
7. AC Neutral: White

Interconnect photovoltaic inverters and/or communications gateway to each other and to the facility's local area network patch panel using Category 6 cable or other cable as directed by the inverter manufacturer.

Provide provisions for programming and initializing the system metering and reporting software per the Owner's requirements. The Contractor shall organize a meeting with the Owner to finalize the programming and user interfaces of the program software.

Install equipment per the manufacturer's recommendations.

LABELING

Label all photovoltaic system equipment as required by code.

Label ground fault indicators:
"IN THE EVENT OF A GROUND FAULT INDICATION – THE NORMALLY GROUNDED CONDUCTORS MAY BE ENERGIZED AND UNDERGROUNDED"

Label all AC-alternating current and DC-direct current disconnects of the photovoltaic power system:
"----PHOTOVOLTAIC SYSTEM DISCONNECT----WARNING. ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION"

The AC disconnecting means for each photovoltaic inverter system shall be labeled with the following:
1. Operating Current:
2. Operating Voltage:
3. Maximum System Voltage:

Short Circuit Current: The interactive system point of interconnection shall be labeled at the disconnecting means with the following:
1. Maximum AC Output Operating Current:
2. Operating AC Voltage:

The building service entrance disconnect shall be clearly labeled to identify there is a photovoltaic system interconnection. The location of the interactive system disconnect shall be identified with a plaque reading:
"WARNING – PHOTOVOLTAIC SYSTEM DISCONNECT LOCATED AT 0209-PANEL MDP IN FIRST FLOOR ELECTRICAL ROOM 102."

SUBMITTALS

Photovoltaic Panels: Include unit dimensions, weight, material construction, wattage, voltage, current, open circuit voltage, short circuit current, installation and maintenance information, and manufacturer voltage correction factor in information.

Photovoltaic Microinverter: Include unit dimensions, weight, installation and maintenance information. Also include the following:
Input: DC voltage range, max current input.
Output: AC voltage range, total harmonic distortion, power factor, efficiency, maximum current output.
General: Power consumption, enclosure type, compliance with references.
Environment: Ambient temperature rating, cooling requirements.

Array Mounting System:
Calculations, drawings and installation details shall be designed and sealed by a Structural Engineer licensed in the State of Illinois experienced in solar mounting frame design and installation.

Coordination drawing drawn to scale and coordinating the photovoltaic array with other systems and equipment in the vicinity for use in the development and layout of the mounting frame.

Clear indication of design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.

Plan drawings and details shall be cross-referenced. Details provided are to clearly indicate attachment to structure, correctly representing the fastening requirements.

Provide list of certified installers with proof of certification.

Provide calculation of expected annual total kilowatt hours for proposed equipment and installation.

Provide detailed calculations demonstrating array and inverter compatibility.

Operation and maintenance data: Include description of operation and servicing procedures, list of major components, recommended remedial and preventative maintenance procedures, and list of spare parts.

FIELD QUALITY CONTROL

Check for damage and tight connections prior to allowing the photovoltaic panels to begin power generation.

Check for damage and proper operation of the photovoltaic inverters.

Verify operation of the metering and reporting system components. Adjust and update the graphical user interface for project specific conditions.

Notify Owner/Architect/Engineer seven days prior to beginning final witness testing of the photovoltaic system. The Contractor shall fully test the complete photovoltaic system prior to notifying the Owner/Architect/Engineer for final witness testing.

Test, measure, and record the following system values:
1. Date:
2. Time of test:
3. Testers:
4. Sun overcast conditions (full sun) (scattered clouds) (full cloud coverage).
5. Inverter:
DC input current:
DC input voltage:
AC output current:
AC output voltage:
Output power:

Performance Test of Interactive Inverter System:

Verify proper operation of the photovoltaic system. Verify the photovoltaic system is producing power and delivering it to the building electrical distribution system.

Simulate power outage of electrical utility by switching the main electrical service disconnect from "closed" to "open".

Verify that each individual photovoltaic inverter has stopped producing electrical energy and has disconnected itself from the photovoltaic panels and building electrical distribution system.

Simulate return of utility electrical power by switching the main electrical service disconnect from "open" to "closed".

Verify each photovoltaic inverter has reconnected to the photovoltaic panels and building electrical distribution system. Verify power delivery from the photovoltaic inverters to the building electrical distribution system.

Document any test failure, including reason for failure and corrective actions. Retest the photovoltaic system to complete satisfactory operation.

OWNER TRAINING
Provide complete overview of the photovoltaic system to the Owner including:
1. System overview
2. System operation
3. Manufacturer maintenance instructions
4. System component locations
5. Operation of the metering and reporting components and software
6. Minimum Training Time:
Eight hours includes:
Four hours system components.
Four hours computer software operation.

METERING AND REPORTING

Provide manufacturer's software for metering and reporting on personal computer. The manufacturer's software shall include provisions for custom initialization of the photovoltaic system viewing and reporting.

Displayed and Recorded Data:

The following data shall be provided for each photovoltaic inverter and updated every 10 seconds.
a. Power
b. kWh today
c. Total kWh
d. Date
e. Time

The following data shall be provided for the entire photovoltaic system:
a. Power
b. kWh today
c. Total kWh
d. Date
e. Time
f. kWh to utility today
g. Total kWh to utility

The above information shall be recorded, logged, and compiled by the personal computer software for production and performance evaluation purposes.

Provide data reporting and recording of all manufacturers' standard reporting functions and data acquisition reporting.

Monitoring and metering for public displays, web pages, and in-facility displays. System shall include 3-phase metering, gateway, and internet capabilities. Display screens shall include:
a. Energy meters of generation and usage
b. 15-minute energy demand
c. Historical graphs of daily, three-day, weekly, monthly, and annual
d. Weather module displaying irradiance, temperature and wind speed, and National government weather feed.
e. Equivalencies options including gasoline, light bulbs, trees, and tons of CO2
f. Customizable options and pages

Display equipment: Flat panel PC. (Furnished and installed by owner).

Inverter communications and monitoring for performance, trouble, and diagnostics. Input and output voltages, amperages, and power and fault alarms shall communicate to the gateway and designated users.

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