



January 26, 2024

To: ReVision Energy  
7 Commercial Drive  
Brentwood, NH 03833

Subject: Structural Certification for Installation of Solar Panels  
Morales Residence  
33 Johnson Court  
Portsmouth, NH. 03801

To Whom It May Concern,

A design check for the subject residence was done on the existing roofing and framing systems for the installation of solar panels over the roof. From a field inspection of the property, the existing roof support structures were observed by the client's auditors as follows:

The roof structure of (MP1) consists of composition shingle over plywood sheathing on 1x decking that is supported by nominal 2x6 rafters @ 24" o.c., paired with nominal 2x6 ceiling joists @ 24" o.c.. The rafters have a max projected horizontal span of 11'-6", with a slope of 30 degrees. The rafters are connected at the ridge to a continuous 1x8 ridge board and are supported at the eave by a load bearing wall. There are 2x4 vertical struts at 48" o.c. that connect the ridge to the ceiling joists.

The roof structure of (MP2) consists of composition shingle on roof plywood that is supported by nominal 2x8 rafters @ 16" o.c., paired with nominal 2x6 ceiling joists @ 16" o.c.. The rafters have a max projected horizontal span of 8'-8", with a slope of 30 degrees. The rafters are connected at the ridge to a continuous 2x12 ridge board and are supported at the eave by a load bearing wall.

The existing roof framing system of (MP1) is judged to be inadequate to withstand the loading imposed by the installation of the solar panels. Structural reinforcement is required. Sister upgrade is required for (MP1). Stitch new 10'-0" long 2x6 SPF#2 or DF#2 (min) to existing member with Simpson SDW 22300 screws @ 16" o.c. or 10d nails @ 6" o.c..

The existing roof framing system of (MP2) is judged to be adequate to withstand the loading imposed by the installation of the solar panels. No reinforcement is necessary.

The spacing of the solar standoffs should be kept at 48" o.c. with a staggered pattern to ensure proper distribution of loads in wind zones 1 and 2, and less than 32" o.c. in wind zone 3. For composition shingle roofs, each standoff shall have (1) #14 x 4" L roofing screw connecting to the rafters, or (6) #14 x 3" L roofing screws connecting to the roof sheathing.

I further certify that all applicable loads required by the codes and design criteria listed below were applied to the Ironridge solar rail system and analyzed by the manufacturer. Furthermore, the installation crews have been thoroughly trained to install the solar panels based on the specific roof installation instructions developed by Ironridge for the racking system and Ironridge for the roof connections. Finally, I accept the certifications indicated by the solar panel manufacturer for the ability of the panels to withstand high wind and snow loads.

Design Criteria:

- Applicable Codes = 2018 IBC/IRC, ASCE 7-16, and 2015 NDS
- Roof Dead Load = 10.8 psf (MP1) -- 8.77 psf (MP2)
- Roof Live Load = 20 psf



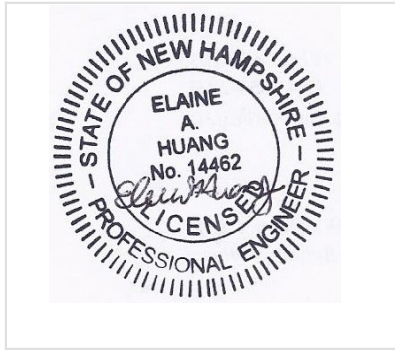
EAH Structural Consulting  
11 Ponybrook Lane  
Lexington, MA 02421  
PHONE 1.978.406.8921  
Elaine@EAHstructural.com

- Wind Speed = 125 mph, Exposure C
- Ground Snow Load = 50 psf - Roof Snow Load = 38.5 psf

Please contact me with any further questions or concerns regarding this project.

Sincerely,

Elaine Huang, P.E.  
Project Engineer



## Gravity Loading

Roof Snow Load Calculations		
$p_g$ = Ground Snow Load =	50 psf	
$p_f = 0.7 C_e C_t I p_g$		(ASCE7 - Eq 7.3-1)
$C_e$ = Exposure Factor =	1	(ASCE7 - Table 7.3-1)
$C_t$ = Thermal Factor =	1.1	(ASCE7 - Table 7.4-1)
$I$ = Importance Factor =	1	
$p_f$ = Flat Roof Snow Load =	38.5 psf	
$p_s = C_s p_f$		(ASCE7 - Eq 7.4-1)
$C_s$ = Slope Factor =	1	
<b><math>p_s</math> = Sloped Roof Snow Load =</b>	<b>38.5 psf</b>	

### PV Dead Load = 4 psf (Per ReVision Energy)

Roof Dead Load (MP1)		
Composition Shingle	2.50	
1x Decking	3.00	
Double 2x6 Rafters @ 24"o.c.	2.30	
Vaulted Ceiling	0.00	(Ceiling Not Vaulted)
Miscellaneous	3.00	
<b>Total Roof DL (MP1)</b>	<b>10.8 psf</b>	
DL Adjusted to 30 Degree Slope	12.5 psf	

Roof Dead Load (MP2)		
Composition Shingle	2.50	
Roof Plywood	2.00	
2x8 Rafters @ 16"o.c.	2.27	
Vaulted Ceiling	0.00	(Ceiling Not Vaulted)
Miscellaneous	2.00	
<b>Total Roof DL (MP2)</b>	<b>8.8 psf</b>	
DL Adjusted to 30 Degree Slope	10.13	

## Wind Calculations

### Per ASCE 7-16 Chapter 29.4

Input Variables		
Wind Speed	125 mph	Ultimate
Exposure Category	C	
Roof Shape	gable	
Roof Slope	30 degrees	
Mean Roof Height	25 ft	
Building Least Width	40 ft	
Effective Wind Area	21.2 ft	

Design Wind Pressure Calculations		
<b>Wind Pressure <math>P = qh*(G*Cp) * rE * ra</math></b>		(Eq_29.4-7)
$qh = 0.00256 * Kz * Kzt * Kd * Ke * V^2 * I$		(Eq_26.10-1)
$Kz$ (Exposure Coefficient) = 0.94		(Table 26.10-1)
$Kzt$ (topographic factor) = 1		(Fig. 26.8-1)
$Kd$ (Wind Directionality Factor) = 0.85		(Table 26.6-1)
$V$ (Design Wind Speed) = 125 mph		
$I$ Importance Factor = 1		(Table 1.5-1)
$qh = 31.96$		
$rE = 1.00$		(Fig. 29.4-7)
$r_a = 0.75$		(Fig. 29.4-8)

Standoff Uplift Calculations					
	Zone 1	Zone 2	Zone 3	Positive	
$G_{Cp} =$	-1.50	-1.80	-2.20	0.80	(Fig. 30.4-2)
Uplift Pressure =	-35.96 psf	-43.15 psf	-52.73 psf	25.6 psf	
0.6 x Uplift Pressure	-21.57 psf	-25.89 psf	-31.64 psf		(ASCE-7 2.4.1.7)
X Standoff Spacing =	4.00	4.00	2.67		
Y Standoff Spacing =	3.25	3.25	3.25		
Tributary Area =	13.00	13.00	8.68		
<b>Footing Uplift =</b>	<b>-280 lb</b>	<b>-337 lb</b>	<b>-275 lb</b>		

Standoff Uplift Check	
Maximum Design Uplift =	-337 lb
Standoff Uplift Capacity =	400 lb
400 lb capacity > 337 lb demand	<b>Therefore, OK</b>

Fastener Uplift Capacity Check	
Fastener =	1 - 5/16" dia Lag
Number of Fasteners =	1
Embedment Depth =	2.5
Pullout Capacity Per Inch =	205 lb (NDS Eq 12.2-1)
Fastener Capacity =	513 lb (NDS Eq 11.3-1)
w/ F.S. of 1.0 =	513 lb
513 lb capacity > 337 lb demand	<b>Therefore, OK</b>

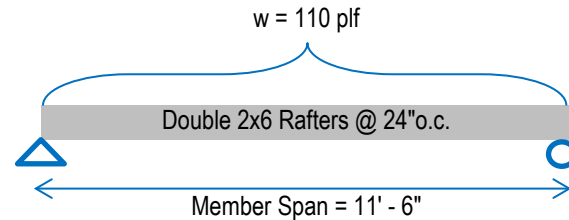
## Framing Check

(MP1)

**PASS - With Framing Upgrades**

Dead Load            12.5 psf  
 PV Load              4.0 psf  
 Snow Load           38.5 psf

Governing Load Combo = DL + SL  
**Total Load            55.0 psf**



### Member Properties - Based on Upgraded Section

Member Size	S (in <sup>3</sup> )	I (in <sup>4</sup> )	Lumber Sp/Gr	Member Spacing
Double 2x6	15.13	41.59	HF#1	@ 24"o.c.

### Check Bending Stress

$$F_b \text{ (psi)} = f_b \times C_d \times C_f \times C_r \quad \text{(NDS Table 4.3.1)}$$

$$975 \times 1.15 \times 1.3 \times 1.15$$
 Allowed Bending Stress = 1676.2 psi

Maximum Moment =  $(wL^2) / 8$   
 = 1817.47 ft#  
 = 21809.7 in#  
 Actual Bending Stress = (Maximum Moment) / S  
 = 1442 psi

**Allowed > Actual -- 86.1% Stressed -- Therefore, OK**

### Check Deflection

Allowed Deflection (Total Load) =  $L/180$  (E = 1500000 psi Per NDS)  
 = 0.766 in  
 Deflection Criteria Based on = Simple Span  
 Actual Deflection (Total Load) =  $(5 \cdot w \cdot L^4) / (384 \cdot E \cdot I)$   
 = 0.694 in  
 $L/199 < L/180$  **Therefore OK**

Allowed Deflection (Live Load) =  $L/240$   
 = 0.575 in  
 Actual Deflection (Live Load) =  $(5 \cdot w \cdot L^4) / (384 \cdot E \cdot I)$   
 = 0.486 in  
 $L/284 < L/240$  **Therefore OK**

### Check Shear

Member Area = 16.5 in<sup>2</sup>                      F<sub>v</sub> (psi) = 150 psi                      (NDS Table 4A)  
 Allowed Shear = F<sub>v</sub> \* A / 1.5 = 1650 lb                      Max Shear (V) = w \* L / 2 = 632 lb

**Allowed > Actual -- 38.4% Stressed -- Therefore, OK**





**PROJECT SUMMARY:**

THE PROJECT SCOPE INCLUDES THE DESIGN, SPECIFICATION, PROCUREMENT, INSTALLATION AND COMMISSIONING OF A COMPLETE, TURN-KEY, GRID-TIED PHOTOVOLTAIC ELECTRIC SYSTEM.

MODULE TYPE	(25) Q CELLS Q.PEAK DUO BLK ML-G10+ 410W
INVERTER	(25) ENPHASE IQ8A-72-2-US
OPTIMIZER	N/A
STORAGE SYSTEM	N/A
ARRAY PITCH	30°
ARRAY AZIMUTH	229°
RACKING	BLACK IRONRIDGE XRI00 ALUMINUM RAIL
ATTACHMENT	ECOSFASTEN GREENFASTEN GFI WITH SS 4" X 5/16" LAG SCREWS

**AUTHORITIES HAVING JURISDICTION:**

BUILDING AUTHORITY	PORTSMOUTH NH
ELECTRICAL AUTHORITY	PORTSMOUTH NH
ZONING/PLANNING AUTHORITY	PORTSMOUTH NH
ELECTRICAL UTILITY	EVERSOURCE

**DESIGN CRITERIA:**

OCCUPANCY	RESIDENTIAL
DESIGN WIND LOAD	125 MPH
RISK CATEGORY	II
GROUND SNOW LOAD	50 PSF
EXPOSURE CATEGORY	B
ROOF HEIGHT	20' ABOVE GRADE TO EAVES
ROOF COMPOSITION	ASPHALT SHINGLE
RAFTER	MPI 2X6", MPI 2X8"
RAFTER SPACING	MPI 24" OC, MP2 16" OC

**SHEET LIST:**

G001	TITLE SHEET
E100	SITE PLAN
S100	ROOF MODULE LAYOUT
S200	RAIL CUT SHEET
E400	ONE-LINE DIAGRAM
A200	SAFETY PLAN
E700	STICKER MAP

**GENERAL NOTES:**

1. ALL WORK SHALL COMPLY WITH LOCAL AND STATE ORDINANCES AND BUILDING CODES.
2. ELECTRICAL INSTALLATION SHALL COMPLY WITH STATE AND LOCALLY ADOPTED ELECTRICAL CODE.
3. ROOFTOP PENETRATIONS SHALL BE SEALED.
4. ALL EQUIPMENT SHALL BE LISTED AND TESTED BY A RECOGNIZED LABORATORY.
5. MODULE CONNECTORS MUST BE MATCHING BRAND AND TYPE OR BE A UL LISTED ASSEMBLY.
6. SYSTEM SHALL CONFORM TO RAPID SHUTDOWN REQUIREMENTS PER NEC 690.
7. CONDUIT RUNS BETWEEN SUB-ARRAYS, COMBINERS, AND DISCONNECTS SHALL BE INSTALLED IN THE MOST DIRECT ROUTE POSSIBLE.
8. ELECTRICAL EQUIPMENT SHALL BE INSTALLED TO MAINTAIN CLEARANCES REQUIRED BY NEC 110.
9. EQUIPMENT SHALL BE LABELED PER NEC 2020 REQUIREMENTS.
10. ENSURE INVERTER IS SET TO ISO-NE STANDARDS.



**REVISION ENERGY**

7 COMMERCIAL DRIVE  
BRENTWOOD, NH 03833  
(603)-679-1777

**CLIENT:**

ALBERT MORALES  
33 JOHNSON CT  
PORTSMOUTH NH, 03801

**SYSTEM TYPE:**

10.25KWDC, 8.725KWAC  
GRID TIED SOLAR PV  
SYSTEM

**FOR CONSTRUCTION**

DESIGNED BY: MCF  
PRINT SIZE: 11" x 17"  
SCALE: NA  
DATE: 3/6/2024  
DWG TITLE

**TITLE SHEET**

DWG NUMBER

G001

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**PROJECT SUMMARY:**

MODULE TYPE	(25) Q CELLS Q.PEAK DUO BLK ML-G10+ 410W
INVERTER	(25) ENPHASE IQ8A-72-2-US
OPTIMIZER	N/A
STORAGE SYSTEM	N/A
ARRAY PITCH	30°
ARRAY AZIMUTH	229°
RACKING	BLACK IRONRIDGE XRI00 ALUMINUM RAIL
ATTACHMENT	ECOSFASTEN GREENFASTEN GFI WITH SS 4" X 5/16" LAG SCREWS

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OCCUPANCY	RESIDENTIAL
DESIGN WIND LOAD	125 MPH
RISK CATEGORY	II
GROUND SNOW LOAD	50 PSF
EXPOSURE CATEGORY	B
ROOF HEIGHT	20' ABOVE GRADE TO EAVES
ROOF COMPOSITION	ASPHALT SHINGLE
RAFTER	MPI 2X6", MPI 2X8"
RAFTER SPACING	MPI 24" OC, MP2 16" OC

**EQUIPMENT LOCATIONS:**

- INTERIOR:  
 MAIN PANEL  
 SERVICE DISCONNECT  
 PV AC COMBINER PANEL  
 PV AC SUPPLY SIDE DISCONNECT
- EXTERIOR:  
 UTILITY NET METER  
 LOCKABLE PV AC DISCONNECT (RSID)  
 PV MODULES AND MICROINVERTERS



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**SITE PLAN**

DWG NUMBER  
 E100

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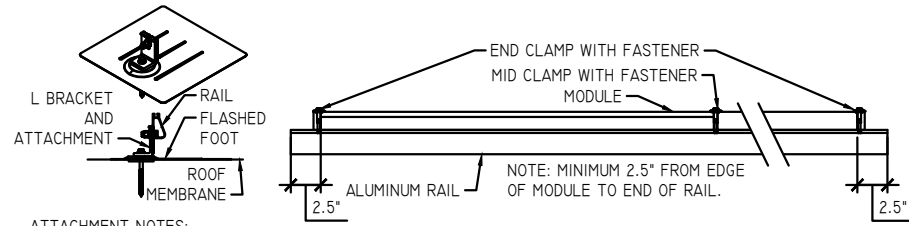
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ROOF MODULE LAYOUT

DWG NUMBER

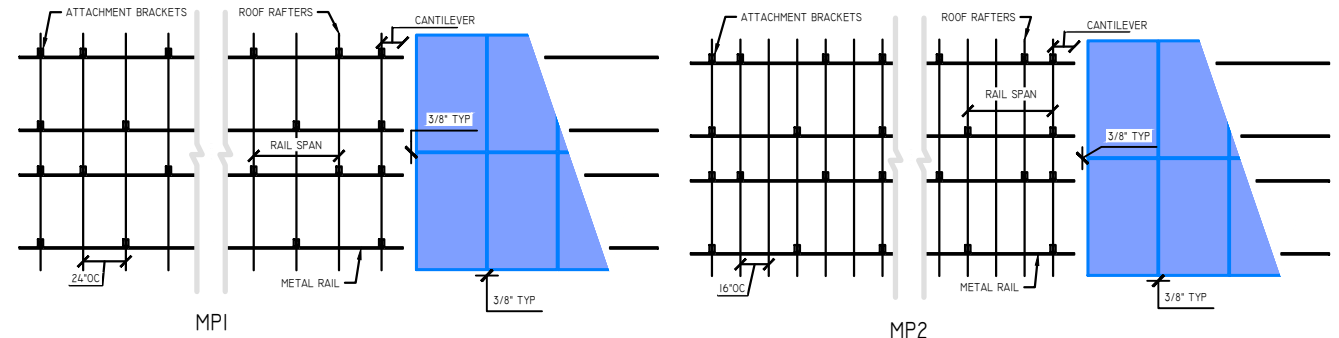
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A U T H O R I T I E S .



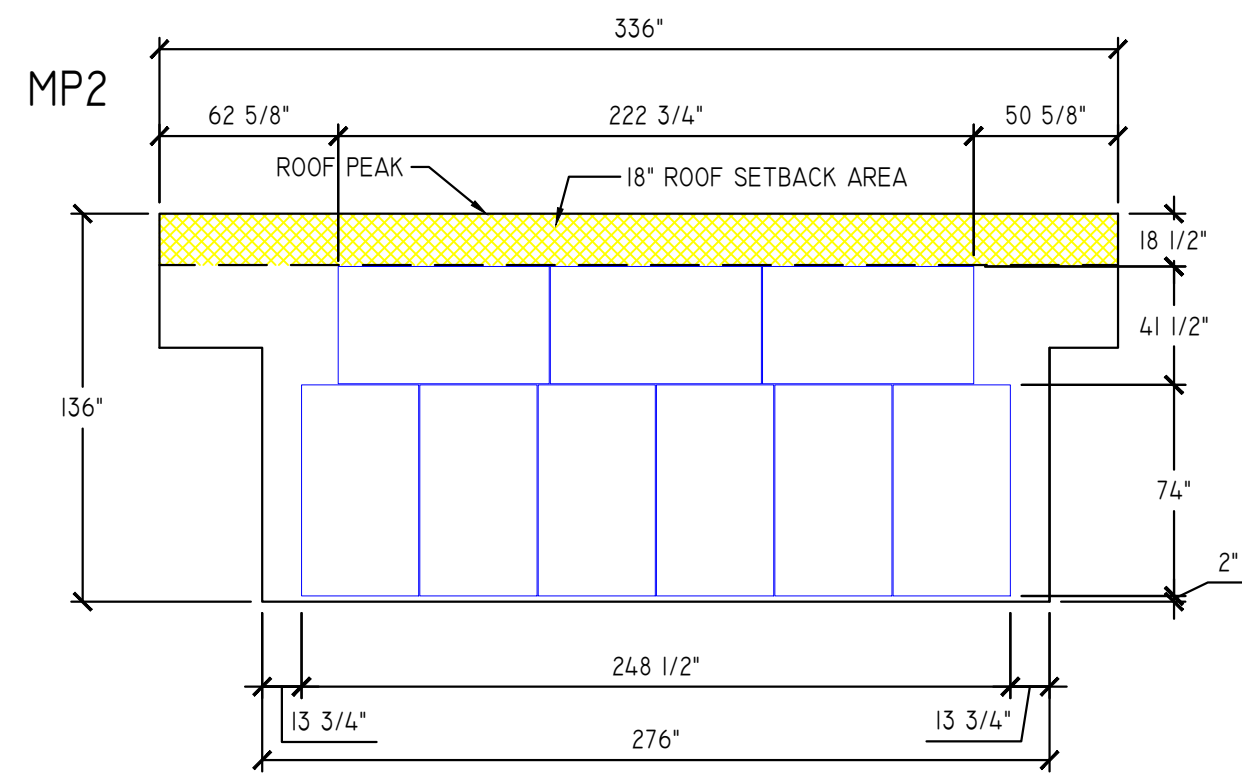
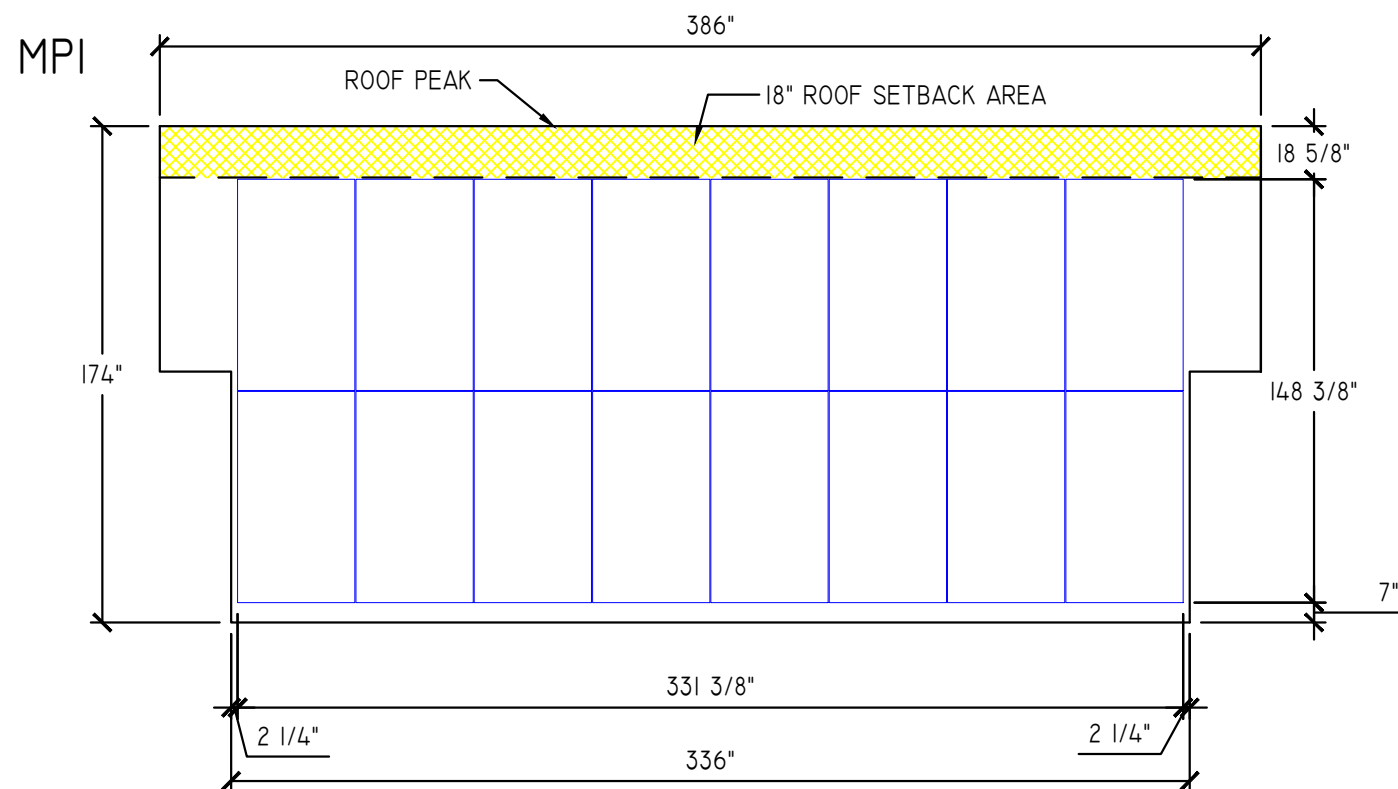
ATTACHMENT NOTES:

1. MAXIMUM RAIL LENGTH IS 100' BEFORE EXPANSION GAP IS REQUIRED.
2. MAXIMUM RAIL SPAN IS TYPICALLY 4'. THIS DISTANCE WILL VARY BASED ON ROOF SLOPE, SNOW LOAD, WIND SPEED, AND EXPOSURE CATEGORY.
3. MAXIMUM RAIL CANTILEVER DISTANCE IS 0.40 X RAIL SPAN.
4. SEAL ALL ATTACHMENT POINTS WITH GEOCELL. SEALS SHALL BE WATERTIGHT BETWEEN THE ATTACHMENT BRACKETS, ROOF MATERIAL AND STRUCTURAL MEMBERS.
5. ROOF ATTACHMENTS SHALL BE STAGGERED FOR EVEN DISTRIBUTION OF LOAD ON ROOF RAFTERS.
6. CLEARANCE BETWEEN THE ROOF AND THE BOTTOM OF THE MODULES SHALL BE A MINIMUM OF 2"



ATTACHMENT SPACING BY ROOF ZONE			
ZONE #	ZONE 1	ZONE 2	ZONE 3
MAX. RAIL SPAN (IN.)	48	48	MPI 24, MP2 32
MAX. CANTILEVER (IN.)	19.2	19.2	19.2

A  
N.T.S. ROOF ATTACHMENT AND SPACING DETAILS

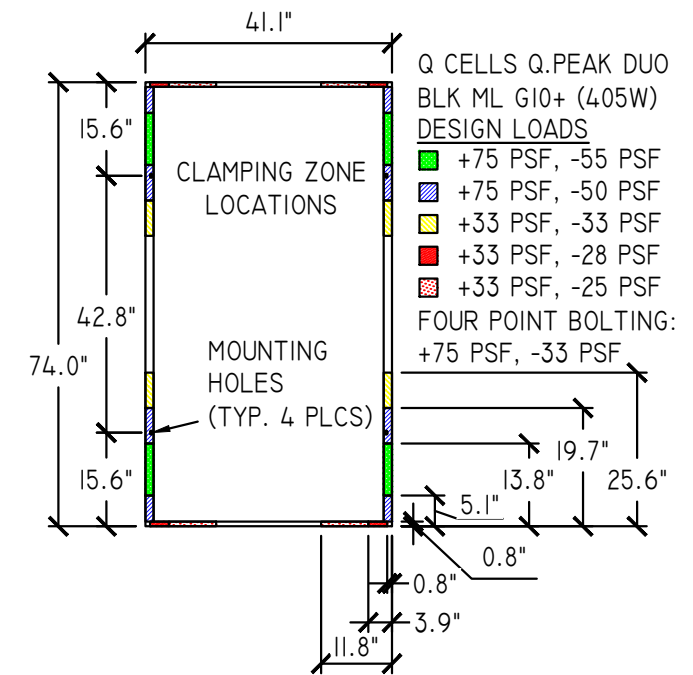
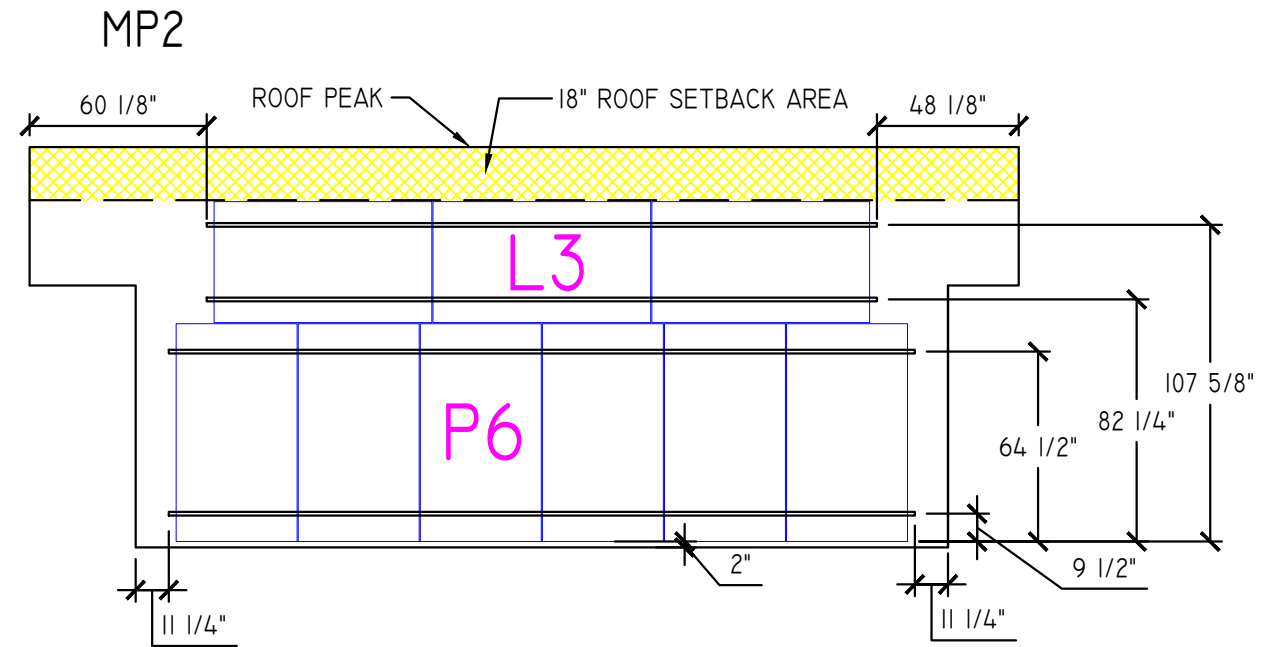
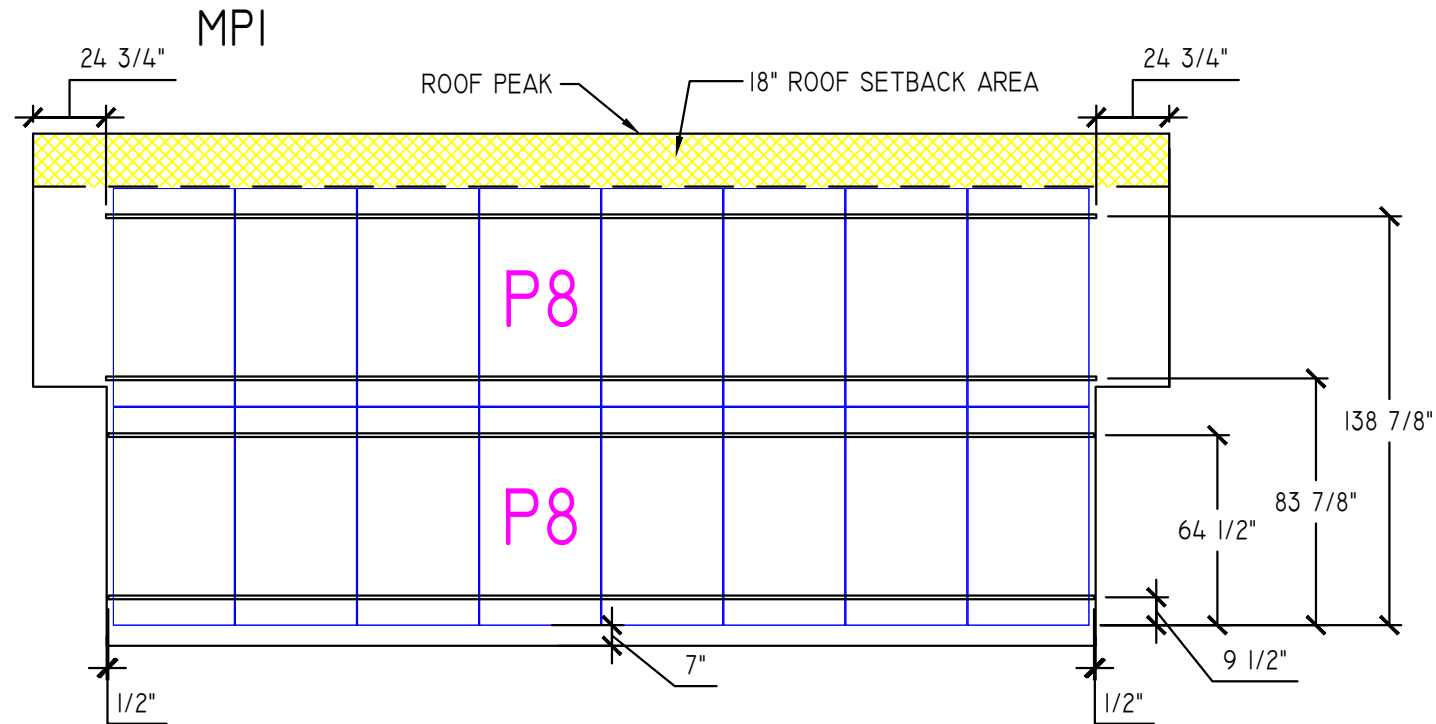


SUMMARY			
TYPE	PRODUCT	DIMENSIONS	QUANTITY
MODULE:	Q CELLS Q.PEAK DUO BLK ML-G10+ 410W	41.14IN x 73.98IN x 32MM	25
RAIL:	IRON RIDGE XRI00 - 17'	204 IN	(8) FULL (8) CUT
FASTENERS:	IRON RIDGE UFO	0.375 IN	60 MIN

INVERTER	WATTS / STRING	MAX MODS PER STRING
ENPHASE IQ8A-72-2-US	N/A	11

RAIL LENGTH										
RAIL SECTION TAG	NUMBER OF RAIL SECTIONS	QTY OF PANELS IN SECTION	RAFTER SPACING	MODULE ORIENTATION	RAIL ORIENTATION	RAIL LENGTH (IN)	FULL STICKS	CUT PIECE (IN)		
P6	2	6	16"	PORTRAIT	HORIZONTAL	253 3/4	1	(1)	49 3/4	
P8	4	8	24"	PORTRAIT	HORIZONTAL	336 3/4	1	(1)	132 3/4	
L3	2	4	16"	LANDSCAPE	HORIZONTAL	302	1	(1)	98	

CUT LIST	
RAIL LENGTH (IN)	QTY
FULL (17')	8
49 3/4	2
132 3/4	4
98	2



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GRID TIED SOLAR PV  
SYSTEM

FOR CONSTRUCTION

DESIGNED BY: MCF

PRINT SIZE: 11" x 17"

SCALE: NA

DATE: 3/6/2024

DWG TITLE

RAIL CUT SHEET

DWG NUMBER

S200

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PORTSMOUTH NH, 03801

**SYSTEM TYPE:**

10.25KWDC, 8.725KWAC  
GRID TIED SOLAR PV  
SYSTEM

MODULE SPECIFICATIONS		
Q CELLS Q.PEAK DUO BLK ML-G10+ 410W QTY 25		
STC RATING	410	W
Vmp	38.48	V
Imp	10.65	A
Voc	45.31	V
Isc	11.11	A
TEMP COEFF. Voc	-0.27	%/°C

MODULE-LEVEL DC OPTIMIZER SPECIFICATIONS		
QTY		
NOMINAL DC RATING (WATTS)	N/A	W
MAX OUTPUT CURRENT Idc	N/A	A

GRID TIED INVERTER SPECIFICATIONS		
ENPHASE IQ8A-72-2-US QTY 25		
NOMINAL AC RATING (WATTS)	349	W
NOMINAL VAC	240	V
MAX Iac	1.45	A
CEC EFFICIENCY	96.5	%

STICKER CALCULATIONS		
MAXIMUM DC VOLTAGE	N/A	V
MAXIMUM DC CIRCUIT CURRENT	N/A	A
RATED AC OUTPUT CURRENT	36.25	A

MONITORING
HOME ROUTER

**DESIGN NOTES:**

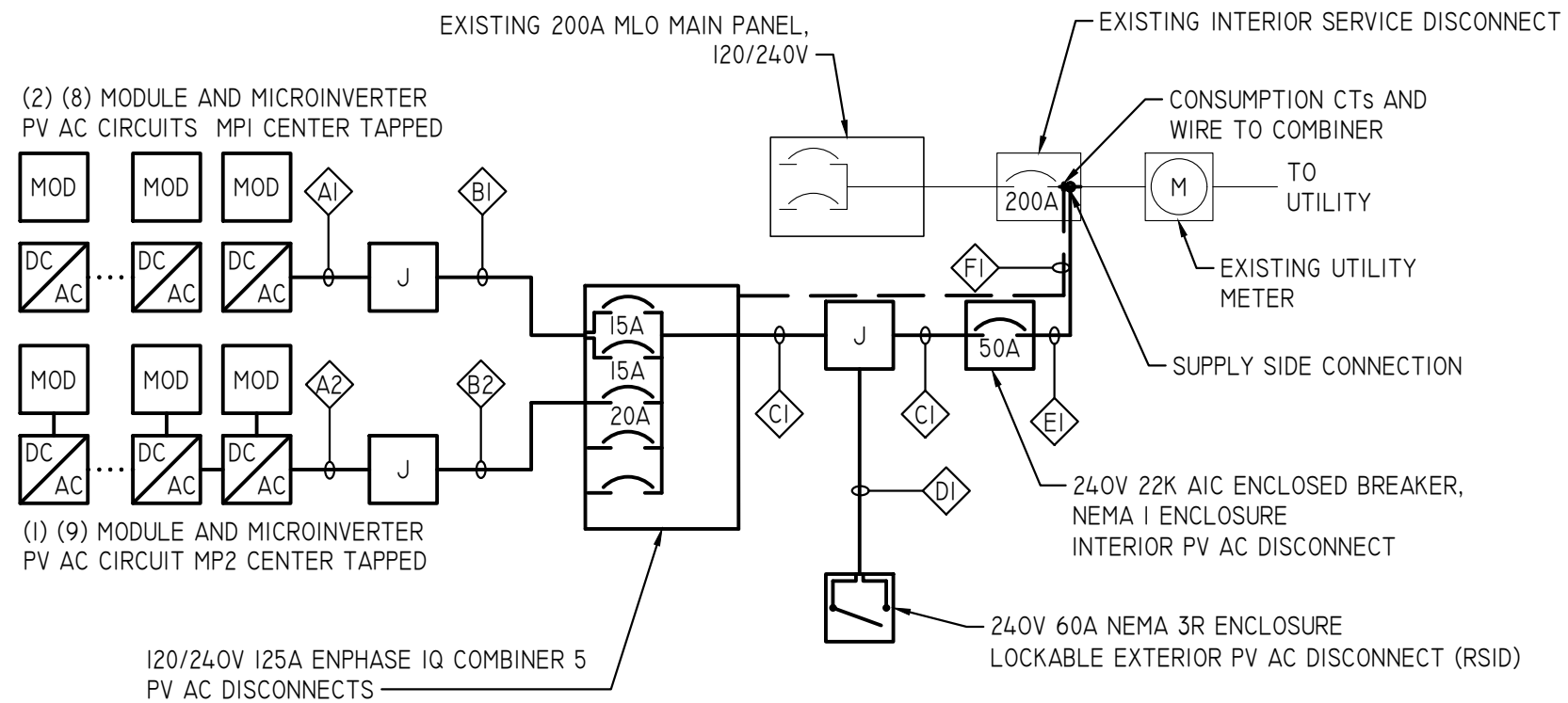
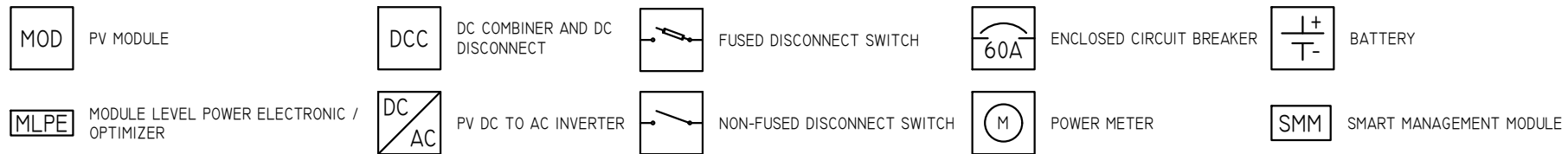
- ALL CONDUCTORS SHALL BE COPPER UNLESS NOTED OTHERWISE.
- SYSTEM VOLTAGE DROP SHALL NOT EXCEED 5%
- LOWEST EXPECTED AMBIENT TEMPERATURE IS BASED ON ASHRAE EXTREME MIN FOR THE SPECIFIED LOCATION.
- AVERAGE HIGH TEMPERATURE IS BASED ON ASHRAE 2% AVG. FOR THE SPECIFIED LOCATION.

**LINE TYPES:**

— EXISTING  
— NEW

WIRING SCHEDULE								
TAG	FROM / TO	CONDUCTORS	WIRE TYPE	LENGTH (FT)	AS BUILT LENGTH (FT)	VOLTAGE DROP	CONDUIT	CONDUIT FILL
A1	MPI PV ARRAY / JUNCTION BOX	L:(4) #12 G:(1) #6	Q-CABLE, PORT	25		0.15%		
B1	JUNCTION BOX / ENPHASE IQ COMBINER PANEL	L:(4) #10 G:(1) #10	THWN-2 600V CU	70		0.81%	3/4" EMT	20%
A2	MP2 PV ARRAY / JUNCTION BOX	L:(2) #12 G:(1) #6	Q-CABLE, PORT	20		0.15%		
B2	JUNCTION BOX / ENPHASE IQ COMBINER PANEL	L:(2) #10 G:(1) #10	THWN-2 600V CU	60		0.78%	3/4" EMT	12%
C1	ENPHASE IQ COMBINER PANEL / INTERIOR PV AC DISCONNECT	L:(2) #8 N:(1) #10 G:(1) #10	THWN-2 600V CU	15		0.35%	3/4" EMT	22%
D1	JUNCTION BOX / EXTERIOR PV AC DISCONNECT (RSID)	L:(4) #8 N:(2) #10 G:(1) #10	THWN-2 600V CU	20		0.47%	1" EMT	24%
E1	INTERIOR PV AC DISCONNECT / SUPPLY-SIDE INTERCONNECTION	L:(2) #6 N:(1) #6	THWN-2 600V CU	10		0.15%	3/4" EMT	29%
F1	ENPHASE IQ COMBINER PANEL / SUPPLY-SIDE INTERCONNECTION	L:(2)	CAT 5E	25		0.00%		

**SYMBOLS:**



**FOR CONSTRUCTION**

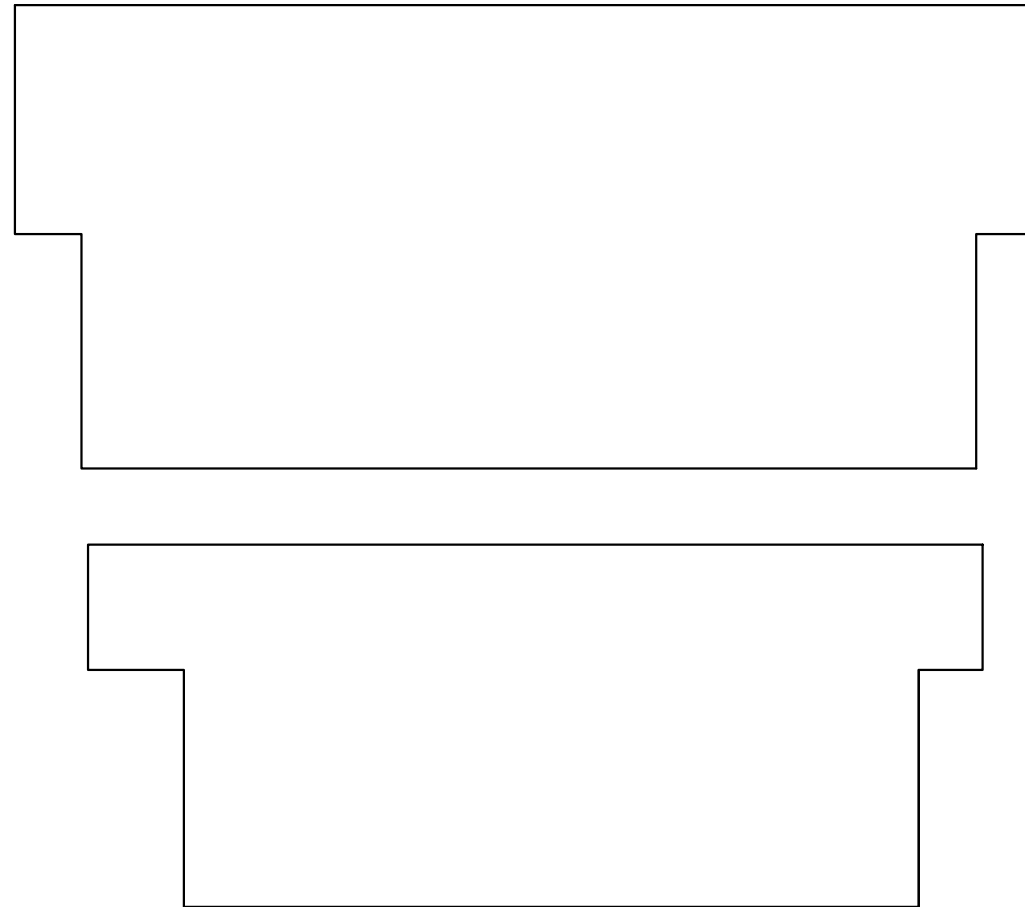
DESIGNED BY: MCF  
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DWG TITLE

**ONE LINE DIAGRAM**

DWG NUMBER  
**E400**

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**SAFETY SHEET NOTES:**

1. DRAW IN APPROXIMATE ANCHOR LOCATIONS AND SWING RADIUS
2. DRAW IN APPROXIMATE RESTRICTED ACCESS ZONE(RULE OF THUMB 10' FOR EVERY STORY OF BUILDING)
3. DRAW IN MACHINERY OR PERSONNEL ACCESS PATHS

**ANCHOR POINT ATTACHMENT NOTES:**

1. ANCHOR POINTS REQUIRING FASTENERS MUST BE INSTALLED IN TO BUILDING STRUCTURE (RAFTERS OR PURLINS)
2. ANCHOR POINTS TO BE INSTALLED A MINIMUM OF 72" FROM ROOF RAKE
3. MAXIMUM SPACING BETWEEN ANCHOR POINTS IS 96"
4. LEAVE BEHIND ANCHOR TO BE INSTALLED UNDER TOP LEFT AND TOP RIGHT PANELS TO FACILITATE SAFE ROOF EXIT
5. 3 MINIMUM ANCHORS PER ROOF
6. ANCHOR POINTS 1:1 (ONE PERSON PER ANCHOR POINT AT A TIME)
7. WORK IS TO BE DONE WHILE WITHIN 30 DEGREES OF ANCHOR



**REVISION ENERGY**

7 COMMERCIAL DRIVE  
BRENTWOOD, NH 03833  
(603)-679-1777

**CLIENT:**

ALBERT MORALES  
33 JOHNSON CT  
PORTSMOUTH NH, 03801

**SYSTEM TYPE:**

10.25KWDC, 8.725KWAC  
GRID TIED SOLAR PV  
SYSTEM

**FOR CONSTRUCTION**

DESIGNED BY: MCF

PRINT SIZE: 11" x 17"

SCALE: NA

DATE: 3/6/2024

DWG TITLE

**SAFETY PLAN**

DWG NUMBER

A200

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THIS DIAGRAM IS PROVIDED AS A SERVICE AND IS BASED ON THE UNDERSTANDING OF THE INFORMATION SUPPLIED. IT IS SUBJECT TO CHANGE BASED ON ACTUAL CONDITIONS, APPLICABLE EDITION OF THE NATIONAL ELECTRIC CODE, AND LOCAL GOVERNMENTAL AUTHORITIES.

# Q.PEAK DUO BLK ML-G10+ SERIES



385-410 Wp | 132 Cells  
20.9% Maximum Module Efficiency

MODEL Q.PEAK DUO BLK ML-G10+



6 busbar  
cell technology

12 busbar  
cell technology



## Breaking the 20% efficiency barrier

Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 20.9%.



## A reliable investment

Inclusive 25-year product warranty and 25-year linear performance warranty<sup>1</sup>.



## Enduring high performance

Long-term yield security with Anti LeTID Technology, Anti PID Technology<sup>2</sup> and Hot-Spot Protect.



## Extreme weather rating

High-tech aluminium alloy frame, certified for high snow (5400 Pa) and wind loads (4000 Pa).



## Innovative all-weather technology

Optimal yields, whatever the weather with excellent low-light and temperature behaviour.



## The most thorough testing programme in the industry

Qcells is the first solar module manufacturer to pass the most comprehensive quality programme in the industry: The new "Quality Controlled PV" of the independent certification institute TÜV Rheinland.

<sup>1</sup> See data sheet on rear for further information.

<sup>2</sup> APT test conditions according to IEC/TS 62804-1:2015, method A (-1500V, 96h)

### The ideal solution for:



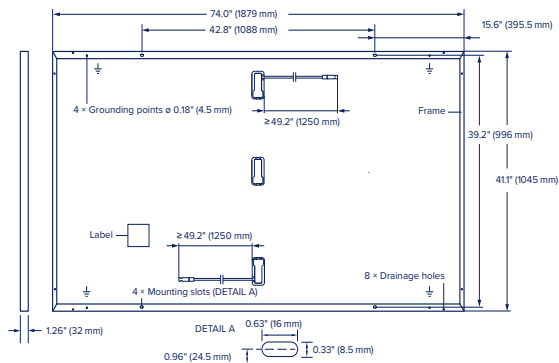
Rooftop arrays on  
residential buildings



# Q.PEAK DUO BLK ML-G10+ SERIES

## Mechanical Specification

Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodised aluminium
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm <sup>2</sup> Solar cable; (+) ≥ 49.2 in (1250 mm), (-) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68

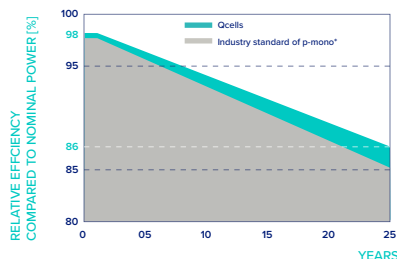


## Electrical Characteristics

POWER CLASS		385	390	395	400	405	410	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC <sup>1</sup> (POWER TOLERANCE +5 W/-0 W)								
Minimum	Power at MPP <sup>1</sup>	$P_{MPP}$ [W]	385	390	395	400	405	410
	Short Circuit Current <sup>1</sup>	$I_{SC}$ [A]	11.04	11.07	11.10	11.14	11.17	11.20
	Open Circuit Voltage <sup>1</sup>	$V_{OC}$ [V]	45.19	45.23	45.27	45.30	45.34	45.37
	Current at MPP	$I_{MPP}$ [A]	10.59	10.65	10.71	10.77	10.83	10.89
	Voltage at MPP	$V_{MPP}$ [V]	36.36	36.62	36.88	37.13	37.39	37.64
	Efficiency <sup>1</sup>	$\eta$ [%]	≥19.6	≥19.9	≥20.1	≥20.4	≥20.6	≥20.9
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT <sup>2</sup>								
Minimum	Power at MPP	$P_{MPP}$ [W]	288.8	292.6	296.3	300.1	303.8	307.6
	Short Circuit Current	$I_{SC}$ [A]	8.90	8.92	8.95	8.97	9.00	9.03
	Open Circuit Voltage	$V_{OC}$ [V]	42.62	42.65	42.69	42.72	42.76	42.79
	Current at MPP	$I_{MPP}$ [A]	8.35	8.41	8.46	8.51	8.57	8.62
	Voltage at MPP	$V_{MPP}$ [V]	34.59	34.81	35.03	35.25	35.46	35.68

<sup>1</sup>Measurement tolerances  $P_{MPP} \pm 3\%$ ;  $I_{SC}$ ;  $V_{OC} \pm 5\%$  at STC: 1000 W/m<sup>2</sup>, 25 ± 2°C, AM 1.5 according to IEC 60904-3 • <sup>2</sup>800 W/m<sup>2</sup>, NMOT, spectrum AM 1.5

## Qcells PERFORMANCE WARRANTY

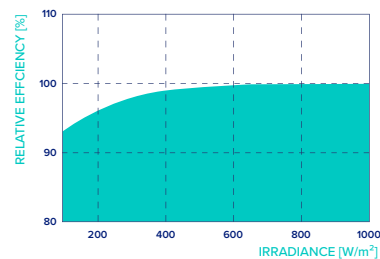


At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organisation of your respective country.

<sup>1</sup>Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

## PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25°C, 1000 W/m<sup>2</sup>).

## TEMPERATURE COEFFICIENTS

Temperature Coefficient of $I_{SC}$	$\alpha$ [%/K]	+0.04	Temperature Coefficient of $V_{OC}$	$\beta$ [%/K]	-0.27
Temperature Coefficient of $P_{MPP}$	$\gamma$ [%/K]	-0.34	Nominal Module Operating Temperature	NMOT [°F]	109 ± 5.4 (43 ± 3°C)

## Properties for System Design

Maximum System Voltage	$V_{SYS}$ [V]	1000 (IEC)/1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI/UL 61730	TYPE 2
Max. Design Load, Push/Pull <sup>3</sup>	[lbs/ft <sup>2</sup> ]	75 (3600 Pa)/55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	-40°F up to +185°F (-40°C up to +85°C)
Max. Test Load, Push/Pull <sup>3</sup>	[lbs/ft <sup>2</sup> ]	113 (5400 Pa)/84 (4000 Pa)		

<sup>3</sup> See Installation Manual

## Qualifications and Certificates

UL 61730, CE-compliant, Quality Controlled PV - TÜV Rheinland, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells),



Qcells pursues minimizing paper output in consideration of the global environment.

Note: Installation instructions must be followed. Contact our technical service for further information on approved installation of this product.  
Hanwha Q CELLS America Inc. 400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL +1 949 748 59 96 | EMAIL hqc-inquiry@qcells.com | WEB www.qcells.com

qcells



# IQ8 Series Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US	IQ8M-72-2-US	IQ8A-72-2-US	IQ8H-240-72-2-US	IQ8H-208-72-2-US <sup>1</sup>
Commonly used module pairings <sup>2</sup>	W	235 – 350	235 – 440	260 – 460	295 – 500	320 – 540+	295 – 500+
Module compatibility		60-cell/120 half-cell	60-cell/120 half-cell, 66-cell/132 half-cell and 72-cell/144 half-cell				
MPPT voltage range	V	27 – 37	29 – 45	33 – 45	36 – 45	38 – 45	38 – 45
Operating range	V	25 – 48	25 – 58				
Min/max start voltage	V	30 / 48	30 / 58				
Max input DC voltage	V	50	60				
Max DC current <sup>3</sup> [module Isc]	A	15					
Overvoltage class DC port		II					
DC port backfeed current	mA	0					
PV array configuration		1x1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit					
OUTPUT DATA (AC)		IQ8-60-2-US	IQ8PLUS-72-2-US	IQ8M-72-2-US	IQ8A-72-2-US	IQ8H-240-72-2-US	IQ8H-208-72-2-US <sup>1</sup>
Peak output power	VA	245	300	330	366	384	366
Max continuous output power	VA	240	290	325	349	380	360
Nominal (L-L) voltage/range <sup>4</sup>	V	240 / 211 – 264					208 / 183 – 250
Max continuous output current	A	1.0	1.21	1.35	1.45	1.58	1.73
Nominal frequency	Hz	60					
Extended frequency range	Hz	50 – 68					
AC short circuit fault current over 3 cycles	Arms	2					4.4
Max units per 20 A (L-L) branch circuit <sup>5</sup>		16	13	11	11	10	9
Total harmonic distortion		<5%					
Overvoltage class AC port		III					
AC port backfeed current	mA	30					
Power factor setting		1.0					
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging					
Peak efficiency	%	97.5	97.6	97.6	97.6	97.6	97.4
CEC weighted efficiency	%	97	97	97	97.5	97	97
Night-time power consumption	mW	60					
MECHANICAL DATA							
Ambient temperature range		-40°C to +60°C (-40°F to +140°F)					
Relative humidity range		4% to 100% (condensing)					
DC Connector type		MC4					
Dimensions (HxWxD)		212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")					
Weight		1.08 kg (2.38 lbs)					
Cooling		Natural convection – no fans					
Approved for wet locations		Yes					
Pollution degree		PD3					
Enclosure		Class II double-insulated, corrosion resistant polymeric enclosure					
Environ. category / UV exposure rating		NEMA Type 6 / outdoor					
COMPLIANCE							
Certifications		CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01					
		This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.					

(1) The IQ8H-208 variant will be operating in grid-tied mode only at 208V AC. (2) No enforced DC/AC ratio. See the compatibility calculator at <https://link.enphase.com/module-compatibility> (3) Maximum continuous input DC current is 10.6A (4) Nominal voltage range can be extended beyond nominal if required by the utility. (5) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

## XR Rail Family

The XR Rail Family offers the strength of a curved rail in three targeted sizes. Each size supports specific design loads, while minimizing material costs. Depending on your location, there is an XR Rail to match.



### XR10

XR10 is a sleek, low-profile mounting rail, designed for regions with light or no snow. It achieves 6 foot spans, while remaining light and economical.

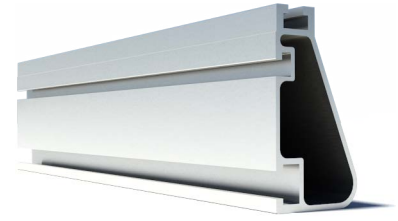
- 6' spanning capability
- Moderate load capability
- Clear anodized finish
- Internal splices available



### XR100

XR100 is the ultimate residential mounting rail. It supports a range of wind and snow conditions, while also maximizing spans up to 8 feet.

- 8' spanning capability
- Heavy load capability
- Clear & black anodized finish
- Internal splices available



### XR1000

XR1000 is a heavyweight among solar mounting rails. It's built to handle extreme climates and spans 12 feet or more for commercial applications.

- 12' spanning capability
- Extreme load capability
- Clear anodized finish
- Internal splices available

## Rail Selection

The following table was prepared in compliance with applicable engineering codes and standards. Values are based on the following criteria: ASCE 7-10, Roof Zone 1, Exposure B, Roof Slope of 7 to 27 degrees and Mean Building Height of 30 ft. Visit [IronRidge.com](http://IronRidge.com) for detailed span tables and certifications.

Load		Rail Span					
Snow (PSF)	Wind (MPH)	4'	5' 4"	6'	8'	10'	12'
None	100	XR10		XR100		XR1000	
	120						
	140						
	160						
10-20	100					XR1000	
	120						
	140						
	160						
30	100						
	160						
40	100						
	160						
50-70	160						
80-90	160						