

DISPLAY THIS CARD ON PRINCIPAL FRONTAGE OF WORK



CITY OF PORTLAND BUILDING PERMIT



This is to certify that

BOYSON MICHAEL & NANCY L GRANT JTS/Revision
Energy LLC

PERMIT ID: 2013-00222

Located at

82 MACKWORTH ST

CBL: 139 C005001

has permission to **Install solar panels on roof.**

provided that the person or persons, firm or corporation accepting this permit shall comply with all of the provisions of the Statutes of Maine and of the Ordinances of the City of Portland regulating the construction, maintenance and use of the buildings and structures, and of the application on file in the department.

Notification of inspection and written permission procured before this building or part thereof is lathed or otherwise closed-in. 48 HOUR NOTICE IS REQUIRED.

A final inspection must be completed by owner before this building or part thereof is occupied. If a certificate of occupancy is required, it must be procured prior to occupancy.

A handwritten signature in black ink, appearing to be "A. Grant", written over a horizontal line.

Fire Prevention Officer

Code Enforcement Officer / Plan Reviewer

**THIS CARD MUST BE POSTED ON THE STREET SIDE OF THE PROPERTY
THERE IS A PENALTY FOR REMOVING THIS CARD**

PERMIT ID: 2013-00222

Located at: 82 MACKWORTH ST

CBL: 139 C005001

City of Portland, Maine - Building or Use Permit

389 Congress Street, 04101 Tel: (207) 874-8703, Fax: (207) 874-8716

Permit No: 2013-00222	Date Applied For: 02/01/2013	CBL: 139 C005001
---------------------------------	--	----------------------------

Location of Construction: 82 MACKWORTH ST	Owner Name: BOYSON MICHAEL & NANCY L	Owner Address: 82 MACKWORTH ST	Phone:
Business Name:	Contractor Name: Revision Energy LLC	Contractor Address: 142 Presumpscot street Portland	Phone (207) 323-1805
Lessee/Buyer's Name	Phone:	Permit Type: Structure other than Building	

Proposed Use: Single Family	Proposed Project Description: Install solar panels on roof.
---------------------------------------	---

Dept: Zoning	Status: Approved	Reviewer: Marge Schmuckal	Approval Date: 02/24/2013
Note:			Ok to Issue: <input checked="" type="checkbox"/>
Dept: Building	Status: Approved w/Conditions	Reviewer: Tammy Munson	Approval Date: 02/28/2013
Note:			Ok to Issue: <input checked="" type="checkbox"/>
1) Separate permits are required for any electrical, plumbing, sprinkler, fire alarm, HVAC systems, heating appliances, including pellet/wood stoves, commercial hood exhaust systems and fuel tanks. Separate plans may need to be submitted for approval as a part of this process.			

BUILDING PERMIT INSPECTION PROCEDURES
Please call 874-8703 (ONLY)
or email: buildinginspections@portlandmaine.gov

With the issuance of this permit, the owner, builder or their designee is required to provide adequate notice to the city of Portland Inspections Services for the following inspections. Appointments must be requested 48 to 72 hours in advance of the required inspection. The inspection date will need to be confirmed by this office.

- **Please read the conditions of approval that is attached to this permit!! Contact this office if you have any questions.**
- **Permits expire in 6 months. If the project is not started or ceases for 6 months.**
- **If the inspection requirements are not followed as stated below additional fees may be incurred due to the issuance of a "Stop Work Order" and subsequent release to continue.**

REQUIRED INSPECTIONS:

Close-in Plumbing/Framing
Final Inspection

The project cannot move to the next phase prior to the required inspection and approval to continue, REGARDLESS OF THE NOTICE OF CIRCUMSTANCES.

IF THE PERMIT REQUIRES A CERTIFICATE OF OCCUPANCY, IT MUST BE PAID FOR AND ISSUED TO THE OWNER OR DESIGNEE BEFORE THE SPACE MAY BE OCCUPIED.



Professional design, installation and service of renewable energy systems

2 Kilowatt Grid-Tied Photovoltaic System Proposal

Client: Nancy Grant
 Address: 82 Mackworth Street, Portland, ME 04103
 Date: 23 December 2011



Array Location

Roof Orientation:
 215 degrees
 (near ideal south)

Roof Pitch:
 12:12
 45 degree angle

Roof Material:
 Asphalt shingle

Project Summary

System	Performance	Cost	Incentives	Net Cost
2 kilowatt grid-tied photovoltaic array coupled with enphase energy microinverters. Includes real-time system monitoring.	<ul style="list-style-type: none"> Produce roughly 2,680 kilowatt hours of clean, renewable electricity annually. Offset roughly 3,590 lbs. of CO2 emissions annually. 	\$10,361 Installed	-(\$3,108) fed tax credit -(\$2,000) State rebate	\$5,253

System Overview

Based on an evaluation of your household electricity demand and ideal rooftop solar gain, ReVision Energy proposes a roof-mounted photovoltaic array of 2 kilowatts (nominal). The system utilizes Canadian Solar 235-watt photovoltaic panels and Enphase Energy microinverters. The proposed array will consist of nine panels arranged in three rows of three panels each and the total array area will be roughly 160 s.f.

Liberty
 207-589-4171

Portland
 207-221-6342

Exeter, NH
 603-501-1822

www.revisionenergy.com



Professional design, installation and service of renewable energy systems

Component Specifications

- (9) 235-watt Canadian Solar photovoltaic panels (www.canadiansolar.com)
- (9) Enphase Energy M215 microinverters (www.enphaseenergy.com)
- Lifetime subscription to Enphase Enlighten web-based monitoring service (<http://www.enphaseenergy.com/products/products/enlighten.cfm>)
- IronRidge aluminum mounting system (www.ironridge.com)
- All hardware, disconnects, cable, and labor to provide a code-compliant, NABCEP-certified installation.



At left is a grid-tied photovoltaic array installed by ReVision Energy on a home in Portland.

We are proposing a similar flush-mounted installation for your home.

The Canadian Solar photovoltaic panels come with a 25-year performance warranty and expected useful lifespan of 40 years. This maintenance-free system enables you to lock in your own clean electricity rate for the next four decades.

System Operation

Whenever sun shines on the solar electric panels, direct current electricity will be generated. The DC electricity from each module is converted to AC electricity by the individual Enphase inverters, affixed to the underside of each panel. The advantage of microinverters is that the output of the rest of the array is not affected if a portion of panels are shaded.

The AC electricity that is created by the inverters will then feed directly into your home's load center. Any loads operating while the sun is shining will be fed directly by the solar electricity. The local utility company will install a second electric meter near the existing meter recording your usage, to record electricity you feed into the grid. If there is more electricity being generated by the sun than being used in the house, the second meter will spin, creating a credit on your next bill. You can bank your surplus from month to month for up to a year.

Liberty
207-589-4171

Portland
207-221-6342

Exeter, NH
603-501-1822

www.revisionenergy.com



Professional design, installation and service of renewable energy systems

February 1, 2013

City of Portland
389 Congress Street
Portland, ME 04101

RE: ReVision Energy Solar Installation at 82 Mackworth Street

Dear Code Enforcement,

ReVision Energy has been contracted to design and install a solar electric and solar hot water system at the above address in Portland. This letter is to confirm that all work will be performed by licensed and qualified installers, expert in the field and in compliance with both manufacturer's recommendations and all applicable local and state codes and standards. This also confirms that the roof structure can handle the weight of the panel load, in addition to snow load. The weight of the panels does not change the structural integrity of the building.

ReVision Energy employs licensed engineers, plumbers, and electricians and carries the solar industries highest certifications (NABCEP) in both solar thermal and photovoltaic installation. We're committed to high quality, code compliant work and look forward to working together with the city and the CEO to ensure that all your requirements and needs are met and that our customer ends up with a system that is beautiful, functional and safe.

Electrical and grounding:

All electrical work to be performed by a licensed ME electrician and will conform to NEC 2011 revision as well as NABCEP standards. Specifically, wiring and grounding of the photovoltaic system will be governed by manufacturer's recommendations and article 690. All installed metal components are grounded via the grounding electrode conductor.

If you have any questions or concerns, we'd like to address them as quickly and completely as possible. Please don't hesitate to call or e mail anytime.

Respectfully,

Fortunat Mueller, P.E.
Co-owner
ReVision Energy
(207) 752-6358
fortunat@revisionenergy.com

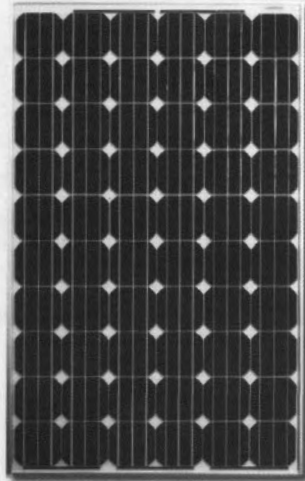
Bangor
207-570-4222

Liberty
207-589-4171

Portland
207-221-6342

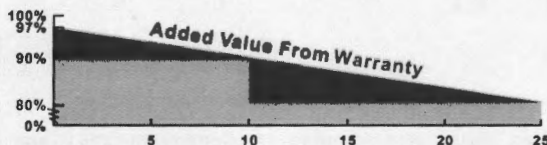
Portsmouth
603-486-7170

www.revisionenergy.com

CS6P
230/235/240/245/250M


Key Features

- Industry first comprehensive warranty insurance by AM Best rated leading insurance companies in the world
- Industry leading plus only power tolerance: 0 ~ +5W
- Strong framed module, passing mechanical load test of 5400Pa to withstand heavier snow load
- The 1st manufacturer in the PV industry certified for ISO:TS16949 (The automotive quality management system) in module production since 2003
- ISO 17025 qualified manufacturer owned testing lab, fully complying to IEC, TUV, UL testing standards
- **Backed By Our New 10/25 Linear Power Warranty Plus our added 25 year insurance coverage**



- 10 year product warranty on materials and workmanship
- 25 year linear power output warranty

On-grid Module

CS6P is a robust solar module with 60 solar cells. These modules can be used for on-grid solar applications. Our meticulous design and production techniques ensure a high-yield, long-term performance for every module produced. Our rigorous quality control and in-house testing facilities guarantee Canadian Solar's modules meet the highest quality standards possible.

Applications

- On-grid residential roof-tops
- On-grid commercial/industrial roof-tops
- Solar power stations
- Other on-grid applications

Quality Certificates

- IEC 61215, IEC 61730, UL 1703, CEC Listed, MCS, CE
- ISO 9001: 2008: Standards for quality management systems
- ISO/TS16949:2009: The automotive quality management system

Environmental Certificates

- ISO 14001:2004: Standards for Environmental management systems
- QC080000 HSPM: The Certification for Hazardous Substances Regulations
- Reach Compliance



CS6P-230/235/240/245/250M

Electrical Data

STC	CS6P-230M	CS6P-235M	CS6P-240M	CS6P-245M	CS6P-250M
Nominal Maximum Power (Pmax)	230W	235W	240W	245W	250W
Optimum Operating Voltage (Vmp)	29.9V	30.1V	30.2V	30.3V	30.4V
Optimum Operating Current (Imp)	7.70A	7.82A	7.95A	8.09A	8.22A
Open Circuit Voltage (Voc)	37.1V	37.2V	37.3V	37.4V	37.5V
Short Circuit Current (Isc)	8.22A	8.34A	8.46A	8.61A	8.74A
Module Efficiency	14.30%	14.61%	14.92%	15.23%	15.54%
Operating Temperature	-40°C~+85°C				
Maximum System Voltage	1000V (IEC) /600V(UL)				
Maximum Series Fuse Rating	15A				
Application Classification	Class A				
Power Tolerance	0 ~ +5W				

Under Standard Test Conditions (STC) of irradiance of 1000W/m², spectrum AM 1.5 and cell temperature of 25°C

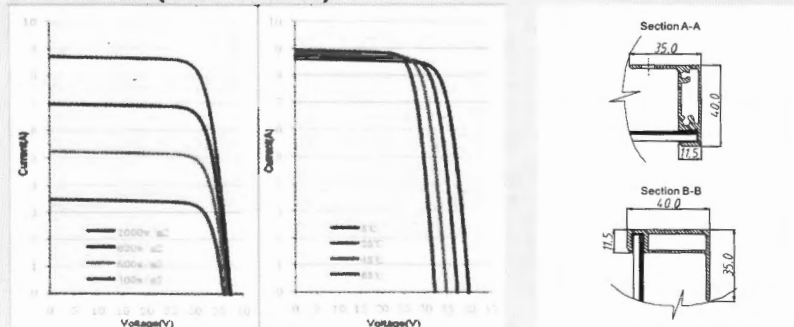
NOCT	CS6P-230M	CS6P-235M	CS6P-240M	CS6P-245M	CS6P-250M
Nominal Maximum Power (Pmax)	166W	170W	173W	177W	180W
Optimum Operating Voltage (Vmp)	27.3V	27.5V	27.5V	27.6V	27.7V
Optimum Operating Current (Imp)	6.09A	6.18A	6.29A	6.40A	6.51A
Open Circuit Voltage (Voc)	34.0V	34.1V	34.2V	34.3V	34.4V
Short Circuit Current (Isc)	6.65A	6.75A	6.85A	6.97A	7.08A

Under Normal Operating Cell Temperature, Irradiance of 800 W/m², spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s

Mechanical Data

Cell Type	Mono-crystalline 156 x 156mm, 2 or 3 Busbars
Cell Arrangement	60 (6 x 10)
Dimensions	1638 x 982 x 40mm (64.5 x 38.7 x 1.57in)
Weight	20kg (44.1 lbs)
Front Cover	3.2mm Tempered glass
Frame Material	Anodized aluminium alloy
J-BOX	IP65, 3 diodes
Cable	4mm ² (IEC)/12AWG(UL), 1100mm
Connectors	MC4 or MC4 Comparable
Standard Packaging (Modules per Pallet)	24pcs
Module Pieces per container (40 ft. Container)	672pcs (40'HQ)

I-V Curves (CS6P-250M)



*Specifications included in this datasheet are subject to change without prior notice.

About Canadian Solar

Canadian Solar Inc. is one of the world's largest solar companies. As a leading vertically-integrated manufacturer of ingots, wafers, cells, solar modules and solar systems. Canadian Solar delivers solar power products of uncompromising quality to worldwide customers. Canadian Solar's world class team of professionals works closely with our customers to provide them with solutions for all their solar needs.

Canadian Solar was founded in Canada in 2001 and was successfully listed on NASDAQ Exchange (symbol: CSIQ) in November 2006. Canadian Solar has already expanded its module manufacturing capacity to 2.05GW and cell manufacturing capacity to 1.3GW in 2011.

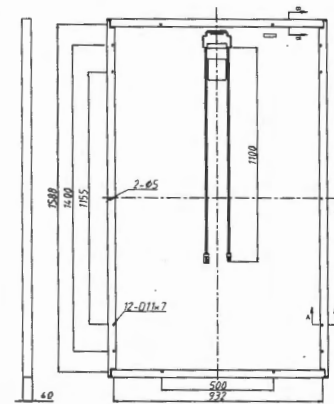
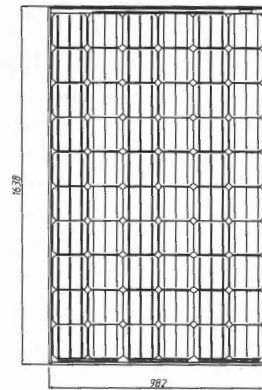
Temperature Characteristics

Temperature Coefficient	Pmax	-0.45%/°C
	Voc	-0.35%/°C
	Isc	0.060%/°C
Normal Operating Cell Temperature	45±2°C	

Performance at Low Irradiance

Industry leading performance at low irradiation environment, +95.5% module efficiency from an irradiance of 1000W/m² to 200W/m² (AM 1.5, 25 °C)

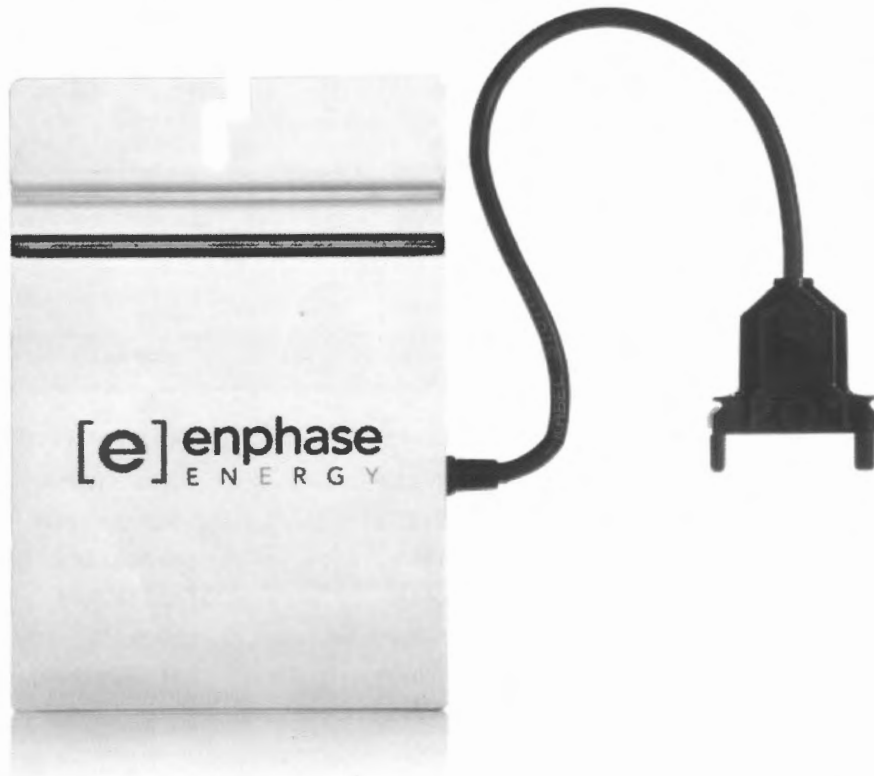
Engineering Drawings





ENPHASE MICROINVERTER

M215



The Enphase Energy Microinverter System improves energy harvest, increases reliability, and dramatically simplifies design, installation and management of solar power systems. The Enphase System includes the microinverter, the Envoy Communications Gateway, and Enlighten, Enphase's monitoring and analysis website.

PRODUCTIVE [- Maximum energy production
- Resilient to dust, debris and shading
- Performance monitoring per module

RELIABLE [- System availability greater than 99.8%
- No single point of system failure

SMART [- Quick & simple design, installation and management
- 24/7 monitoring and analysis

SAFE [- Low voltage DC
- Reduced fire risk



MICROINVERTER TECHNICAL DATA

Input Data (DC)		M215-60-2LL-S22/S23 M215-60-2LL-S22-NA/S23-NA (Ontario)	
Recommended maximum input power (STC)	260W		
Maximum input DC voltage	45V		
Peak power tracking range	22V – 36V		
Operating range	16V – 36V		
Min./Max. start voltage	26.4V/45V		
Max. DC short circuit current	15A		
Max. input current	10.5A		
Output Data (AC)		@208 Vac	@240 Vac
Maximum output power	215W	215W	
Nominal output current	1.0 A*	0.9 A*	
Nominal voltage/range	208V/183V-229V	240V/211V-264V	
Extended voltage/range	208V/179V-232V	240V/206V-269V	
Nominal frequency/range	60.0/59.3-60.5	60.0/59.3-60.5	
Extended frequency/range	60.0/59.2-60.6	60.0/59.2-60.6	
Power factor	>0.95	>0.95	
Maximum units per 20A branch circuit	26 (three phase)	17 (single phase)	
Maximum output fault current	1.05 Arms, over 3 cycles; 25.2 Apeak, 1.74ms duration		
			*Arms at nominal voltage
Efficiency			
CEC weighted efficiency		96.0%	
Peak inverter efficiency		96.3%	
Static MPPT efficiency (weighted, reference EN 50530)		99.8%	
Dynamic MPPT efficiency (fast irradiation changes, reference EN 50530)		99.9%	
Night time power consumption		46mW	
Mechanical Data			
Operating temperature range	-40°C to +65°C		
Dimensions (WxHxD)	17.3 cm x 16.4 cm x 2.5 cm (6.8" x 6.45" x 1.0")*		
Weight	1.6 kg (3.5 lbs)		
Cooling	Natural convection – no fans		
Enclosure environmental rating	Outdoor – NEMA 6		
			*without mounting bracket
Features			
Compatibility	Pairs with most 60-cell PV modules		
Communication	Power line		
Warranty	25 years, limited		
Compliance	UL1741/IEEE1547, FCC Part 15 Class B CAN/CSA-C22.2 NO. 0-M91, 0.4-04, and 107.1-01		

Enphase Energy, Inc.

201 1st Street, Petaluma, CA 94952
877 797 4743 www.enphase.com

 Printed on 100 percent recycled paper.

IRONRIDGE XR ROOF MOUNT PLATFORM

KEY FEATURES

- ◆ Extruded aluminum components are lightweight for easy handling yet strong enough for most roof mount applications
- ◆ Choice of XRL (lightweight) and XRS (standard) rails
- ◆ Both XRL and XRS rails come with slots for attaching L-feet and top slots for attaching panel clamps
- ◆ XRS rails has slot for bottom mounting clamps
- ◆ Hidden internal splice bars are aesthetically pleasing
- ◆ Internal splices provide superior strength and flexibility with L-feet placement
- ◆ Adjustable L-feet have vertical extension slots for easy adjustability of up to 1-3/8"
- ◆ Standoffs provide increased airflow and ventilation and enable precise placement of flashings
- ◆ Standoffs come in four standard heights: 3", 4", 6", and 7"
- ◆ XR platform compatible with popular flashings including QuickMount and Oatey
- ◆ Panel clamps for both top and bottom mounting
- ◆ Panel clamps for most popular photovoltaic modules
- ◆ Mid-clamp design maximizes panel density
- ◆ Ground clips eliminate the need for copper wire between modules
- ◆ The XR Roof Mount components are covered with an industry-leading 10 year limited product warranty and a 5 year limited finish warranty
- ◆ All XR Roof Mount components are PE certified



The IronRidge XR platform is a reliable, comprehensive, and feature rich photovoltaic mounting solution. Anchored by the XRS (Standard) and XRL (Light) rails, the XR platform includes all of the components necessary for supporting virtually any commercial or residential roof mount installation, regardless of surface material or roof grade.

The XRS and XRL rails are manufactured from extruded aluminum to maximize spans while minimizing weight for improved handling. The graceful curves of the XRS rail will please even the most aesthetically demanding customers: Rails can be extended with the IronRidge patent-pending internal splice bars, providing a strong support connection and ultimate flexibility in footing attachment locations. Installers have a variety of options in attaching IronRidge rails to the roof, including adjustable L-feet, aluminum standoffs, and tilt legs for optimizing power. In addition, IronRidge accommodates modules from most major manufacturers. Top-down panel clamps securely grip the outside frame of the module, freeing the installer from the constraints of panel mounting holes. The XRS rail has an additional side slot to enable the option of bottom mounting. Lastly, grounding clips pierce the anodized rails, creating a ground path through the equipment and eliminating the need to run copper wire between every module.

IronRidge provides a complete technical support system that includes step-by-step installation guides, engineering certification documentation, easy-to-read span charts, and on-line configurator software.

See reverse for product specifications and ordering information. Please contact your local distributor for configuration assistance.

SPECIFICATIONS

- ◆ XRL/XRS Rail – 6105-T5 extruded anodized aluminum
- ◆ XRL/XRS Splice Bars – 6105-T5 extruded aluminum
- ◆ Standoffs – 6105-T5 extruded aluminum
- ◆ L-feet: 6105-T5 extruded aluminum
- ◆ Clamps: 5052-H32 aluminum
- ◆ Hardware: 18-8 Stainless Steel

XRS PROPERTIES

- ◆ Area = .807136 inches²
- ◆ Centroid relative to output coordinate system origin
 - ◆ X = 0.5556
 - ◆ Y = 1.4097
 - ◆ Z = 120.000
- ◆ Moments of Inertia of the area (at the centroid)
 - ◆ Lxx = 0.8430
 - ◆ Lxy = 0.1117
 - ◆ Lxz = 0.0000
 - ◆ Lyx = 0.1117
 - ◆ Lyy = 0.1822
 - ◆ Lyz = 0.0000
 - ◆ Lzx = 0.0000
 - ◆ Lzy = 0.0000
 - ◆ Lzz = 1.0252
- ◆ Polar Moment of Inertia
 - ◆ At Centroid = 1.0252⁴
- ◆ Principal Moments of Inertia
 - ◆ Ix = 0.1638
 - ◆ Iy = 0.8614
- ◆ Principal-Part Axes
 - ◆ Angle = 99.343 degrees
- ◆ Moments of Inertia (output)
 - ◆ LXX = 11625.205
 - ◆ LXY = 0.5204
 - ◆ LXZ = 53.8153
 - ◆ LYX = 0.5204
 - ◆ LYY = 11623.1909
 - ◆ LYZ = 136.5369
 - ◆ LZX = 53.8153
 - ◆ LZY = 136.5369
 - ◆ LZZ = 2.8784

ORDERING INFORMATION

XR Rails		
Part Number	Description	Weight
51-7000-144a	XRS Standard Rail (1) – 12 feet	11.364 lbs
51-7000-168a	XRS Standard Rail (1) – 14 feet	13.258 lbs
51-7000-192a	XRS Standard Rail (1) – 16 feet	15.152 lbs
51-7000-216a	XRS Standard Rail (1) – 18 feet	17.046 lbs
51-6000-144a	XRL Light Rail (1) – 12 feet	6.288 lbs
51-6000-168a	XRL Light Rail (1) – 14 feet	7.336 lbs
51-6000-192a	XRL Light Rail (1) – 16 feet	8.384 lbs
51-6000-216a	XRL Light Rail (1) – 18 feet	9.432 lbs
29-7000-010	XRS Splice Kit (1)	0.442 lbs
29-7000-000	XRL Splice Kit (1)	0.151 lbs
Panel Clamps		
Part Number	Description	Weight
29-7000-xxx	End Clamps (4) – depends on panel	.251-.290 lbs
29-7000-10x	Mid Clamps (4) – depends on panel	.213-.251 lbs
29-7000-117	Under Clamps (4)	0.324 lbs
Footing Attachments & Flashings		
Part Number	Description	Weight
29-7000-017	L-foot Kit (4)	0.872 lbs
51-600x-500	3"-7" Standoffs – Specify L-foot or Tilt leg	.533-.710 lbs
31-1000-001	Oatey Galvanized Flashing 11830 (12)	8.750 lbs
31-1000-000	QuickMount QMSCA12 (12)	13.390 lbs
51-7200-0XX	Tilt Legs (7" – 40")	.0658 lbs/inch
51-7210-000	Tilt Leg Bracket	1.576 lbs
Grounding		
Part Number	Description	Weight
29-4000-001	WEEB DMC-Clip (100)	0.258 lbs
29-4000-002	WEEB Grounding Lug (100)	12.356 lbs
29-4000-003	WEEB Bonding Jumper (100)	17.614 lbs
29-4000-006	WEEB ACC-PV Wire Clip (100)	0.625 lbs

L-FOOT DIMENSIONS

