Descriptive Report and Test Results

MASTER CONTRACT: 266909
REPORT: 70072584
PROJECT: 70103370

Edition 1**:** August 12, 2016; Project 70072584 – Albuquerque
Prepared by Chase Henson; Reviewed by Ze Guo

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Edition 2: March 15, 2017; Project 70103370 – Albuquerque
Prepared by Andrew Koretoff

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PRODUCTS

CLASS - C531302 - POWER SUPPLIES - PHOTOVOLTAICS - PV Racking.
CLASS - C531382 - POWER SUPPLIES - PHOTOVOLTAICS-PV Racking and clamping systems - Certified to US Standards

Models:	RM 5 South	–	South facing, low-slope, ballasted roof-mount PV racking system
	RM DT	–	East-West facing, low-slope, ballasted roof-mount PV racking system

The systems listed are designed to provide bonding/grounding, and mechanical stability for photovoltaic modules. The system employs galvanized steel bays, ballasted with ASTM C1491 concrete blocks. Modules are secured to the racking system with stainless steel end and mid clamps. Where applicable, the system may employ fire skirts and/or wind deflectors made from 18 gauge G180 steel. The modules are bonded to the racking system with anodization-piercing clamps. The system is grounded with 10 AWG copper wire to bonding/grounding lugs.

The grounding of the system is intended to comply with the latest edition of the National Electrical Code, to include NEC 250 & 690. Local codes compliance is required, in addition to national codes. All grounding/bonding connections are to be torqued in accordance with the Installation Manual and the settings used during the certification testing for the current edition of the project report.

The system may employ bay-mounted or module mounted optimizers/micro-inverters.

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Both models are identical in terms of construction material, module clamps, bonding/grounding, and performance rating with the exception of the tilt angle and direction of the systems.

Mechanical ratings for both models:

Downward Design Load (lb/ft²)	36
Upward Design Load (lb/ft²)	16.7
Down-Slope Load (lb/ft²)	5

Conditions of acceptability: Installation is subject to acceptance of the local inspection authorities having jurisdiction. The certification of these products relates only to the methods of installation, bonding, and grounding as outlined in the Installation Manual for each product.

APPLICABLE REQUIREMENTS

UL 2703-1st Edition - Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels.
LTR AE-001-2012 - List of Technical Requirements for Photovoltaic Module and Panel racking Systems

MARKINGS

The manufacturer is required to apply the following markings:

- Products shall be marked with the markings specified by the particular product standard.
- Products certified for Canada shall have all Caution and Warning markings in both English and French.

Additional bilingual markings not covered by the product standard(s) may be required by the Authorities Having Jurisdiction. It is the responsibility of the manufacturer to provide and apply these additional markings, where applicable, in accordance with the requirements of those authorities.

The products listed are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and U.S. Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only.

The following markings appear on the ballast bay by permanent stamping:

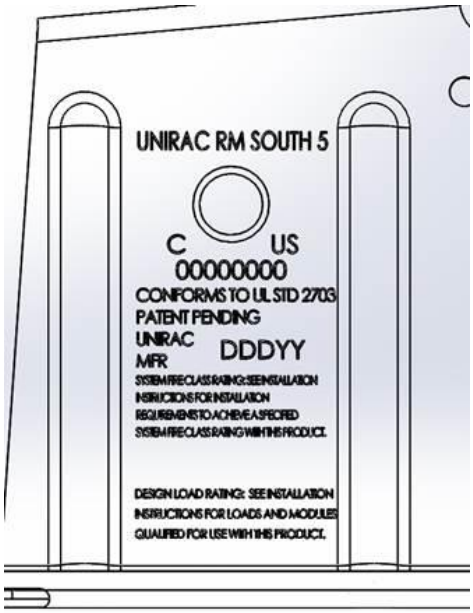
1. Submitter's name and/or CSA Master Contract number "266909";
2. Model designation;
3. Manufacturing date;
4. System fire class rating/designation of information location in Installation Manual;
5. Design load rating/designation of information location in Installation Manual;

UNIRAC RM SOUTH 5
CONFORMS TO UL STD 2703
PATENT PENDING
UNIRAC MFR DDDYY

C US
266909

SYSTEM FIRE CLASS RATING: SEE INSTALLATION INSTRUCTIONS FOR INSTALLATION REQUIREMENTS TO ACHIEVE A SPECIFIED SYSTEM FIRE CLASS RATING WITH THIS PRODUCT.

DESIGN LOAD RATING: SEE INSTALLATION INSTRUCTIONS FOR LOADS AND MODULES QUALIFIED FOR USE WITH THIS PRODUCT.



Nameplate adhesive label material approval information:

Markings applied via permanent stamping to bay.

ALTERATIONS

Markings as described appear on each bay.

FACTORY TESTS

Not Applicable

SPECIAL INSTRUCTIONS FOR FIELD SERVICES

1. Component descriptions marked with either the "(INT)" or "(INT*)" identifiers may be substituted with other components providing the requirements specified under the notes in the "Description" are complied with.

COMPONENT SPECIAL PICKUP

1. Component descriptions marked with the identifier "(CT)" are subject to annual pickup and Conformity Testing.

DESCRIPTION

1. The system does not have a maximum module installation size.
2. The system was evaluated for use with modules up to 21.47 sqft.
3. See Tables 1 and 2 for customer supplied information
4. See Table 3 for the compatible module list.

5. See the attached installation manual for each model installation instructions, and system drawings.

Table 1

Type/Model	RM5	RMDT
Max load rating (PSF)	See § 21	See § 21
Max branch circuit overcurrent-protection device (A)	30	30
Max fuse rating if different than above branch circuit overcurrent-protection device	N/A	N/A
Module end clamp torque (in-lbs)	84 in-lbs minimum	84 in-lbs minimum
Module mid clamp torque (in-lbs)	84 in-lbs minimum	84 in-lbs minimum
Fire skirt or wind dam torque (in-lbs)	120 in-lbs minimum	120 in-lbs minimum
Grounding lug to ballast or frame (in-lbs)	75 in-lbs minimum	75 in-lbs minimum
Optimizer mount torque – 4x20 hex (in-lbs) (to bay)	120 in-lbs minimum	120 in-lbs minimum
Optimizer mount torque – allen head (in-lbs) (to bay)	53 in-lbs minimum	53 in-lbs minimum
Micro-inverter mount (in-lbs) (to bay)	120 in-lbs minimum	120 in-lbs minimum
MLPE Microinverter/Optimizer (to module frame)	240 in-lbs minimum	240 in-lbs minimum

Table 2

MODULE RACKING SYSTEM TYPE/S		
	EAST-WEST (RMDT)	SOUTH (RM5)
MODULE TYPE		
Module Fire Type ……:	Type 1 or 2, Class A for Low Slope	
IDENTIFICATION OF COMPONENTS AND MATERIALS		
Ballast bay .....:	16G ASTM A653 GR50 Steel, G235 Galvanization	
Module clamp and hardware .....:	Stainless steel	
Ballast block .....:	ASTM C1491 solid concrete block	
Wind Deflector .....:	18 G G180 steel	
South Skirt .....:	18 G G180 steel	
East Skirt .....:	18 G G180 steel	
West Skirt .....:	18 G G180 steel	
Grounding Lug .....:	Ilsco SGB-4 lug – CSA certified for Grounding/Bonding, and Photovoltaics CSA File: 165122-2429280 (Grounding/Bonding) 165122-2650267 (Photovoltaics)	

Table 3

Module Manufacturer	Model/Series	No. Cells	Frame Thickness
AU Optronics	PM Series	60/72	40

Canadian Solar	CS5A-M CS6P-M CS6X-P CS6U-P CS6U-M CS6K-MS CS6K-M CS6K-P CS6P-P	60 60 72 72 72 60 60 60 60	40 40 40 40 40 40 40 40 40
Centrosolar America	C-Series E-Series	60/72	40
ET Solar	ETAC Module ET Module	60/72	40
Hanwha SolarOne	HSL 60 HSL 72	60/72	40
Hyundai Heavy Industries	MG Series TI Series RI Series MI Series	60 72 72 72	35 50 50 40
JA Solar	JAP6 60 JAM6 60 JAP6 72 JAM6 72	60 60 72 72	40 40 45 45
Jinko Solar	JKMxxxM-60 JKMxxxP-60 JKMxxxPP-60 JKMxxxP	60 60 60 72	40
Kyocera	KD-F Series	60	46
LG Electronics	MONO X MONO X 2 MONO X Plus MONO X Plus NeON 2/2 Black Mono NeON 2 NeON R/R Black (back contact) NeON 2 Bifacial	60 60 60 72 60 72 60 72	35 40 40 40 40 46 40 40
Phono Solar Tech.	Standard Modules Standard Modules	60 72	40 45
Panasonic	VBHNxxxSA15 VBHNxxxSA16	96	35
Q.Cells	Q.PLUS/PEAK/PRO - L G4.x B.LINE PLUS/PRO – L G4.x	72	35
REC	Peak Eco	60 60	38 38

	PE 72	72	45
Renesola	All 60 Cell Modules/Vitrus 2	60/72	40
Sharp	ND-24CQCJ ND-25CQCS ND-Q235F4 ND-F4Q300	60	46
Silfab	SLA-M/P	60	38
SolarWorld	Sunmodule Protect Sunmodule Plus	60/72 60/72	33
Suniva	Optimus Series 60 Optimus Series 72 MV Series 60 MV Series 72	60 72 60 72	35 38 40 46
Suntech	STP "XXX"	60 72	35 40
Sun Edison / Flextronics (rebranded)	F-Series / FLEX FXS R-Series / FLEX FXS	60 72	35/50 35/50
SunPower	X-Series 72 X-Series 96 E-Series 72 E-Series 96 P-Series Sig Black 72 Sig Black 96 AC	72 96 72 96 498 72 96 60	46 46 46 46 46 46 46 46
Trina	PA05 PD05 DD05 PD15 PE14	60 60 60 72 72	35 35 35 40 40
Yingli	YGE-U72 Panda 60 DS YGE 60 Cell Series DS YGE 60 Cell Series 2	72 60 60 60	40 40 40 35

Notes:

1. Component Substitution
   a) Critical components (those identified by mfr name, cat no), which are NOT identified with either "INT" or "INT*" are not eligible for substitution without evaluation and report updating
   b) The term "INT" means a "Certified" and/or "Listed" (or a "Recognized" and/or "Accepted") component may be replaced by one "Certified" and/or "Listed" by another certification organization accredited by the appropriate accreditation body or scheme requirements to the correct standard, for the same application; providing the applicable country identifiers are included and requirements in item "d" below are complied with.
   c) The Term "INT*" means a "Recognized" and/or "Accepted" component may be replaced by one "Recognized" and/or "Accepted" by another certification organization accredited by the appropriate

accreditation body or scheme requirements to the correct standard, for the same application, providing the applicable country identifiers are included, the component is **also** CSA Certified, the requirements in item "d" below are complied with and any "conditions of suitability" for the component (as recorded in this descriptive report) are complied with.

d) Components which have been substituted, must be of an equivalent rating, configuration (size, orientation, mounting) and the applicable minimum creepage and clearance distances are to be maintained from live parts to bonded metal parts and secondary parts.

e) Substitution of a "Certified" and/or "Listed" component with a component that is "Recognized" or "Accepted" is not permitted without evaluation and report updating.

TEST HISTORY

Edition 1: Project 70072584

The subject equipment was found to comply with the following requirements of UL Standard 2703, first edition. The following tests were performed on samples of both indicated models (RM 5; RM DT) and representative module samples listed in the test report. Details of the test results are being kept in the CSA Group document control system:

Bonding Path Resistance: Section 13
Fire Tests: Section 15
Temperature Cycling Test: Section 17
Humidity Test: Section 18
Mechanical Loading Test: Section 21
Bonding Conductor Test: Section 22

The following tests were considered not applicable, were satisfied through design review, or some other means of evaluation for acceptability:

Terminal Torque: Section 14
Accelerated Aging: Section 16
Corrosive Atmosphere Test: Section 19
Metallic Coating Thickness: Section 20
Bonding Strap Pull Test: Section 23

Edition 2: Project 70103370

The project report was updated to include the list of compatible modules from the previous test report. Additional modules with similar characteristics were added to the list of modules after reviewing for compatibility and similarity to previously listed modules. The updated list applies to both models (RM 5; RM DT). Details of the review are being stored in the CSA Group document control system. No additional tests were deemed necessary.

---End of Report---