



DOTec CORP.

Customized Engineering Solutions

November 29, 2016

Unirac, Inc.
1411 Broadway Boulevard NE
Albuquerque, New Mexico 87102-1545
TEL: (505) 248-2702 (Technical Support)

Attn.: Engineering Department,

Re: Engineering Certification for Unirac's DGFT (Distribution Ground Fixed Tilt)

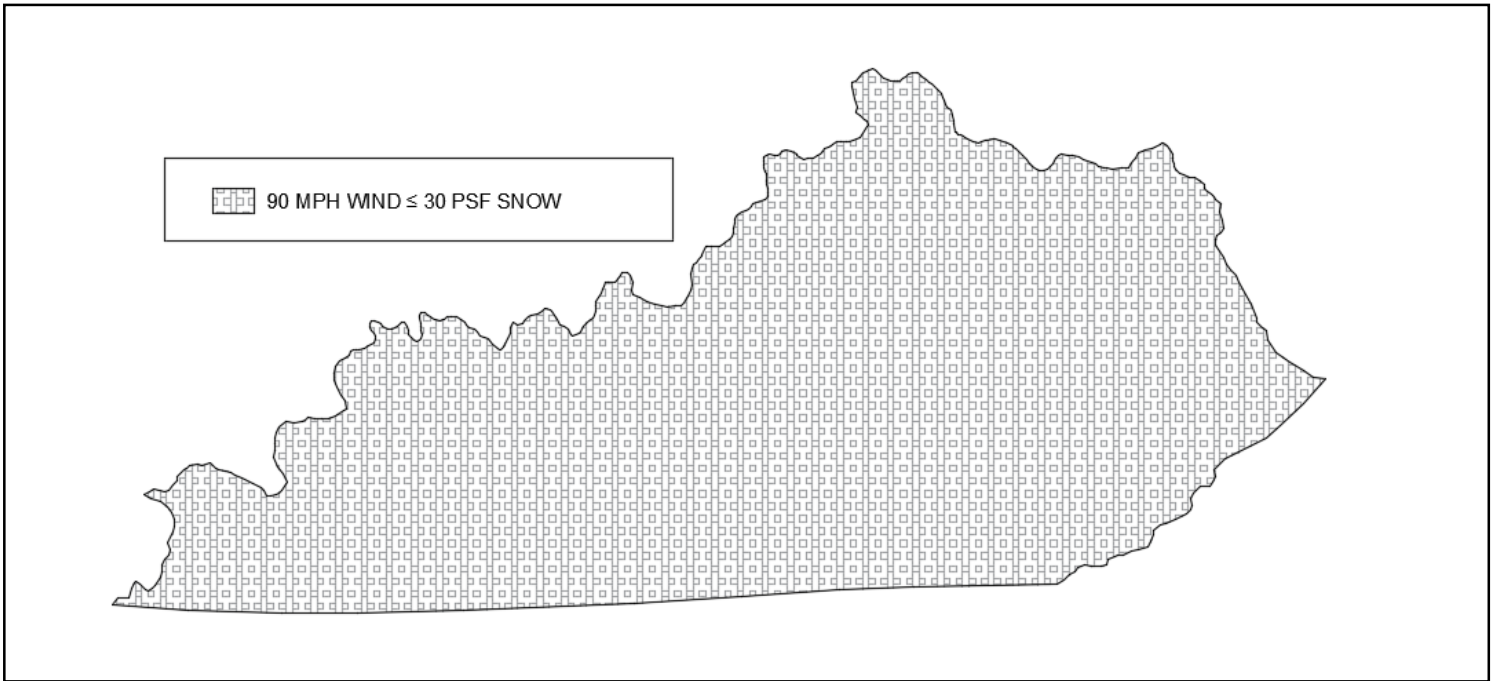
DOTec Engineering, Inc. has reviewed Unirac's DGFT design tool and design methodology. This approved design tool was utilized to develop the design tables listed below. The design methodology is acceptable for a code compliant, ground mount racking structure, supporting photovoltaic (PV) solar modules for residential/commercial.

All analysis and information included in the following DGFT design tables comply with the following:

1. 2009 International Building Code and 2012 International Building Code, by International Code Council, Inc., 2009 and 2012
2. ASCE/SEI 7-05 and ASCE/SEI 7-10 Minimum Design Loads and other Structures, by ASCE, 2006 and 2013
3. 2005 Aluminum Design Manual and 2010 Aluminum Design Manual (ADM), by the Aluminum Association, 2005 and 2010

This letter certifies that the structural analysis of the racking members, connections, and foundation designs (as listed in the following design tables) are in compliance with the above Codes.

See design tables on the following pages;



For Reference Only

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| NOTES: |
| 1. SEE SHEET SD-100 FOR TABLE/PILE REQUIREMENTS FOR A 60 CELL SOLAR PANEL |
| 2. REFER TO SHEET SD-300 FOR TABLE CROSS SECTIONAL DIMENSIONS AND PARTS LIST. |
| 3. SEE DETAILS AND NOTES ON SHEETS SD-100 AND SD-400 FOR ADDITIONAL INFORMATION ON SOIL TYPES AND SELECTION OF PROPER FOUNDATION TYPE FOR EACH GFT INSTALLATION. THIS IS THE RESPONSIBILITY OF THE INSTALLER/PROJECT OWNER. |
| 4. SEE SHEET SD-100 FOR RACKING DESIGN CRITERIA |
| 5. SOLAR REQUIREMENTS (FROM OWNER): TABLE TILT ANGLE = 30 DEGREES LEADING EDGE HEIGHT = 30 IN (FROM TOP OF SOLAR PANEL TO GRADE) ROW TO ROW SPACING = VERIFY WITH SOLAR DRAWINGS SOLAR PANEL = BY OTHERS (SEE DIMENSION/WEIGHT LIMITS BELOW) SOLAR PANEL DIM. = 76.5" to 78.46" LENGTH, 38.6" to 39.4" WIDTH, 1.37" TO 1.50" THICKNESS SOLAR PANEL WEIGHT = 47.8 LBS TO 60 LBS NOTE: UNIRAC AND THE ENGINEER OF RECORD ARE NOT RESPONSIBLE FOR THE SOLAR DESIGN, PERFORMANCE, SHADING, ETC. OF THE SOLAR SYSTEM. THIS BELONGS TO THE SOLAR ENGINEER OF RECORD. |

| 90 MPH Wind; ≤ 30 psf Snow ; 72 Cell Module | | | | | | | | | | | | |
|---|------------|---------|--------------|------------|----------|--------------|------------|----------|--------------|------------|----------|--------------|
| Table Size | Exposure C | | | | | | Exposure B | | | | | |
| | Driven | | | Concrete | | | Driven | | | Concrete | | |
| | # of Piles | Dim A | Dim B | # of Piles | Dim A | Dim B | # of Piles | Dim A | Dim B | # of Piles | Dim A | Dim B |
| 2x4 | 2 | 8' - 0" | 2' - 8 5/8" | 2 | 8' - 0" | 2' - 8 5/8" | 2 | 8' - 0" | 2' - 8 5/8" | 2 | 8' - 0" | 2' - 8 5/8" |
| 2x5 | 3 | 6' - 0" | 2' - 4 1/2" | 2 | 9' - 9" | 3' - 6" | 2 | 9' - 9" | 3' - 6" | 2 | 9' - 9" | 3' - 6" |
| 2x6 | 3 | 7' - 0" | 3' - 0 3/8" | 3 | 7' - 0" | 3' - 0 3/8" | 2 | 11' - 9" | 4' - 1 7/8" | 2 | 11' - 9" | 4' - 1 7/8" |
| 2x7 | 3 | 8' - 3" | 3' - 5 1/8" | 3 | 8' - 3" | 3' - 5 1/8" | 3 | 8' - 3" | 3' - 5 1/8" | 2 | 13' - 9" | 4' - 9 5/8" |
| 2x8 | 4 | 7' - 0" | 2' - 10" | 3 | 9' - 6" | 3' - 10" | 3 | 9' - 6" | 3' - 10" | 3 | 9' - 6" | 3' - 10" |
| 2x9 | 4 | 7' - 9" | 3' - 4 2/8" | 4 | 7' - 9" | 3' - 4 1/4" | 3 | 10' - 9" | 4' - 2 3/4" | 3 | 10' - 9" | 4' - 2 3/4" |
| 2x10 | 5 | 7' - 0" | 2' - 7 5/8" | 4 | 8' - 9" | 3' - 6 1/8" | 3 | 11' - 9" | 4' - 10 5/8" | 3 | 11' - 9" | 4' - 10 5/8" |
| 2x11 | 5 | 7' - 6" | 3' - 3 1/2" | 4 | 9' - 6" | 4' - 0 1/2" | 4 | 9' - 6" | 4' - 0 1/2" | 3 | 13' - 0" | 5' - 3 1/2" |
| 2x12 | 6 | 6' - 9" | 3' - 0 3/4" | 5 | 8' - 3" | 3' - 5 1/4" | 4 | 10' - 6" | 4' - 2 1/4" | 4 | 10' - 6" | 4' - 2 1/4" |
| 2x13 | 6 | 7' - 6" | 2' - 10 1/8" | 5 | 9' - 0" | 3' - 7 1/8" | 4 | 11' - 3" | 4' - 8 5/8" | 4 | 11' - 3" | 4' - 8 5/8" |
| 2x14 | 6 | 8' - 0" | 3' - 2 7/8" | 5 | 9' - 9" | 3' - 8 7/8" | 4 | 12' - 3" | 4' - 10 3/8" | 4 | 12' - 3" | 4' - 10 3/8" |
| 2x15 | 7 | 7' - 3" | 3' - 1 3/4" | 5 | 10' - 3" | 4' - 4 3/4" | 5 | 10' - 3" | 4' - 4 3/4" | 4 | 13' - 0" | 5' - 4 3/4" |
| 2x16 | 7 | 7' - 9" | 3' - 3 5/8" | 6 | 9' - 0" | 4' - 0 5/8" | 5 | 11' - 0" | 4' - 6 5/8" | 5 | 11' - 0" | 4' - 6 5/8" |
| 2x17 | 8 | 7' - 3" | 2' - 9 7/8" | 6 | 9' - 9" | 3' - 9 7/8" | 6 | 9' - 9" | 3' - 9 7/8" | 5 | 11' - 9" | 4' - 8 3/8" |
| 2x18 | 8 | 7' - 9" | 2' - 8 3/4" | 6 | 10' - 3" | 4' - 2 3/4" | 6 | 10' - 3" | 4' - 2 3/4" | 5 | 12' - 6" | 4' - 10 1/4" |
| 2x19 | 8 | 8' - 0" | 3' - 6" | 7 | 9' - 3" | 3' - 9" | 6 | 10' - 9" | 4' - 7 1/2" | 5 | 13' - 0" | 5' - 6" |
| 2x20 | 9 | 7' - 6" | 3' - 1 7/8" | 7 | 9' - 9" | 3' - 10 7/8" | 6 | 11' - 6" | 4' - 4 7/8" | 6 | 11' - 6" | 4' - 4 7/8" |
| 2x21 | 9 | 8' - 0" | 2' - 9 3/4" | 7 | 10' - 3" | 4' - 0 3/4" | 7 | 10' - 3" | 4' - 0 3/4" | 6 | 12' - 0" | 4' - 9 3/4" |
| 2x22 | 10 | 7' - 6" | 2' - 8 1/2" | 8 | 9' - 3" | 4' - 1" | 7 | 10' - 9" | 4' - 2 1/2" | 6 | 12' - 6" | 5' - 2 1/2" |
| 2x23 | 10 | 7' - 9" | 3' - 2 7/8" | 8 | 9' - 9" | 3' - 11 7/8" | 7 | 11' - 3" | 4' - 4 3/8" | 7 | 11' - 3" | 4' - 4 3/8" |
| 2x24 | 11 | 7' - 3" | 3' - 6 1/8" | 8 | 10' - 3" | 3' - 10 5/8" | 8 | 10' - 3" | 3' - 10 5/8" | 7 | 11' - 9" | 4' - 6 1/8" |
| 2x25 | 11 | 7' - 9" | 2' - 8" | 9 | 9' - 6" | 3' - 5" | 8 | 10' - 6" | 4' - 8" | 7 | 12' - 3" | 4' - 8" |
| 2x26 | 11 | 8' - 0" | 3' - 0 7/8" | 9 | 9' - 9" | 4' - 0 7/8" | 8 | 11' - 0" | 4' - 6 7/8" | 7 | 12' - 9" | 4' - 9 7/8" |
| 2x27 | 12 | 7' - 6" | 3' - 5 5/8" | 10 | 9' - 0" | 4' - 2 5/8" | 8 | 11' - 6" | 4' - 5 5/8" | 8 | 11' - 6" | 4' - 5 5/8" |
| 2x28 | 12 | 7' - 9" | 3' - 9" | 10 | 9' - 6" | 3' - 7 1/2" | 9 | 10' - 6" | 4' - 4 1/2" | 8 | 11' - 9" | 5' - 3" |
| 2x29 | 13 | 7' - 6" | 3' - 0 1/4" | 10 | 9' - 9" | 4' - 1 3/4" | 9 | 11' - 0" | 4' - 0 1/4" | 8 | 12' - 3" | 5' - 1 3/4" |
| 2x30 | 13 | 7' - 9" | 3' - 2 1/8" | 10 | 10' - 0" | 4' - 8 1/8" | 9 | 11' - 3" | 4' - 8 1/8" | 8 | 12' - 9" | 5' - 0 5/8" |

| 90 MPH Wind; ≤ 30 psf Snow; 60 Cell Module | | | | | | | | | | | | |
|--|------------|----------|--------------|------------|----------|--------------|------------|----------|--------------|------------|----------|--------------|
| Table Size | Exposure C | | | | | | Exposure B | | | | | |
| | Driven | | | Concrete | | | Driven | | | Concrete | | |
| | # of Piles | Dim A | Dim B | # of Piles | Dim A | Dim B | # of Piles | Dim A | Dim B | # of Piles | Dim A | Dim B |
| 2x4 | 2 | 8' - 0" | 2' - 8 5/8" | 2 | 8' - 0" | 2' - 8 5/8" | 2 | 8' - 0" | 2' - 8 5/8" | 2 | 8' - 0" | 2' - 8 5/8" |
| 2x5 | 2 | 9' - 9" | 3' - 6" | 2 | 9' - 9" | 3' - 6" | 2 | 9' - 9" | 3' - 6" | 2 | 9' - 9" | 3' - 6" |
| 2x6 | 2 | 11' - 9" | 4' - 1 7/8" | 2 | 11' - 9" | 4' - 1 7/8" | 2 | 11' - 9" | 4' - 1 7/8" | 2 | 11' - 9" | 4' - 1 7/8" |
| 2x7 | 3 | 8' - 3" | 3' - 5 1/8" | 2 | 13' - 9" | 4' - 9 5/8" | 2 | 13' - 9" | 4' - 9 5/8" | 2 | 13' - 9" | 4' - 9 5/8" |
| 2x8 | 3 | 9' - 6" | 3' - 10" | 3 | 9' - 6" | 3' - 10" | 3 | 9' - 6" | 3' - 10" | 2 | 15' - 6" | 5' - 7" |
| 2x9 | 3 | 10' - 9" | 4' - 2 3/4" | 3 | 10' - 9" | 4' - 2 3/4" | 3 | 10' - 9" | 4' - 2 3/4" | 3 | 10' - 9" | 4' - 2 3/4" |
| 2x10 | 4 | 8' - 9" | 3' - 6 1/8" | 3 | 11' - 9" | 4' - 10 5/8" | 3 | 11' - 9" | 4' - 10 5/8" | 3 | 11' - 9" | 4' - 10 5/8" |
| 2x11 | 5 | 7' - 6" | 3' - 3 1/2" | 3 | 13' - 0" | 5' - 3 1/2" | 3 | 13' - 0" | 5' - 3 1/2" | 3 | 13' - 0" | 5' - 3 1/2" |
| 2x12 | 5 | 8' - 3" | 3' - 5 1/4" | 4 | 10' - 6" | 4' - 2 1/4" | 3 | 14' - 3" | 5' - 8 1/4" | 3 | 14' - 3" | 5' - 8 1/4" |
| 2x13 | 5 | 9' - 0" | 3' - 7 1/8" | 4 | 11' - 3" | 4' - 8 5/8" | 4 | 11' - 3" | 4' - 8 5/8" | 4 | 11' - 3" | 4' - 8 5/8" |
| 2x14 | 5 | 9' - 9" | 3' - 8 7/8" | 4 | 12' - 3" | 4' - 10 3/8" | 4 | 12' - 3" | 4' - 10 3/8" | 4 | 12' - 3" | 4' - 10 3/8" |
| 2x15 | 5 | 10' - 3" | 4' - 4 3/4" | 4 | 13' - 0" | 5' - 4 3/4" | 4 | 13' - 0" | 5' - 4 3/4" | 4 | 13' - 0" | 5' - 4 3/4" |
| 2x16 | 5 | 11' - 0" | 4' - 6 5/8" | 5 | 11' - 0" | 4' - 6 5/8" | 4 | 14' - 0" | 5' - 6 5/8" | 4 | 14' - 0" | 5' - 6 5/8" |
| 2x17 | 6 | 9' - 9" | 3' - 9 7/8" | 5 | 11' - 9" | 4' - 8 3/8" | 5 | 11' - 9" | 4' - 8 3/8" | 5 | 11' - 9" | 4' - 8 3/8" |
| 2x18 | 7 | 8' - 9" | 3' - 7 1/4" | 5 | 12' - 6" | 4' - 10 1/4" | 5 | 12' - 6" | 4' - 10 1/4" | 5 | 12' - 6" | 4' - 10 1/4" |
| 2x19 | 7 | 9' - 3" | 3' - 9" | 6 | 10' - 9" | 4' - 7 1/2" | 5 | 13' - 0" | 5' - 6" | 5 | 13' - 0" | 5' - 6" |
| 2x20 | 7 | 9' - 9" | 3' - 10 7/8" | 6 | 11' - 6" | 4' - 4 7/8" | 5 | 13' - 9" | 5' - 7 7/8" | 5 | 13' - 9" | 5' - 7 7/8" |
| 2x21 | 7 | 10' - 3" | 4' - 0 3/4" | 6 | 12' - 0" | 4' - 9 3/4" | 6 | 12' - 0" | 4' - 9 3/4" | 6 | 12' - 0" | 4' - 9 3/4" |
| 2x22 | 8 | 9' - 3" | 4' - 1" | 6 | 12' - 6" | 5' - 2 1/2" | 6 | 12' - 6" | 5' - 2 1/2" | 6 | 12' - 6" | 5' - 2 1/2" |
| 2x23 | 8 | 9' - 9" | 3' - 11 7/8" | 7 | 11' - 3" | 4' - 4 3/8" | 6 | 13' - 0" | 5' - 7 3/8" | 6 | 13' - 0" | 5' - 7 3/8" |
| 2x24 | 8 | 10' - 3" | 3' - 10 5/8" | 7 | 11' - 9" | 4' - 6 1/8" | 6 | 13' - 9" | 5' - 4 5/8" | 6 | 13' - 9" | 5' - 4 5/8" |
| 2x25 | 8 | 10' - 6" | 4' - 8" | 7 | 12' - 3" | 4' - 8" | 6 | 14' - 3" | 5' - 9 1/2" | 6 | 14' - 3" | 5' - 9 1/2" |
| 2x26 | 9 | 9' - 9" | 4' - 0 7/8" | 8 | 11' - 0" | 4' - 6 7/8" | 7 | 12' - 9" | 4' - 9 7/8" | 7 | 12' - 9" | 4' - 9 7/8" |
| 2x27 | 9 | 10' - 3" | 3' - 8 5/8" | 8 | 11' - 6" | 4' - 5 5/8" | 7 | 13' - 3" | 4' - 11 5/8" | 7 | 13' - 3" | 4' - 11 5/8" |
| 2x28 | 10 | 9' - 6" | 3' - 7 1/2" | 8 | 11' - 9" | 5' - 3" | 7 | 13' - 6" | 5' - 10 1/2" | 7 | 13' - 6" | 5' - 10 1/2" |
| 2x29 | 10 | 9' - 9" | 4' - 1 3/4" | 9 | 11' - 0" | 4' - 0 1/4" | 8 | 12' - 3" | 5' - 1 3/4" | 7 | 14' - 0" | 6' - 0 1/4" |
| 2x30 | 10 | 10' - 0" | 4' - 8 1/8" | 9 | 11' - 3" | 4' - 8 1/8" | 8 | 12' - 9" | 5' - 0 5/8" | 8 | 12' - 9" | 5' - 0 5/8" |

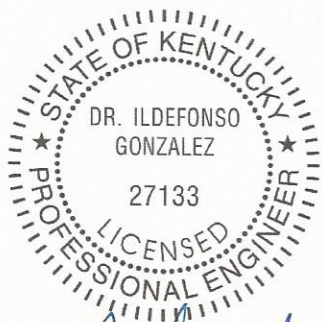
NOTES:

- FOR DIMENSIONS A & B SEE 'PLAN VIEW OF TABLE' ON SHEET SD-300. THESE DIMENSIONS SHALL NOT BE EXCEEDED BY 2".
- DESIGN LOADS SHOWN ABOVE AND FINAL DESIGNS ARE BASED ON ASCE 7-05.
- EXPOSURE B SHALL APPLY WHERE THE GROUND SURFACE ROUGHNESS CONDITION B PREVAILS FOR A DISTANCE OF 1,500 FEET.
- SURFACE ROUGHNESS B IS DEFINED AS URBAN AND SUBURBAN AREAS, WOODED AREAS, OR OTHER TERRAIN WITH NUMEROUS CLOSELY SPACED OBSTRUCTIONS HAVING THE SIZE OF SINGLE-FAMILY DWELLINGS OR LARGER.
- EXPOSURE C SHALL BE USED WHEN EXPOSURE B DOES NOT APPLY OR MEETS THE CRITERIA FOR SURFACE ROUGHNESS C PERTAINING TO OPEN TERRAIN WITH SCATTERED OBSTRUCTIONS.
- CONCRETE PILES AND PARTIAL CONCRETE CAN UTILIZE THE 12.5 FOOT TOTAL LENGTH PILE. DRIVEN PILES AND PARTIAL DRIVEN PILES REQUIRE THE 15.0 FOOT TOTAL LENGTH PILE.

For more information on the above tables, see the DGFT construction drawings, sheets SD-100, SD-300, SD-400, and SD-500. The analysis does not include specific corrosion requirements.

If you have any questions on the above, please contact Unirac, Inc. or DOTec Engineering, Inc.

Certification by:
Dr. Ildefonso "Al" Gonzalez, P.E. PhD
Kentucky #27133
DOTec Engineering, Inc.
St. Charles, MO



Dr. Ildefonso Gonzalez PhD
11/29/12