

SOLAR PV INSTALLATION PROJECT

Rao Residence
17606 Karli Lane
Orland Park, IL 60647

PLAN AND CONSTRUCTION SET

09/28/2018 [UPDATED 10/22/18]

REFERENCED CODES AND ACTS, Orland Park, IL

2015 IBC Building Code w/Village Amendments, Village Code, Title 5, Chapter 1

2015 IRC Building Code w/Village Amendments, Village Code, Title 5, Chapter 1

2015 International Mechanical Code w/Amendments, Village Code, Title 5, Chapter 6

2014 National Electrical Code w/Amendments, Village Code, Title 5, Chapter 3

2014 State of Illinois Plumbing Code w/Amendments, Village Code, Title 5, Chapter 4

2012

International Fire Code w/Amendments, Village Code, Title 5, Chapter s1 & 5

2015 International Property Maintenance Code w/Amendments, Village Code, Title 5, Chapter 7

2015 Illinois Energy Conservation Code (IECC)

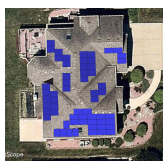


PROJECT SUMMARY:

- 21.24 kW Grid Interactive Solar Array
- (59) 360W SunPower X22-360-D-AC Modules.
- Inverter Output: 240V/1 ϕ , 3W.
- SunPower Invisimount Racking: Flush, Attached Roof Mount.
- Building Service: 200A, 240V, 1 ϕ , 3W
- Pitch: 36° Azimuth: 90°, 180°, 270°
- AC Point of Common Connection: AC Load Side Connection inside Utility Meter Enclosure.
- AC Disconnect on exterior wall of House next to utility meter.

SHEET INDEX:

1. [PROJECT SUMMARY:](#)
2. [OVERHEAD VIEW OF SITE](#)
3. [SITE PLAN](#)
4. [ARRAY & RACKING PLAN - OVERVIEW](#)
5. [ARRAY & RACKING PLAN - NORTHWEST ROOF](#)
6. [ARRAY & RACKING PLAN - SOUTHEAST ROOF](#)
7. [ARRAY & RACKING PLAN - SOUTHWEST ROOF](#)
8. [ARRAY & RACKING PLAN - SOUTH ROOF](#)
9. [ARRAY & RACKING PLAN - NORTHEAST MOST ROOF](#)
10. [ARRAY & RACKING PLAN - NORTHEAST MID ROOF](#)
11. [FRONT ELEVATION](#)
12. [RIGHT ELEVATION](#)
13. [LEFT ELEVATION](#)
14. [REAR ELEVATION](#)
15. [SINGLE LINE DIAGRAM](#)



VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **1**

OWNER CONTACT: 708-337-3274

OVERHEAD VIEW OF SITE



VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 2

OWNER CONTACT: 708-337-3274

SITE PLAN

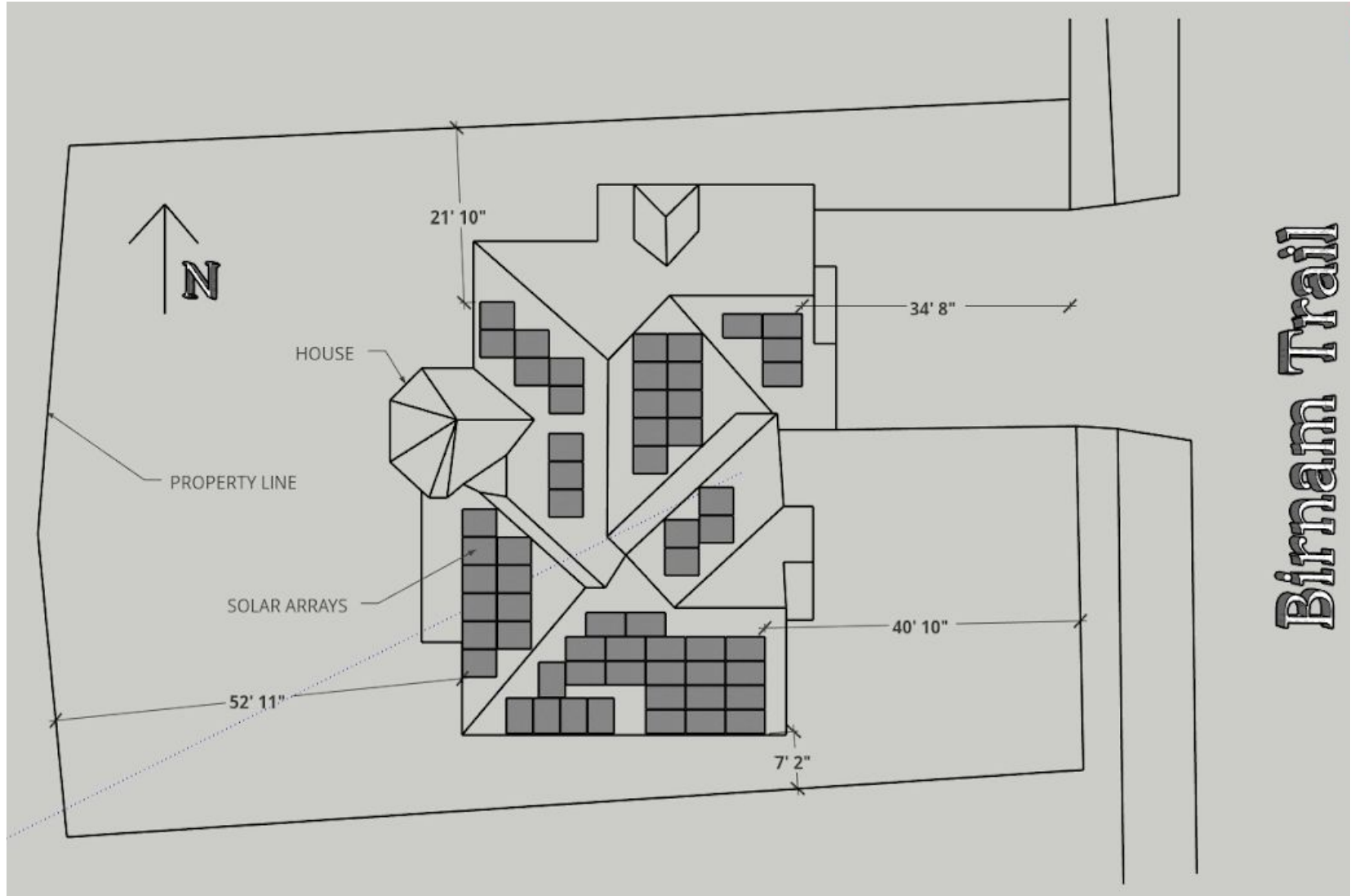
Total area of
proposed
Solar panel
array:

1,035 ft²

Total Area of
Rooftop:

4467 ft²

$1,035/4,467 =$
23.17% total
rooftop area
covered by
solar panel
arrays.



VERSION:
9/28/2018
Drawn: DB,KU

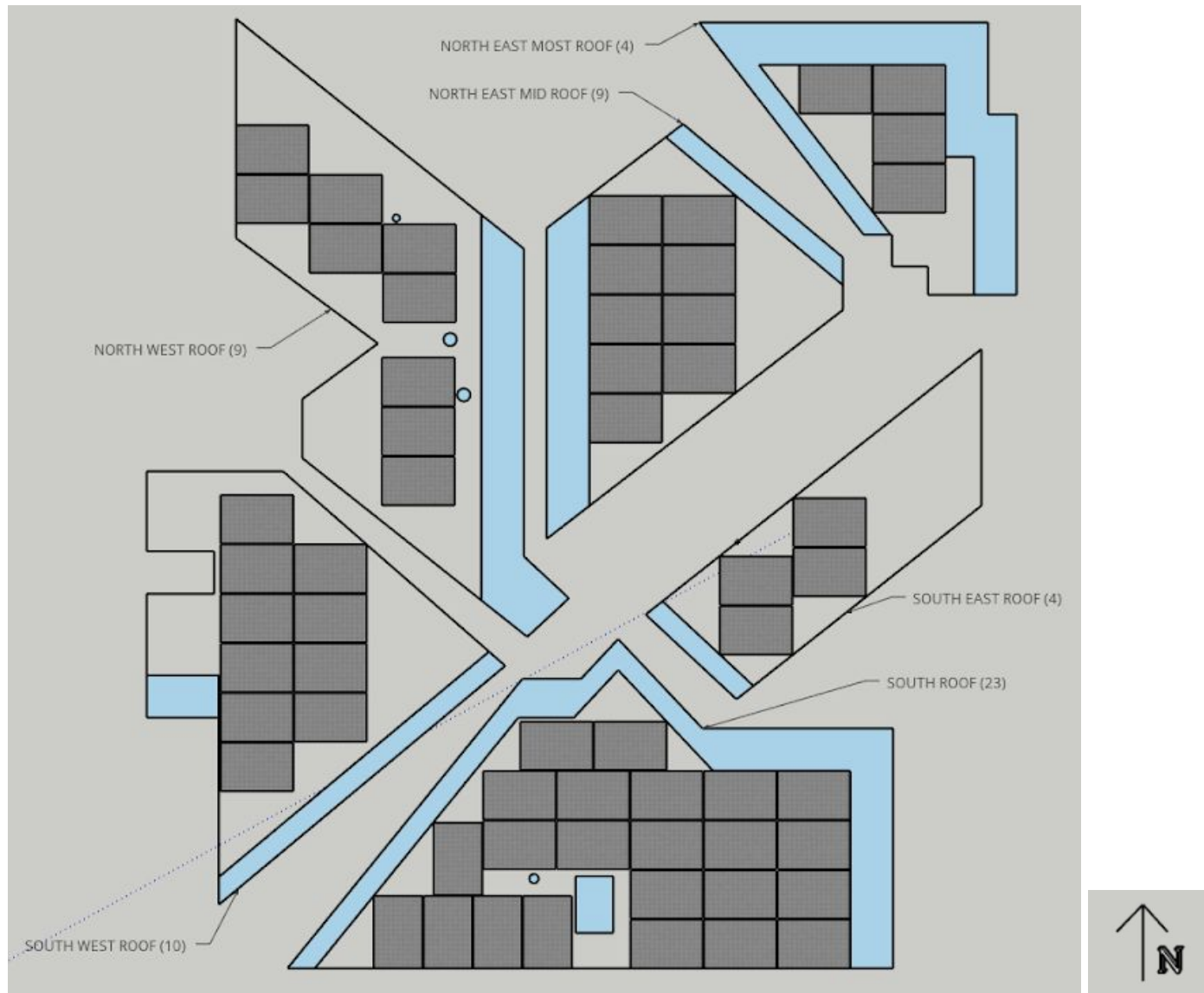


1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 3

OWNER CONTACT: 708-337-3274

ARRAY & RACKING PLAN - OVERVIEW



VERSION:
9/28/2018
Drawn: DB,KU



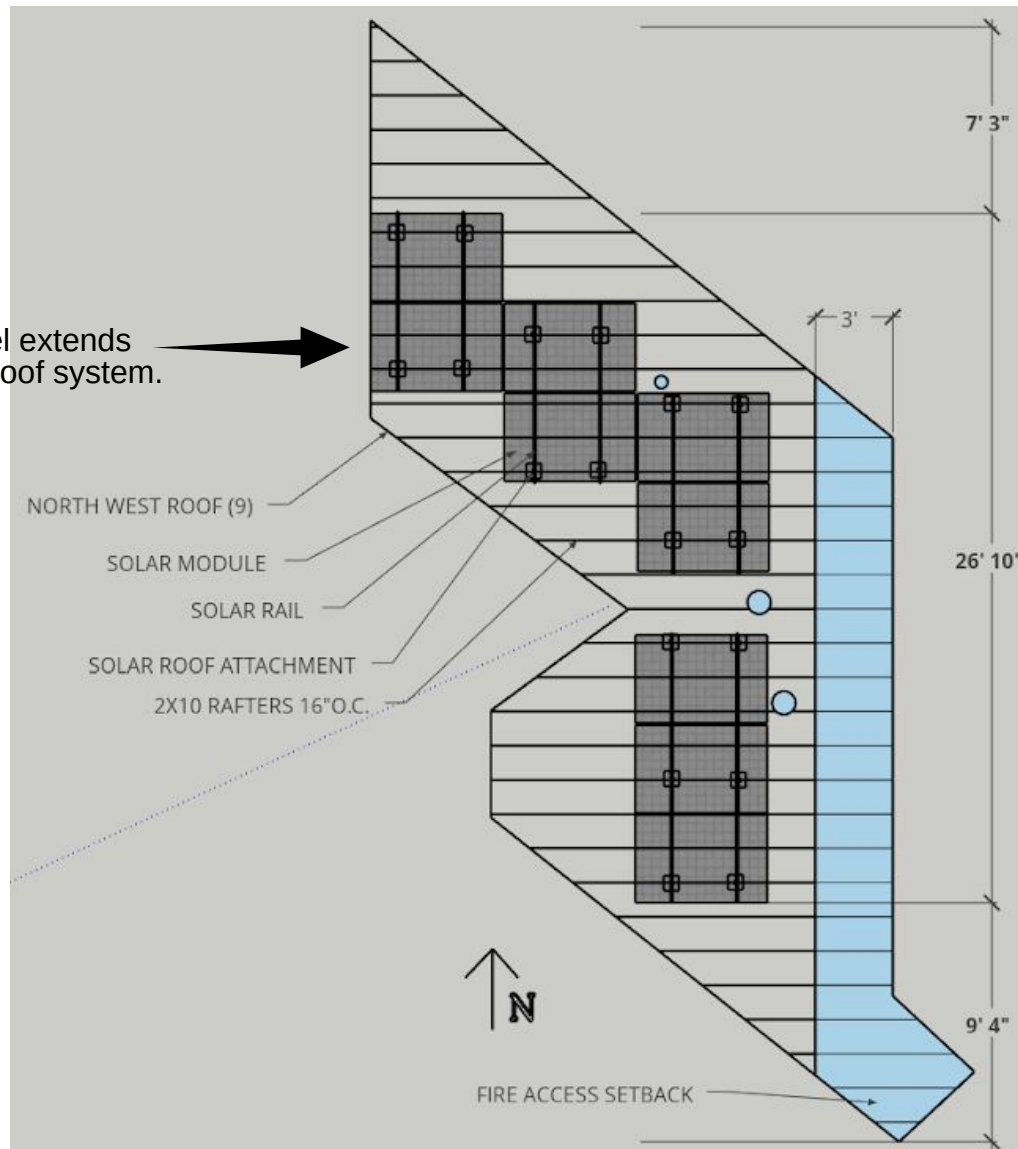
1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 4

OWNER CONTACT: 708-337-3274

ARRAY & RACKING PLAN - NORTHWEST ROOF

Note: No part of the panel extends beyond the edge of the roof system.



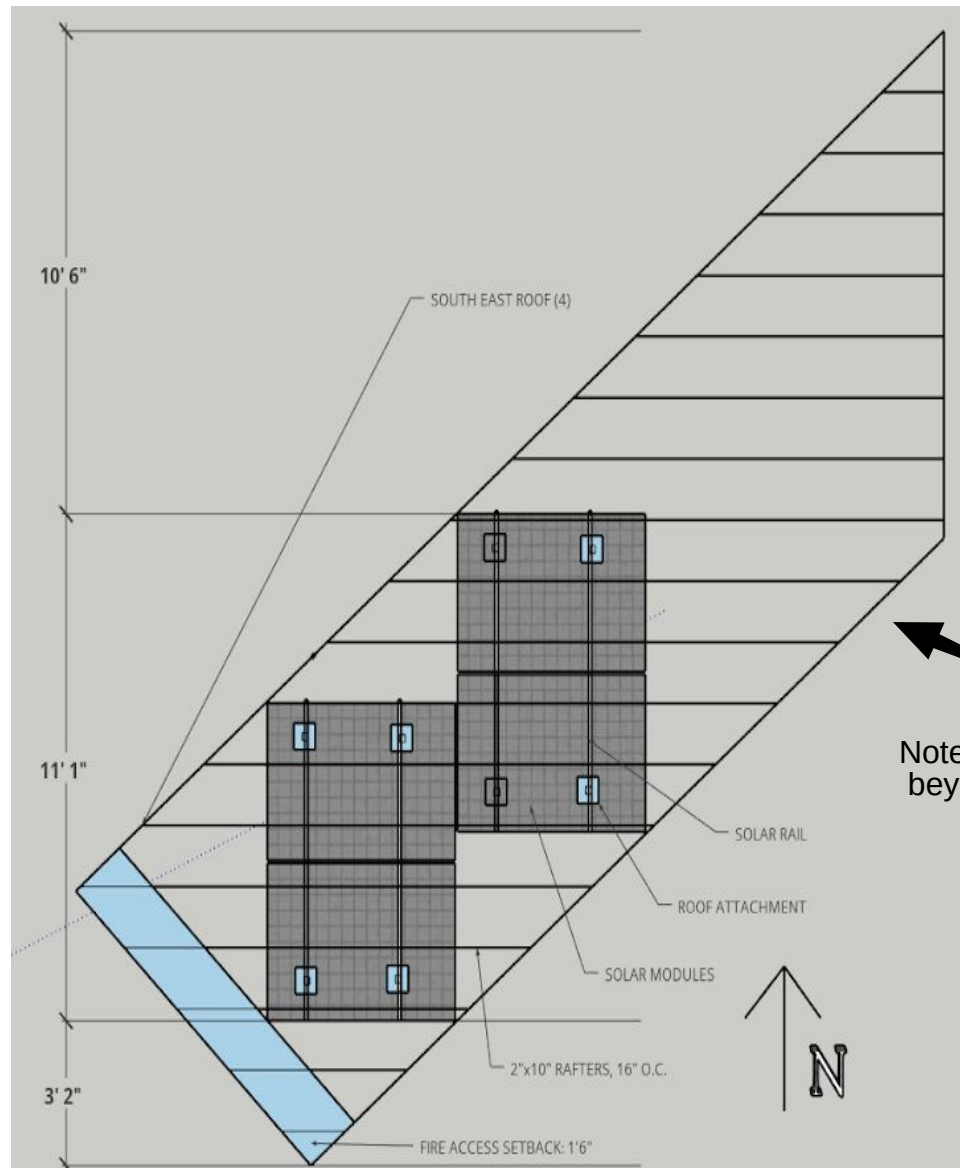
VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 5

ARRAY & RACKING PLAN - SOUTHEAST ROOF



Note: No part of the panel extends beyond the edge of the roof system.



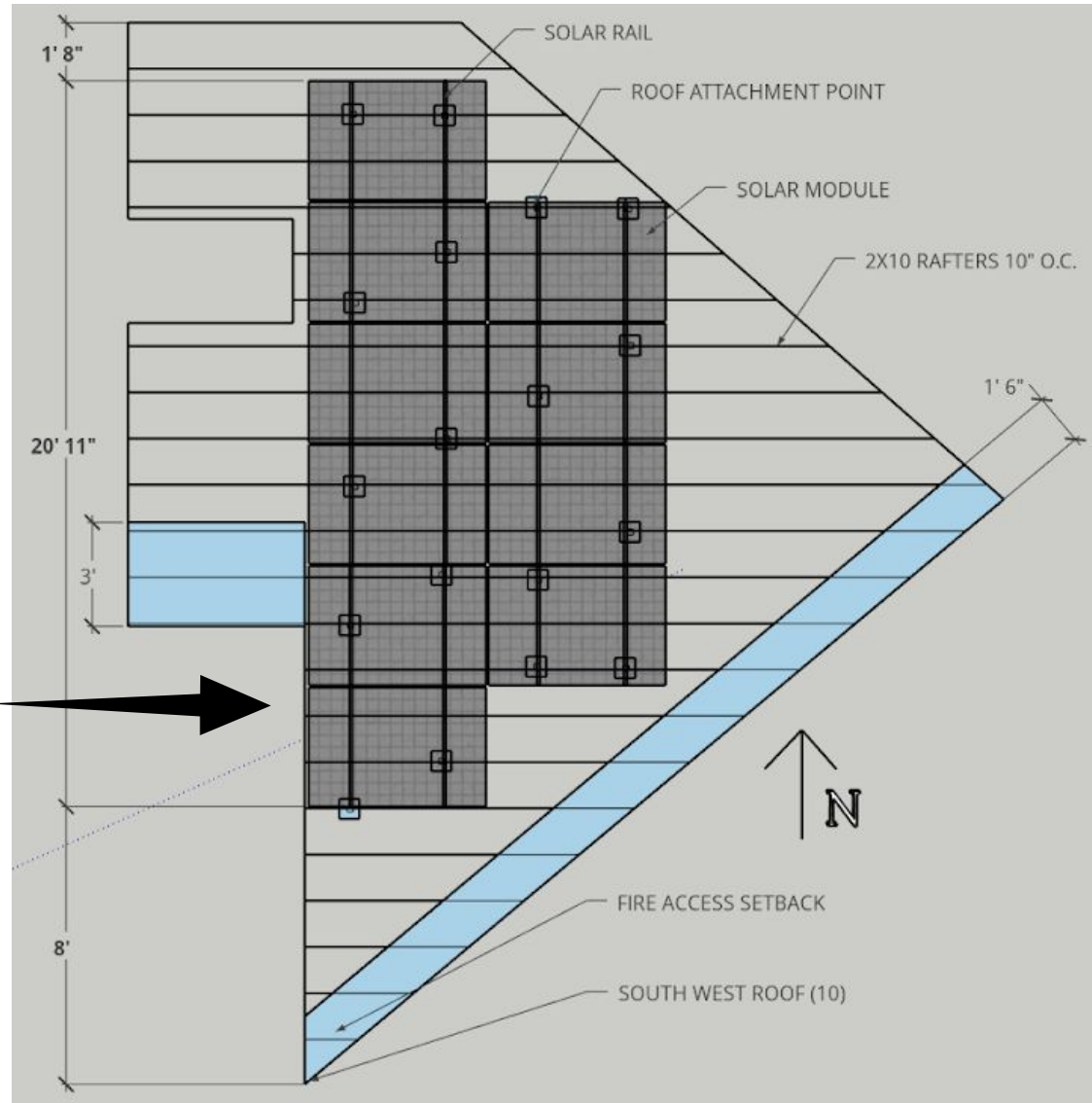
VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 6

ARRAY & RACKING PLAN - SOUTHWEST ROOF



VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 7

ARRAY & RACKING PLAN - SOUTH ROOF



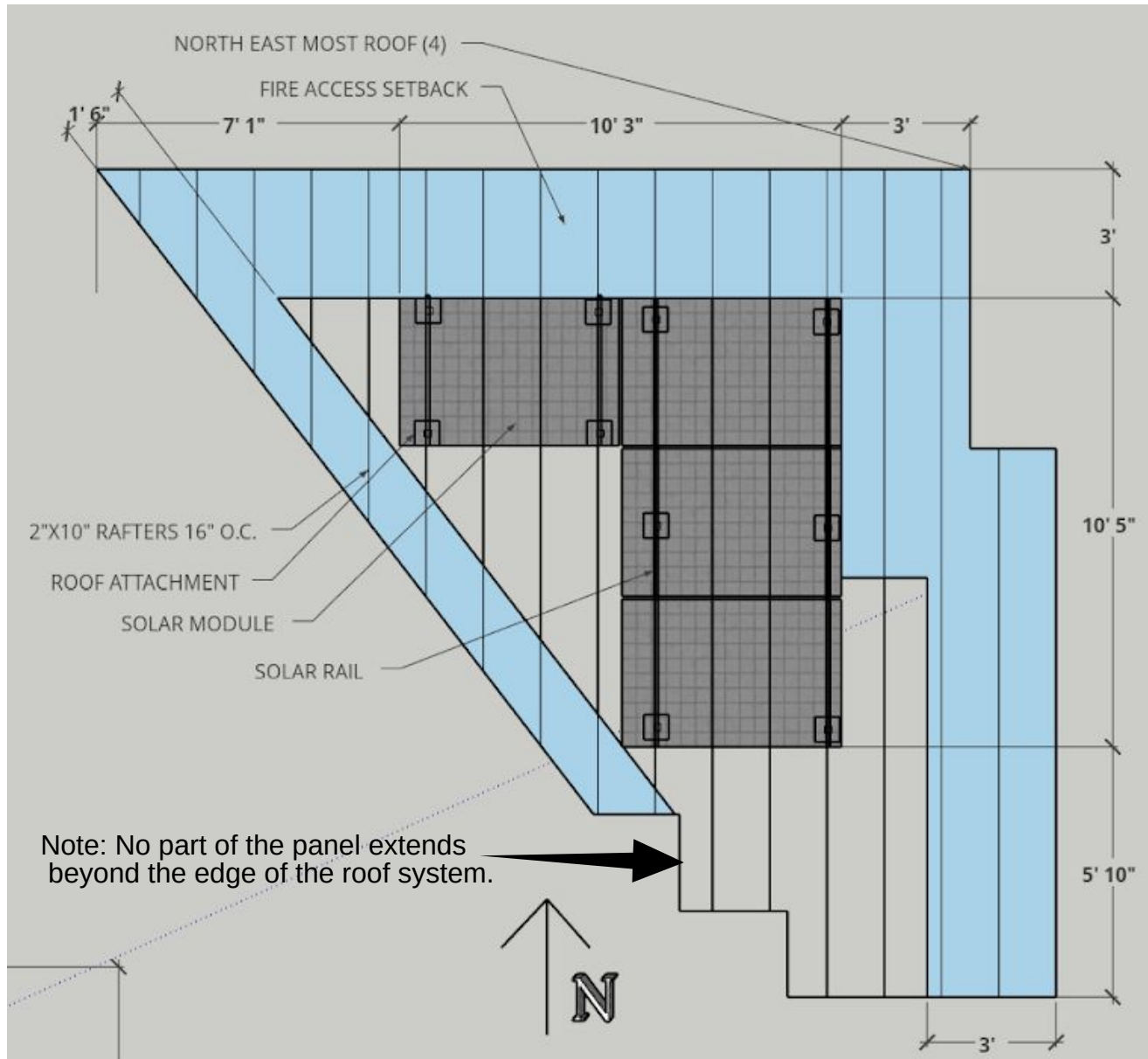
VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 8

ARRAY & RACKING PLAN - NORTHEAST MOST ROOF



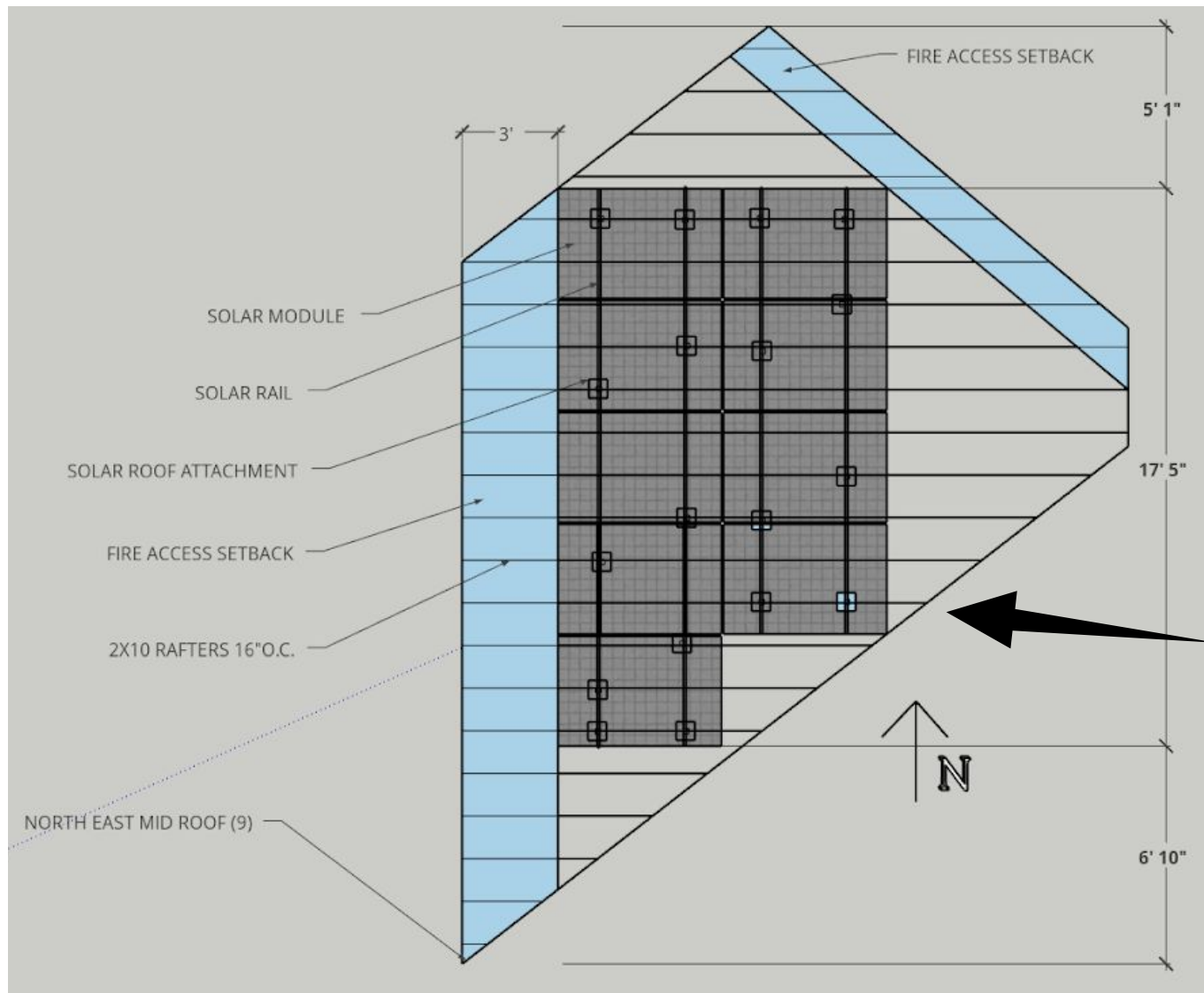
VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 9

ARRAY & RACKING PLAN - NORTHEAST MID ROOF



Note: No part of the panel extends beyond the edge of the roof system.



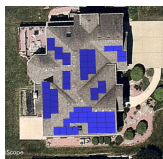
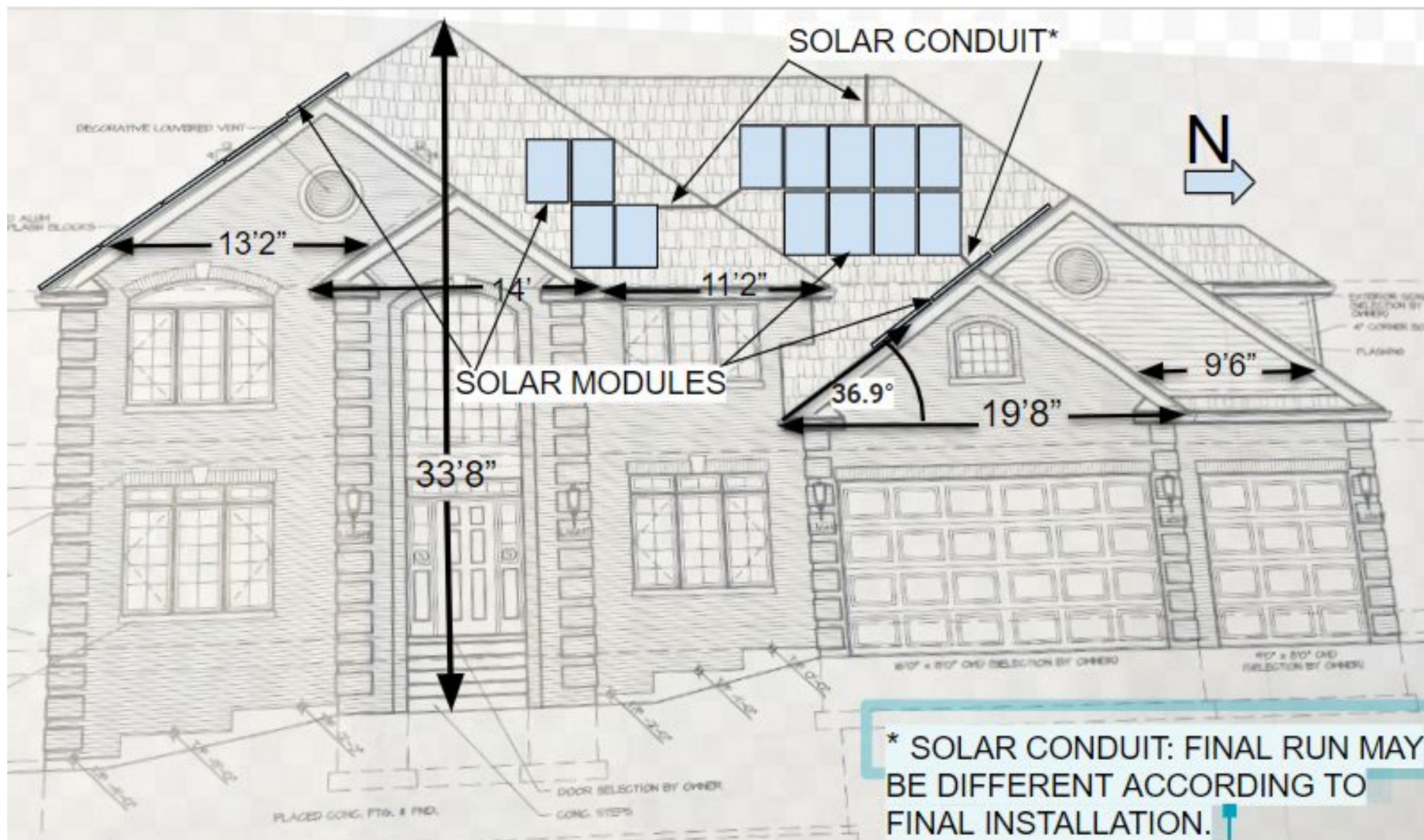
VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 10

FRONT/EAST ELEVATION



VERSION:
9/28/2018
Drawn: DB,KU

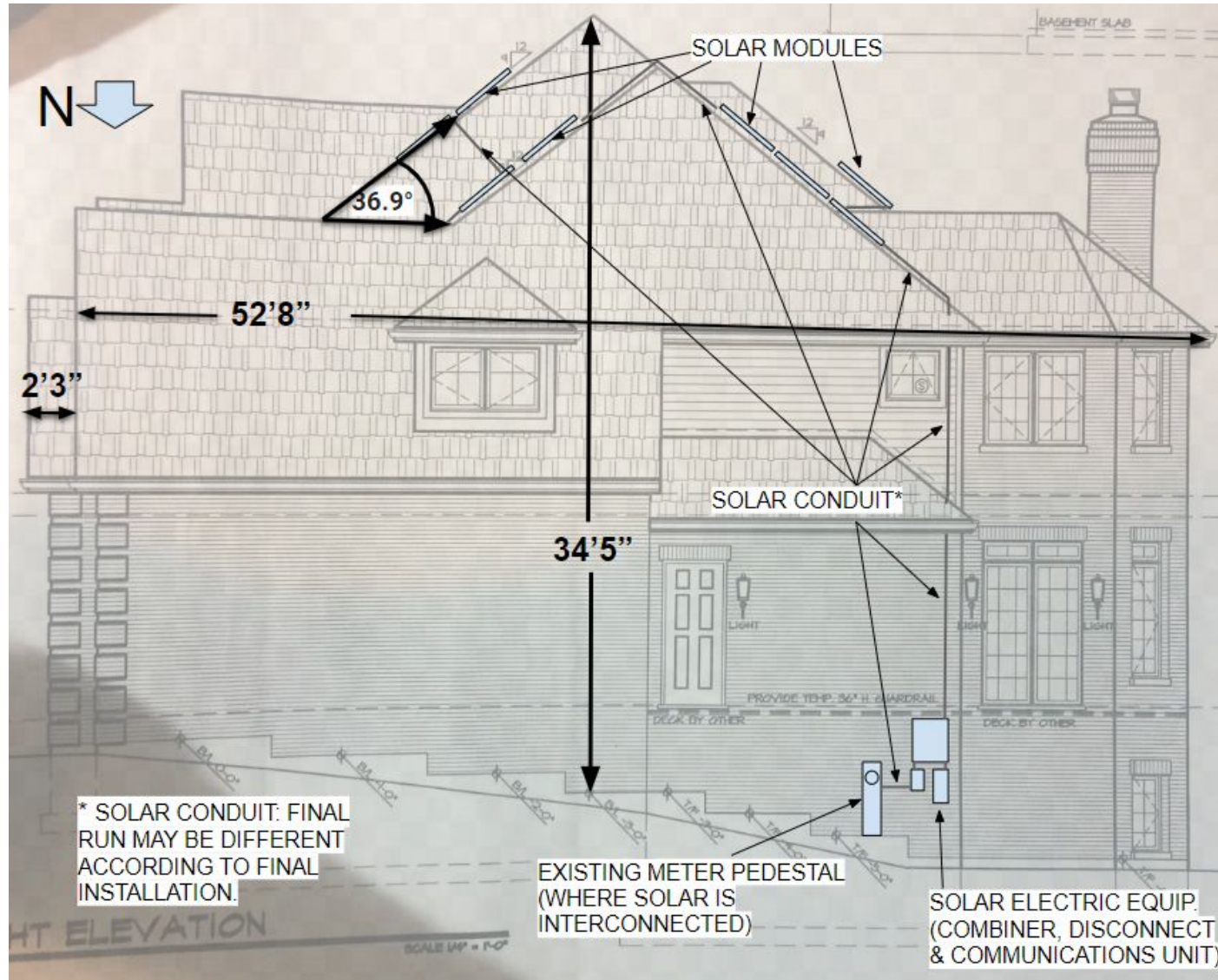


1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 11

OWNER CONTACT: 708-337-3274

RIGHT/NORTH ELEVATION



VERSION:
9/28/2018
Drawn: DB,KU

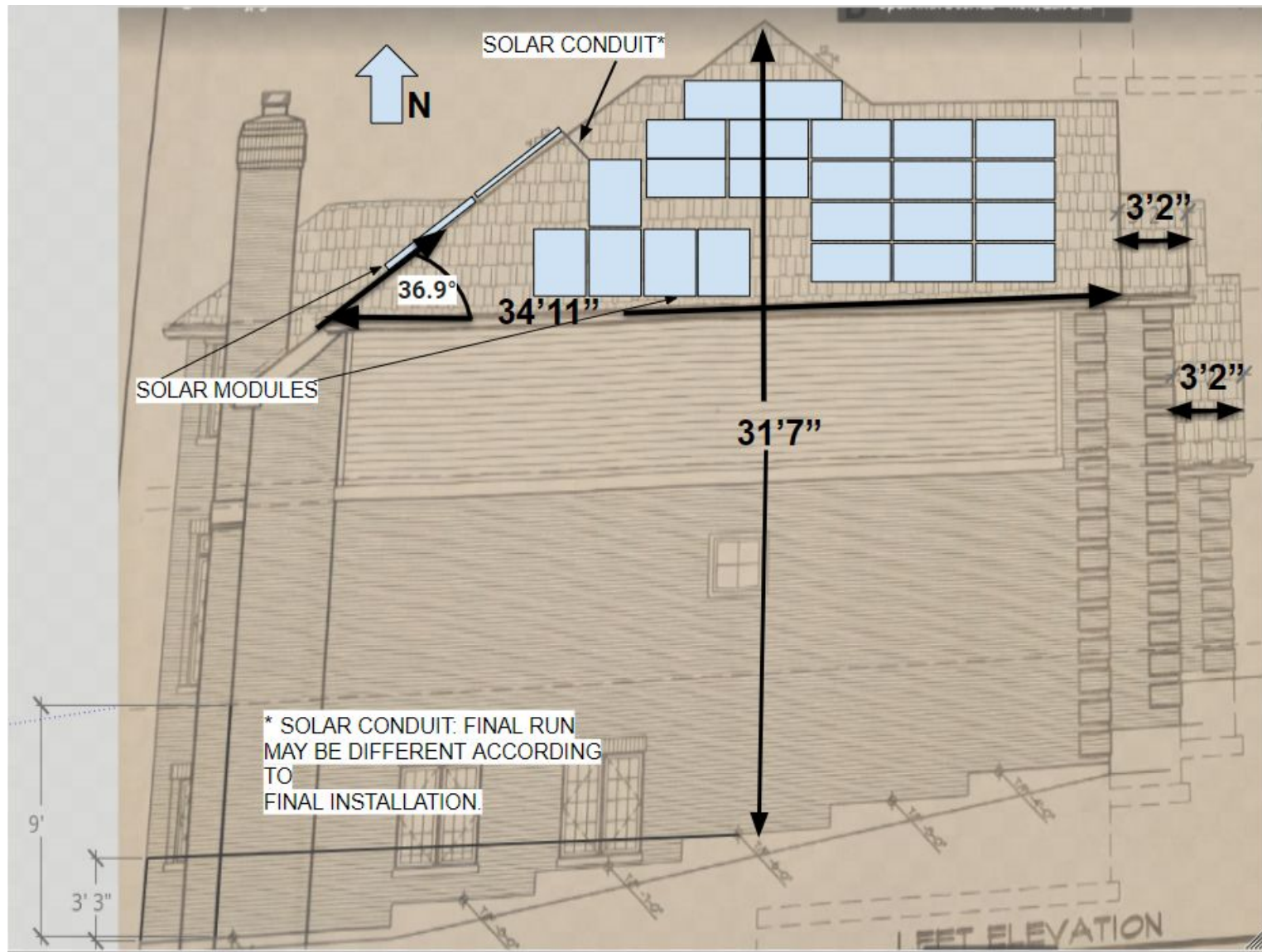


1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 12

OWNER CONTACT: 708-337-3274

LEFT/SOUTH ELEVATION



VERSION:
9/28/2018
Drawn: DB,KU

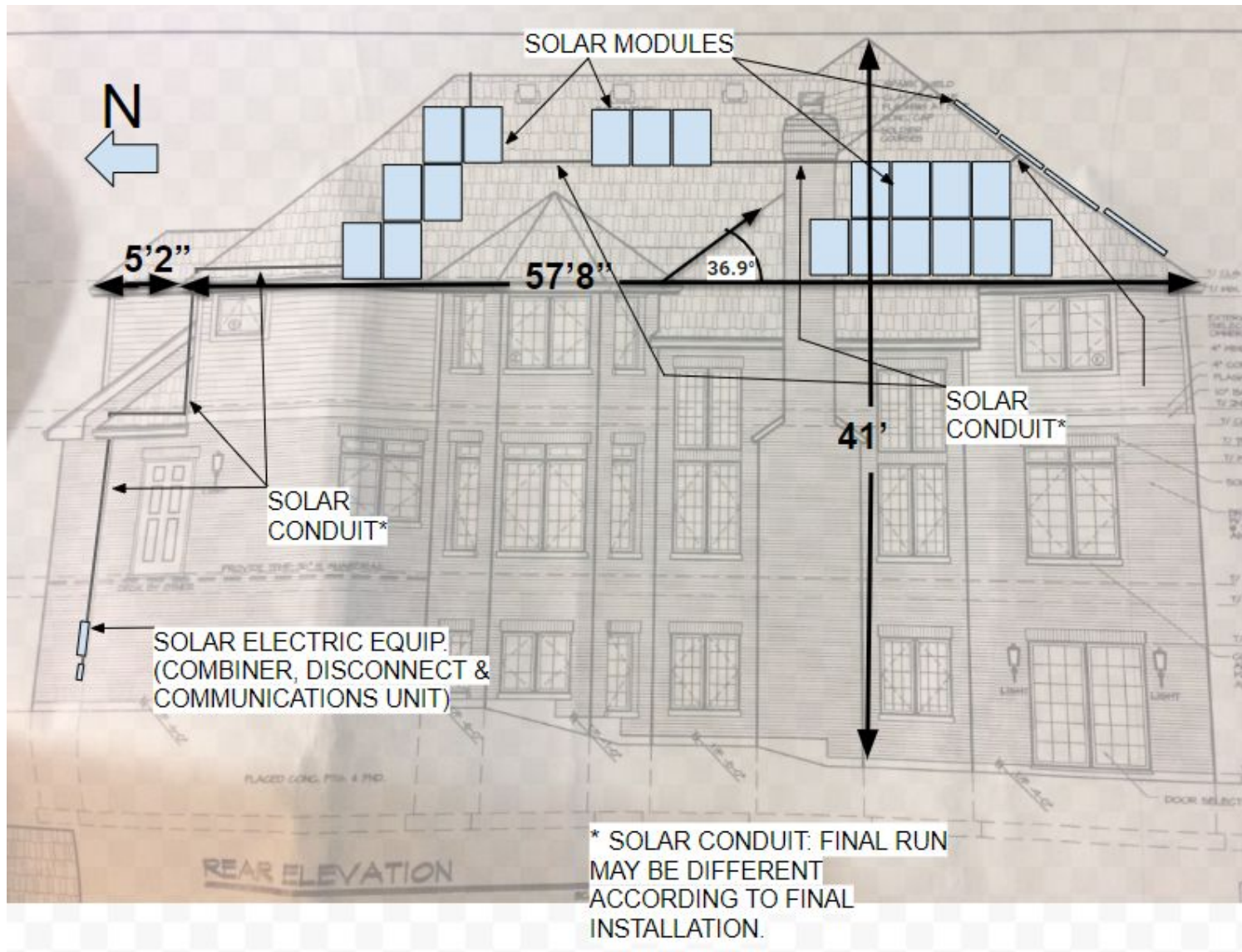


1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 13

OWNER CONTACT: 708-337-3274

REAR/WEST ELEVATION



VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: 17606 Karli Lane Orland Park, IL. 60647
SHEET NUMBER: 14

OWNER CONTACT: 708-337-3274

SINGLE LINE DIAGRAM

EQUIPMENT SCHEDULE

Tag	Description	Qty.	Part #	Location	Notes
A	PV Module/microinverter	51	Sunpower X22-360-D-AC	Roof	360W AC modules
B	Junction Box - roof	1	Nema 3R Junction Box	Roof, near PV modules	
C	Combiner panel	1	Homeline 125A main lug	Outside	5 20A double pole breakers, max. Output current 68A
D	Communications Unit	1	PVS 5X - SunPower	Outside, ground level near utility meter	Fed by 15A double pole breaker in combiner panel
E	AC disconnect	1	100A NEMA 3R disconnect	Outside, ground level near utility meter	Fused with 90A NON FUSES
F	Utility meter panel	1	Existing	Outside	Location of Load Side AC connection using listed ILSCO 4/0-2/0 Insulation piercing taps.
G	Service panel	1	200A	Basement	Existing. Shown for reference.

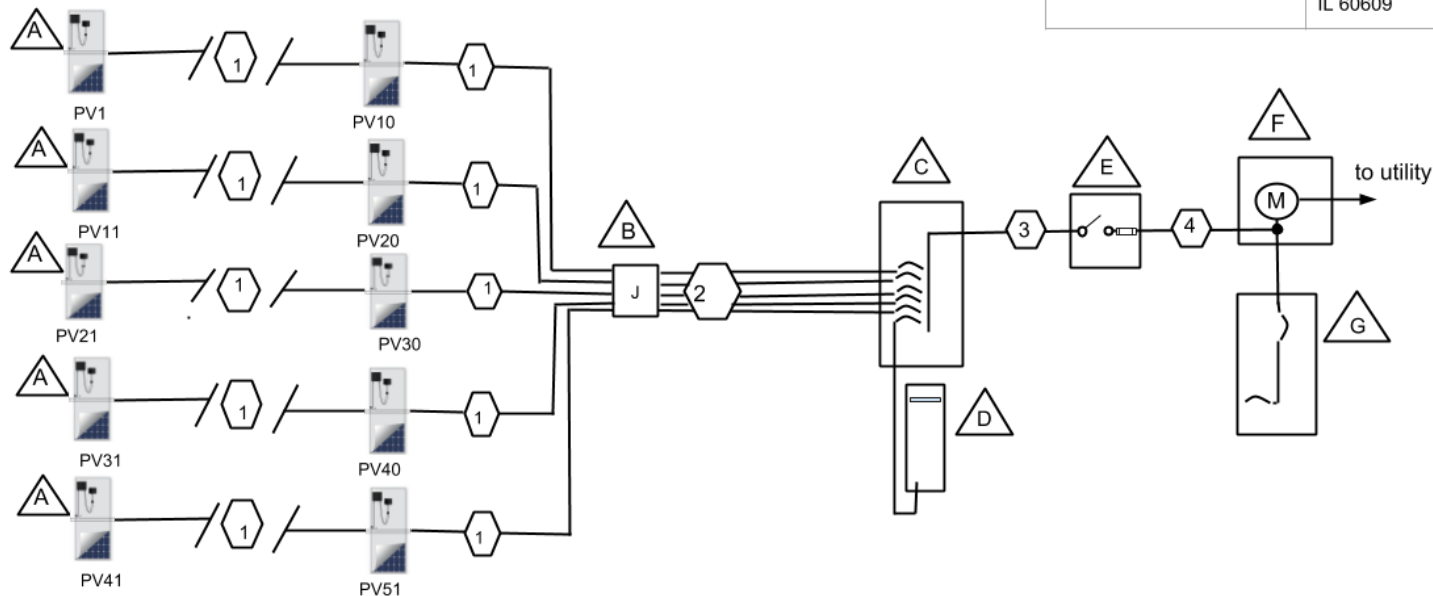
CONDUCTOR-CONDUIT SCHEDULE

Tag	Conductor type	Temp	Quantity and gauge	Conduit
1	Sunpower trunk cable	55°C	(2) #12, (1) #12 EGC	None
2	THWN-2	55°C	(10) #10, (1) #10EGC	1" EMT
3	THWN-2	35°C	(3) #4, (1) #10EGC	1" EMT
4	THWN-2	35°C	(3) #4, (1) #10EGC	1" EMT

17606 Karli Lane, Orland Park, IL 60467
Single Line Diagram

Drawn: JA 9/13/18

Ailey Solar Electric
1965 W Pershing, Chicago,
IL 60609



VERSION:
9/28/2018
Drawn: DB,KU



1965 W. Pershing, Chicago, IL
60609 | Phone: (773)
245-3912 | Email:
info@aileysolar.com

PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **15**

OWNER CONTACT: 708-337-3274

SunPower® X22-360-D-AC | Residential AC Module Series

Design-Driven Advantages

- #1 module aesthetics and efficiency¹
- Unmatched module reliability²
- No electrolytic capacitors
- 25-year Combined Power and Product Warranty
- California Rule 21 Phase 1 compliant

Maximize Value for Roof

- Size system for roof, not string inverter
- Optimize performance of each module

Expand Deployment Options

- Complex roofs and partial shading
- Small systems
- System expandability

Simplify & Speed Installation

- Factory-integrated microinverter
- Robust, double-locking AC connectors
- Design flexibility offsite and onsite
- No DC string sizing process
- Fewer installation steps than competing systems
- Intuitive commissioning

Component of Complete System

- Built for use with SunPower® InvisiMount™ and the SunPower Monitoring System (PVS5x)
- Superior system reliability and aesthetics



Optimize System and Installation Efficiency

SunPower® AC modules, which include a factory-integrated SunPower microinverter, provide a revolutionary combination of high efficiency, high reliability, and module-level DC-to-AC power conversion. Designed specifically for use with SunPower InvisiMount™ and the SunPower Monitoring System, SunPower AC modules enable rapid installation, best-in-class system aesthetics, and intuitive visibility into system performance. All this comes with the best Combined Power and Product Warranty in the industry.

Grid Support Utility-Interactive Smart Inverter

SunPower's new Type D AC module is UL tested and certified to UL 1741 SA and provides advanced smart inverter functions. SunPower Type D AC modules are fully compliant with the California Rule 21 Phase 1 requirements, and the Rule 21 grid profile is easily set during commissioning with SunPower PVS5x monitoring hardware.

sunpower.com

SunPower® X22-360-D-AC | Residential AC Module Series

AC Electrical Data ³		
SRD Profile	IEEE 1547a-2014 ³ (default settings) min. / nom. / max.	CA Rule 21 ³ min. / nom. / max.
Frequency (Hz)	59.5 / 60.0 / 60.5	58.5 / 60.0 / 60.5
Power Factor	0.99 / 1.00 / 1.00	0.85 lead. / 1.00 / 0.85 lag.
Reactive Power		±169 Var Volt-VAR
Voltage	@240 V @208 V	211.2 / 240 / 264 V 183 / 208 / 228.8 V
Max. Current	@240 V @208 V	1.33 A 1.54 A
DC/AC CEC Conversion Efficiency	@240 V @208 V	96.0% 95.5%
Max. Units Per 20 A Branch Circuit	@240 V @208 V	12 (single phase) 10 (two pole) wye
Power		320 W, 320 VA
No active phase balancing for 3 phase installations		

DC Power Data	
SPR-X22-360-D-AC	
Nominal Power ⁴ (P _{nom})	360 W
Power Tolerance	+5/-0%
Avg. Panel Efficiency ⁵	22.2%
Temp. Coef. (Power)	-0.29%/° C
Shade Tolerance	• Three bypass diodes • Integrated module-level maximum power point tracking

Tested Operating Conditions	
Operating Temp.	-40° F to +185° F (-40° C to +85° C)
Max. Ambient Temp.	122° F (50° C)
Max. Load	Wind: 62 psf, 3000 Pa, 305 kg/m ² front & back Snow: 125 psf, 6000 Pa, 611 kg/m ² front
Impact Resistance	1 inch (25 mm) diameter hail at 52 mph (23 m/s)

Mechanical Data	
Solar Cells	96 Monocrystalline Maxeon Gen III
Front Glass	High-transmission tempered glass with anti-reflective coating
Environmental Rating	Outdoor rated
Frame	Class 1 black anodized (highest AAMA rating)
Weight	45.5 lbs (20.6 kg)
Recommended Max. Module Spacing	1.3 in. (33 mm)

¹Highest of over 3,200 silicon solar panels, Photon Module Survey, Feb. 2014

²#1 rank in "PV Module Durability Initiative Public Report," Fraunhofer CSE, Feb 2013. Five out of the top eight largest manufacturers were tested. Campeau, Z. et al. "SunPower Module Degradation Rate," SunPower white paper, Feb 2013. See www.sunpower.com/facts for details.

³Factory set to 1547a-2014 default settings. CA Rule 21 default settings profile set during commissioning. See the *Equinox Installation Guide #518101* for more information.

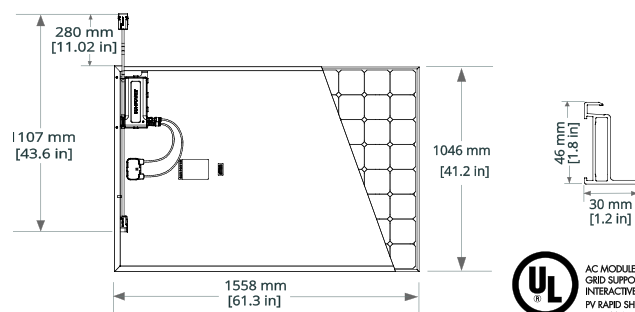
⁴Standard Test Conditions (1000 W/m² irradiance, AM 1.5, 25° C). NREL calibration standard: SOMS current, LACCS FF and voltage. All DC voltage is fully contained within the module.

⁵Based on average of measured power values during production.

See www.sunpower.com/facts for more reference information.

For more details, see extended datasheet: www.sunpower.com/datasheets.

Warranties and Certifications	
Warranties	• 25-year limited power warranty • 25-year limited product warranty
	UL listed to UL 1741 SA
	• SRDs: IEEE 1547-2003, IEEE 1547a-2014, CA Rule 21 Phase 1 • PV Rapid Shutdown Equipment • Equipment Grounding • UL 6703, UL 9703 Connectors and cables (load break disconnection) • UL 1741 AC Module (Type 2 fire rating)
Certifications	Enables installation in accordance with: • NEC 690.6 • NEC 690.12 Rapid Shutdown (inside and outside the array) • NEC 690.15 AC Connectors, 690.33(A) – (E)(1) FCC and ICES-003 Class B When used with InvisiMount racking (UL 2703): • Integrated grounding and bonding • Class A fire rated
PID Test	Potential-induced degradation free



Please read the safety and installation instructions for details.



518986 RevB



SunPower® InvisiMount™ | Residential Mounting System

Simple and Fast Installation

- Integrated module-to-rail grounding
- Pre-assembled mid and end clamps
- Levitating mid clamp for easy placement
- Mid clamp width facilitates consistent, even module spacing
- UL 2703 Listed integrated grounding

Flexible Design

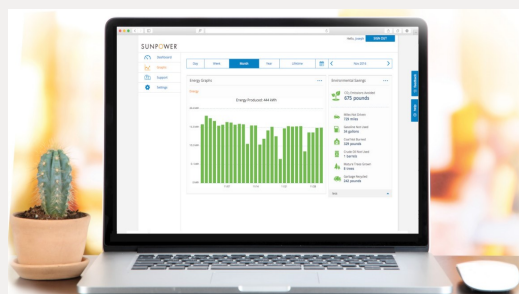
- Addresses nearly all sloped residential roofs
- Design in landscape and portrait with up to 8' rail span
- Pre-drilled rails and rail splice
- Rails enable easy obstacle management

Customer-Preferred Aesthetics

- #1 module and #1 mounting aesthetics
- Best-in-class system aesthetics
- Premium, low-profile design
- Black anodized components
- Hidden mid clamps and new capped, flush end clamps

Part of Superior System

- Built for use with SunPower DC and AC modules
- Best-in-class system reliability and aesthetics
- New optional rooftop transition flashing, rail-mounted J-box, and wire management rail clips
- Combine with SunPower modules and SunPower EnergyLink® monitoring app



Elegant Simplicity

SunPower® InvisiMount™ is a SunPower-designed rail-based mounting system. The InvisiMount system addresses residential sloped roofs and combines faster installation time, design flexibility, and superior aesthetics. The InvisiMount product was specifically envisioned and engineered to pair with SunPower modules. The resulting system-level approach amplifies the aesthetic and installation benefits—for homeowners and for installers.

sunpower.com

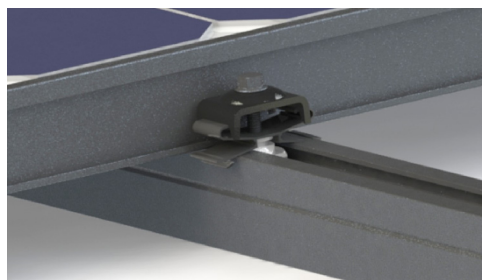




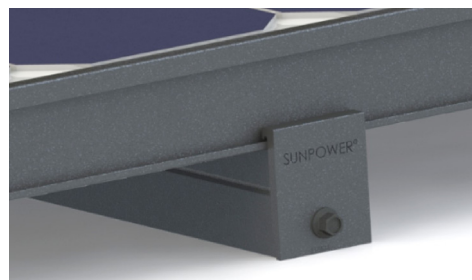
SunPower® InvisiMount™ | Residential Mounting System

InvisiMount Components

Module¹ / Mid Clamp and Rail



Module¹ / End Clamp and Rail



Mid Clamp



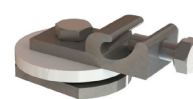
End Clamp



Rail & Rail Splice



Ground Lug Assembly (for DC systems only)



InvisiMount Component Details		
Mid Clamp	Black oxide stainless steel 300 series	63 g (2.2 oz)
End Clamp	Black anodized aluminum 6000 series	110 g (3.88 oz)
Rail	Black anodized aluminum 6000 series	830 g/m (9 oz/ft)
Rail Splice	Aluminum alloy 6000 series	830 g/m (9 oz/ft)
Ground Lug Assembly	304 stainless steel (A2-70 bolt; tin-plated copper lug)	106.5 g/m (3.75 oz)

InvisiMount Operating Conditions	
Temperature	-40° C to 90° C (-40° F to 194° F)
Max. Load (LRFD)	• 3000 Pa uplift • 6000 Pa downforce

Roof Attachment Hardware Supported by Design Tool	
Application	• Composition Shingle Rafter Attachment • Composition Shingle Roof Decking Attachment • Curved and Flat Tile Roof Attachment • Universal interface for other roof attachments

InvisiMount Component LRFD Capacities ²		
Mid Clamp	Uplift	664 lbf
	Shear	540 lbf
End Clamp	Uplift	899 lbf
	Shear	220 lbf
Rail	Moment: upward	548 lbf-ft
	Moment: downward	580 lbf-ft
Rail Splice	Moment: upward	548 lbf-ft
	Moment: downward	580 lbf-ft
L-foot	Uplift	1000 lbf
	Shear	390 lbf

InvisiMount Warranties And Certifications	
Warranties	• 25-year product warranty • 5-year finish warranty
Certifications	• UL 2703 Listed • Class A Fire Rated

Roof Attachment Hardware Warranties	
Refer to roof attachment hardware manufacturer's documentation.	

¹ Module frame that is compatible with the InvisiMount system required for hardware interoperability.

² SunPower recommends that all Equinox™, InvisiMount™, and AC module systems always be designed using the SunPower Design Tool. If a designer decides to instead use the component capacities listed in this document to design a system, note that the capacities shown are Load and Resistance Factor Design (LRFD) design loads, and are NOT to be used for Allowable Stress Design (ASD) calculations; and that a licensed Professional Engineer (PE) must then stamp all calculations. Should you have any questions please contact SunPower Technical Support at 1-800-SUNPOWER (1-800-786-7693).