CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Permit Record

ELECTRICAL

Permit #: 2009-041232-RS

Project Location: 459 TERRACE DR

Permit Date:	Dec 04, 2009	Inspection Area: 2A		Folder:	RS-Single Family-Sub-Trades Only
Permit Approvals Granted:	Electrical: Complete				

APPLICANT: AKEENA SOLAR RSN812505
CONTRACTOR: AKEENA SOLAR RSN812505

OWNER: ANDERSON BARBARA S RSN15636
Permit Tech: Evelyn Rodriguez

Description: 1.) INSTALL FUSH MOUNTED PHOTOVOLTAIC SOLAR SYSEM ON THE ROOF

Technical Description: Photovoltaic System (Single family) (E): 1;

Applicable Codes: 2007 CBC, CMC, CPC; 2007 NEC; 2005 Energy;

Conditions: INSTALLATION DOES NOT EXCEED ANY OF THE FOLLOWING CRITERIA:
TOTAL PANEL WEIGHT (INCLUDING FRAME) IS GREATER THAN 5LBS PER SQUARE FOOT.
MAXIMUM CONCENTRATED LOAD AT EACH POINT OF SUPPORT EXCEED 40LBS.
MAXIMUM HEIGHT ABOVE ROOF SURFACE EXCEEDS 18".
NOT BALLASTED SYSTEM

Final Inspection Record

Code	Inspection	Date	Approved By
918	**Electrical Final**		

See other side for interim inspection record

A total of 1 hours of inspection time have been allocated for this permit. Inspection time will be determined using the requested inspection time or the actual expended inspection time, whichever is greater. Please note that inspection time includes 10 minutes of travel time per stop. Once the allocated inspection time is exceeded additional fees will be assessed for additional services. Cancellation or rescheduling of a scheduled inspection must be received by 2:00 p.m. 2 business days prior to the inspection; otherwise, the inspection time requested will be debited from the allotted hours. Cancellation time may change. Call or check website for current policy.
Field coordinator name: Michael Hsieh, phone #: 408 535-7783. To Schedule An Inspection Call (408)535-3555.

Andalay AC Photovoltaic Wire Diagram

Akeena Solar Inc. 16005 Los Gatos Blvd. Los Gatos, CA 95032
CA License #: 805773 P (408)-402-9400

Address: 459 TERRACE DRIVE, SAN JOSE

Panel Model and Manufacturer: Andalay AC ST175			
See Attached Spec Sheets for Technical Specifications			
	(# of modules x .80 A)		
Branch circuit one total output=	12 A	x 1.25 (over current protection)=	15 A
Branch circuit two total output=	12 A	x 1.25 (over current protection)=	15 A
Total System ouptput including overcurrent protection =	30 A @ 240V AC		

Module: Andalay ST175-1
Module nominal Voltage: 24 V
Module Isc: 5.2 A
Module Imp: 4.95 A
Number of Modules: 30

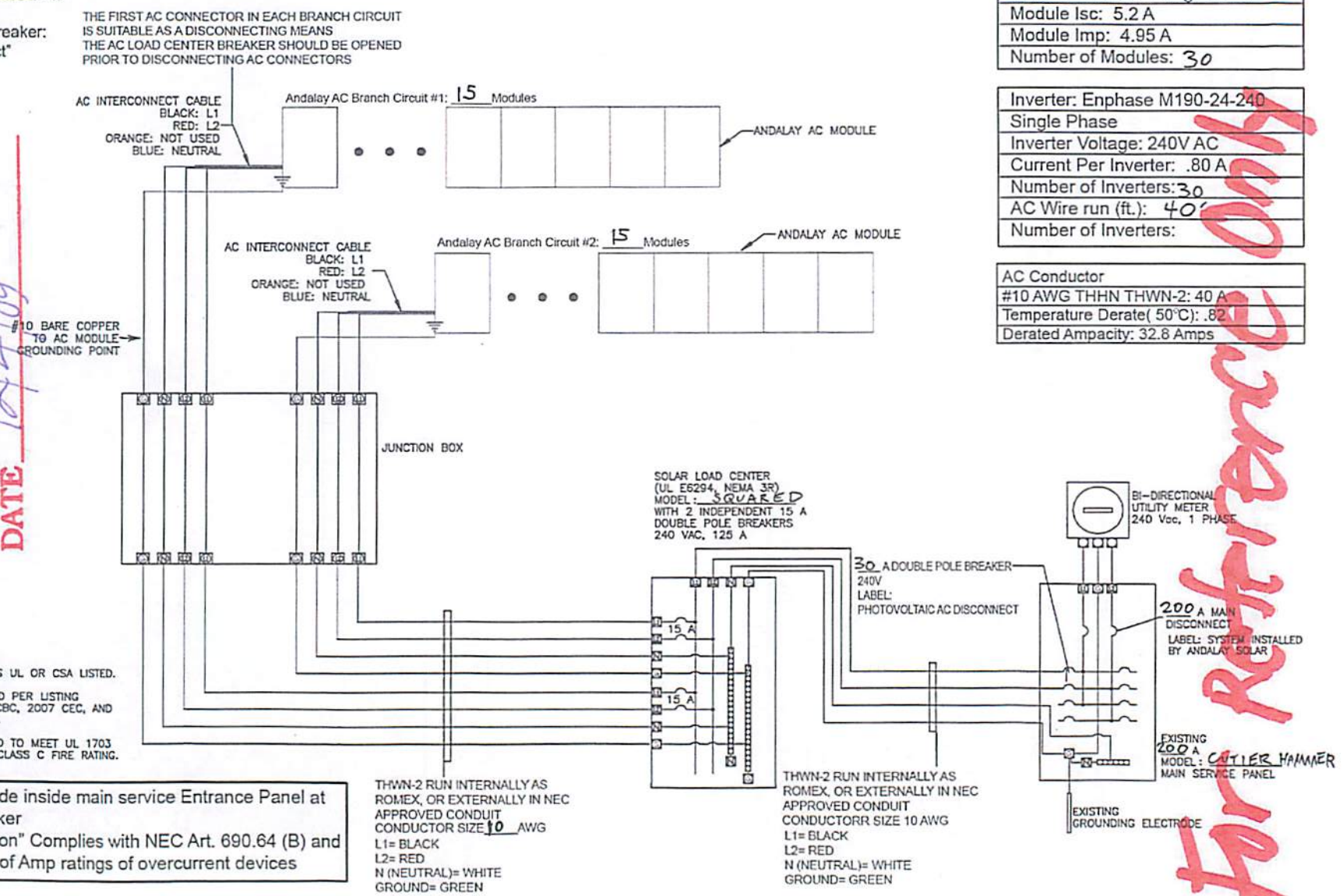
Inverter: Enphase M190-24-240
Single Phase
Inverter Voltage: 240V AC
Current Per Inverter: .80 A
Number of Inverters: 30
AC Wire run (ft.): 40'
Number of Inverters:

AC Conductor
#10 AWG THHN THWN-2: 40 A
Temperature Derate(50°C): .82
Derated Ampacity: 32.8 Amps

Equipment labeled per NEC 690
Label affixed at Electrical Main Service:

"THIS ELECTRICAL SYSTEM IS ALSO SERVED BY AN ANDALAY AC PHOTOVOLTAIC SYSTEM. DISCONNECTING AC BREAKER TURNS OFF ALL AC PV MODULES. NO HIGH VOLTAGE DC PRESENT."

Label Affixed at Solar AC Breaker:
"Photovoltaic AC Disconnect"



CITY OF SAN JOSE
BUILDING DIVISION
B.P. # E09-047233
DATE 12/4/09

NOTES:
1. ALL SUPPLIED EQUIPMENT IS UL OR CSA LISTED.
2. EQUIPMENT TO BE INSTALLED PER LISTING OR LABELING AND 2007 CBC, 2007 CEC, AND 2005 NEC REQUIREMENTS.
3. ALL MODULES ARE CERTIFIED TO MEET UL 1703 STANDARDS AND HAVE A CLASS C FIRE RATING.

Point of Connection made inside main service Entrance Panel at Dedicated 30 A Breaker
This "Point of Connection" Complies with NEC Art. 690.64 (B) and specifically (b)(2); Sum of Amp ratings of overcurrent devices

For Reference Only
Andalay

Photovoltaic Roof Layout and Attachment Detail

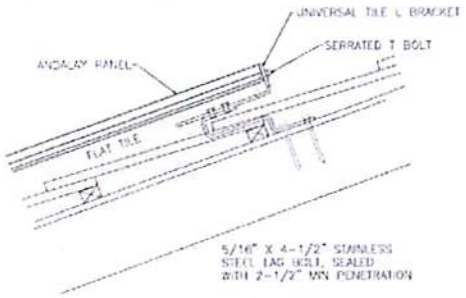
Address: 459 TERRACE DRIVE, SAN JOSE

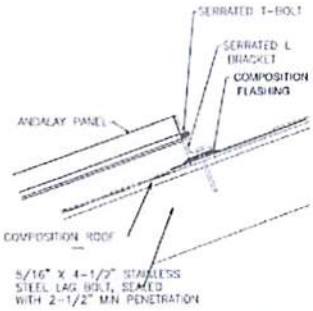
Akeena Solar Inc. 16005 Los Gatos Blvd. Los Gatos, CA 95032 CA License #: 805773

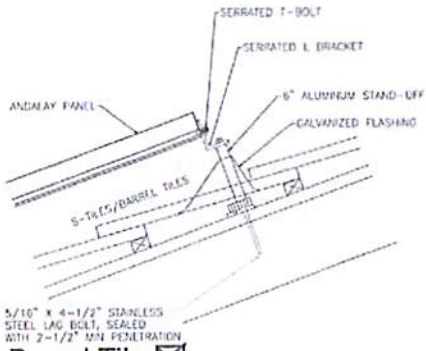
Roof Attachment Method (All Attachment Methods are Flush Mountedand Do Not Exceeda Maximum height of 7")

Rafter Size 2" x 4" TRUSSED

Spaced at 24" on center







Flat Concrete Tile ☐ Composition Shingle ☐ Barrel Tile ☒

Andalay AC Branch Circuit Wire Sizing (Individual Branch Circuits are limited to 15 Andalay AC Panels)

The interior section of below chart represents AC wire run lengths in feet, use this table to determine the minimum wire size per branch circuit.

	Micro-Inverters per Branch								
Wire	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
14 AWG	129	106	88	72	59	48	37	28	19
12 AWG	205	169	139	115	94	75	59	44	30
10 AWG	327	269	223	183	150	120	94	70	48
8 AWG	521	429	355	292	239	192	150	112	77
6 AWG	825	680	562	463	378	304	238	177	122

Wire Circuit Calculation

Maximum Micro-inverter output= 190 Watts AC

190 Watts / 240v = .80 Amps

Over Current Protection Calculation

Maximum # of micro-inverters per branch circuit = 15

15 x .80 A= 12 A

12A x 1.25= 15 A

Requirements

-15 Amp double pole circuit breaker required per branch circuit

Photvoltaic Module Specification

Micro-inverter: Enphase M-190-24-240

Model: Andalay ST175-1

Weight: 40.7 lbs.

Width: 32.2"

Length: 62.6"

Structural Specification

Maximum roof load:

3.4 Lbs per square foot

35.6 lbs. per attachment

Attention Permitting, Code Officials and Building Inspectors:

The Andalay AC solar panels specified for this project are house current AC panels (not ordinary high voltage DC panels), and have built-in racking, wiring, grounding and inverters. Please consider the following key design features and specifications when you evaluate this permit and inspect this job:

- Racking and wiring is built into the panels themselves. Two connected panels were tested by UL and meet all relevant structural integrity standards, including UL 1703.
- Grounding is integrated with the panels and conducted via dual redundant stainless steel threaded splices. This inter-panel grounding path was tested by UL and meets all relevant standards, including UL 1703. There is no need to run a grounding conductor to each panel; simply connecting a grounding conductor to one panel in each row is code compliant.
- Inverters are built into the panels themselves. Output from each panel is two 120 VAC conductors, plus a neutral and frame ground. There is no high voltage DC at all in the panel or the system. Inverters built into these panels are certified to UL 1741 standards. Inverters automatically shut down if there is any interruption in AC voltage or frequency. Shutting off the Solar breaker or building service deactivitates all conductors; there is no possibility of voltage or current in the system if AC power to the panels is disconnected.

We understand that this AC solar panel technology may be new or different than what you are accustomed to. Certain items -- such as a DC disconnect, DC labeling, temperature coefficient calculations, inverter string sizing or racking specifications -- simply do not apply to Andalay AC systems.

We believe that by eliminating all high voltage DC, and integrating the grounding and racking into the panel itself, our customers are getting a much more code compliant, safer, and higher performance system than ordinary solar panels. The attached spec sheets and plans should provide you with the information you need to process the building permit and final inspection. If you have any questions, do not hesitate to contact Akeena Tech Support at 408-402-9448 or techsupport@andalaysolar.com.

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Address:_____

Panel Model and Manufacturer: Andalay AC ST175		
See Attached Spec Sheets for Technical Specifications		
	(# of modules x .80 A)	
Branch circuit one total output=		x 1.25 (over current protection)= A
Branch circuit two total output=		x 1.25 (over current protection)= A
Total System ouptput including overcurrent protection = _____A @ 240V AC		

Equipment labeled per NEC 690
Label affixed at Electrical Main Service:

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Label Affixed at Solar AC Breaker:
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Module: Andalay ST175-1
Module nominal Voltage: 24 V
Module Isc: 5.2 A
Module Imp: 4.95 A
Number of Modules:

Inverter: Enphase M190-24-240
Single Phase
Inverter Voltage: 240V AC
Current Per Inverter: .80 A
Number of Inverters:
AC Wire run (ft.):

AC Conductor
#10 AWG THHN THWN-2: 40 A
Temperature Derate(50°C): .82
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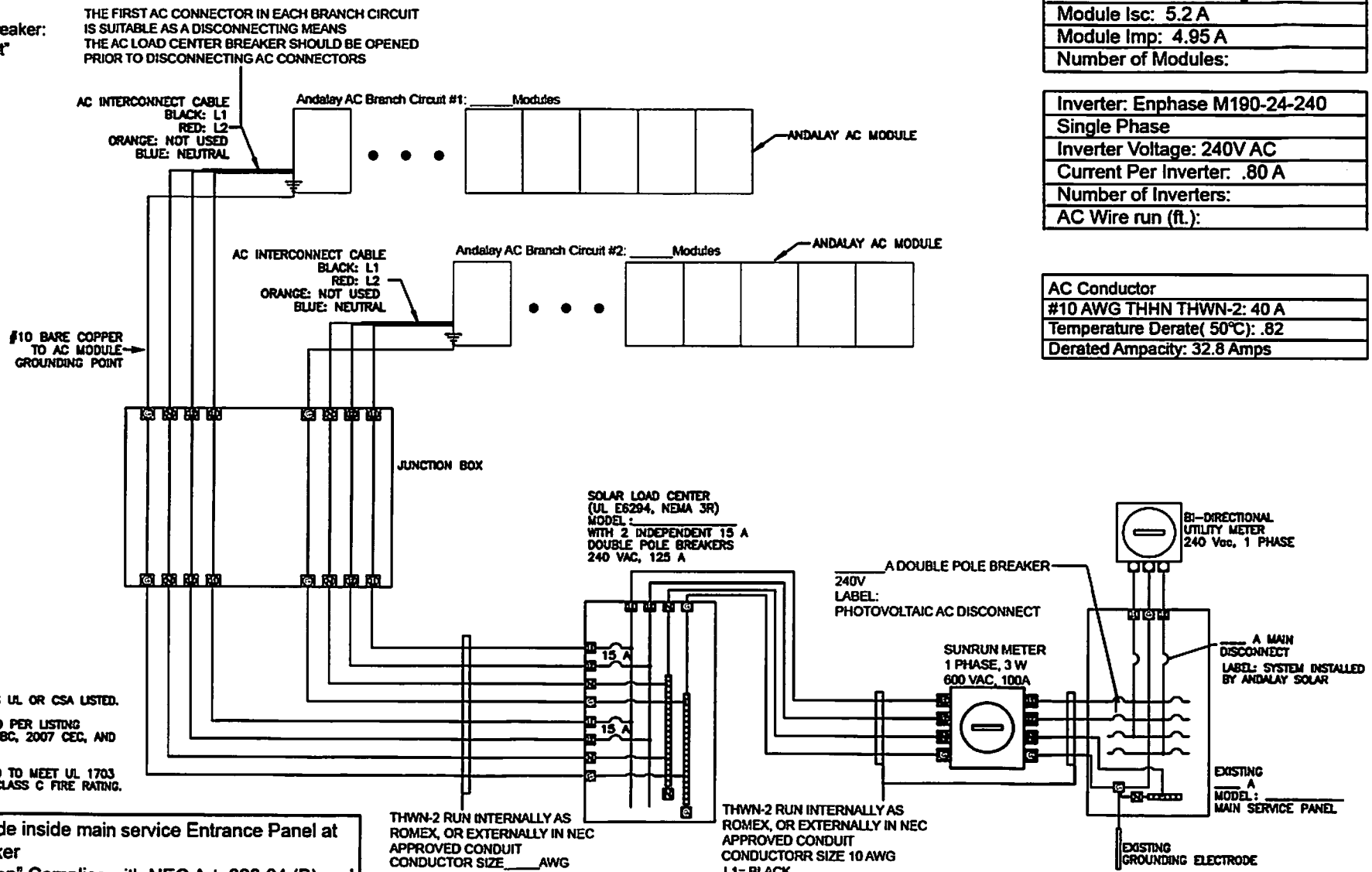

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Photovoltaic Roof Layout and Attachment Detail

Address:_____

Akeena Solar Inc. 16005 Los Gatos Blvd. Los Gatos, CA 95032 CA License #: 805773

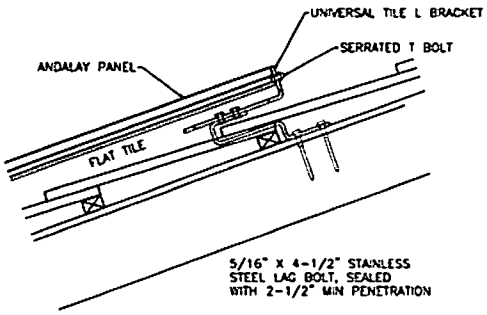
Roof AC
Azimuth_____
Pitch_____

Roof B
Azimuth_____
Pitch_____

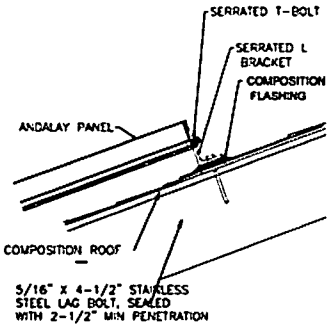
Roof C
Azimuth_____
Pitch_____

Roof Attachment Method (All Attachment Methods are Flush Mounted and Do Not Exceed 7" In Height)

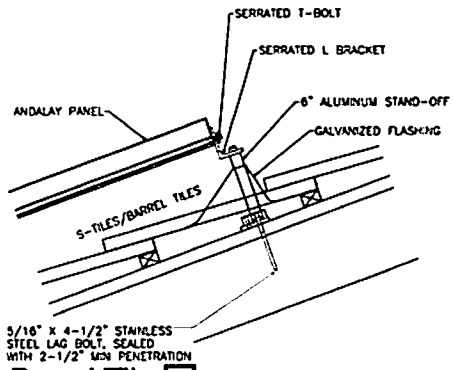
Rafter Size_____
Spaced at _____on center



Flat Concrete Tile ☐



Composition Shingle ☐



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Maximum # of micro-inverters per branch circuit = 15
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Requirements
-15 Amp double pole circuit breaker required per branch circuit

Photvoltaic Module Specification
Micro-inverter: Enphase M-190-24-240
Model: Andalay ST175-1
Weight: 45.7 lb
Width: 32.2"
Length: 62.6"

Structural Specification
Maximum roof load:
3.4 Lbs per square foot
35.6 lbs. per attachment

DC RPM Job Role

Akeena Solar maintains the highest level of standards. It is our objective to set the standard higher than the rest of the industry, and be a model for other companies to match. We take pride in this goal and we expect all Design Consultants to measure up to these standards.

Layout and Attachment Detail page

1) Fill in the street address.
2) Check off Roof Attachment method that corresponds with roof type
3) Use Wire size chart to determine wire size and circle wire size to be used and distance of wire run

Wire Diagram page

1) Fill in Street Address.
2) Enter each branch Circuits number of modules
3) Enter branch circuit one total amperage output by multiplying number of modules in branch one by .8
4) Enter branch circuit two total amperage output by multiplying number of modules in branch two by .8
5) Multiply branch circuit total output by 1.25 to get your over current protection amperage
6) Enter number of inverters
7) Enter the length of wire run from array to load center
8) Size of Breaker is found by the number of modules being used.

#Modules	15	15-20	20-25	25-30	30-35	35-40
Breaker size	15	20	25	30	35	40

If one has a 200A panel, then 200 x 1.2 = 240A and so 240-200= 40A is the back fed limit.

9) Enter Main disconnect amperage
10) Enter Main Service Amperage rating
11) Enter make and model of Main Service

Site Survey RPM Job Role

Akeena Solar maintains the highest level of standards. It is our objective to set the standard higher than the rest of the industry, and be a model for other companies to match. We take pride in this goal and we expect all Field Service Techs to measure up to these standards.

1) Check DC documents for incomplete areas. (If information is missing give back to the DC.)
2) Complete Site Survey check List.
3) Compare with DC Notes. (If there is any discrepancies perform task again and Note both conclusions.)

Layout and Attachment Detail page

1) Fill in the street address.
2) Check off Roof Attachment method that corresponds with roof type
3) Use Wire size chart to determine wire size and circle wire size to be used and distance of wire run

Wire Diagram page

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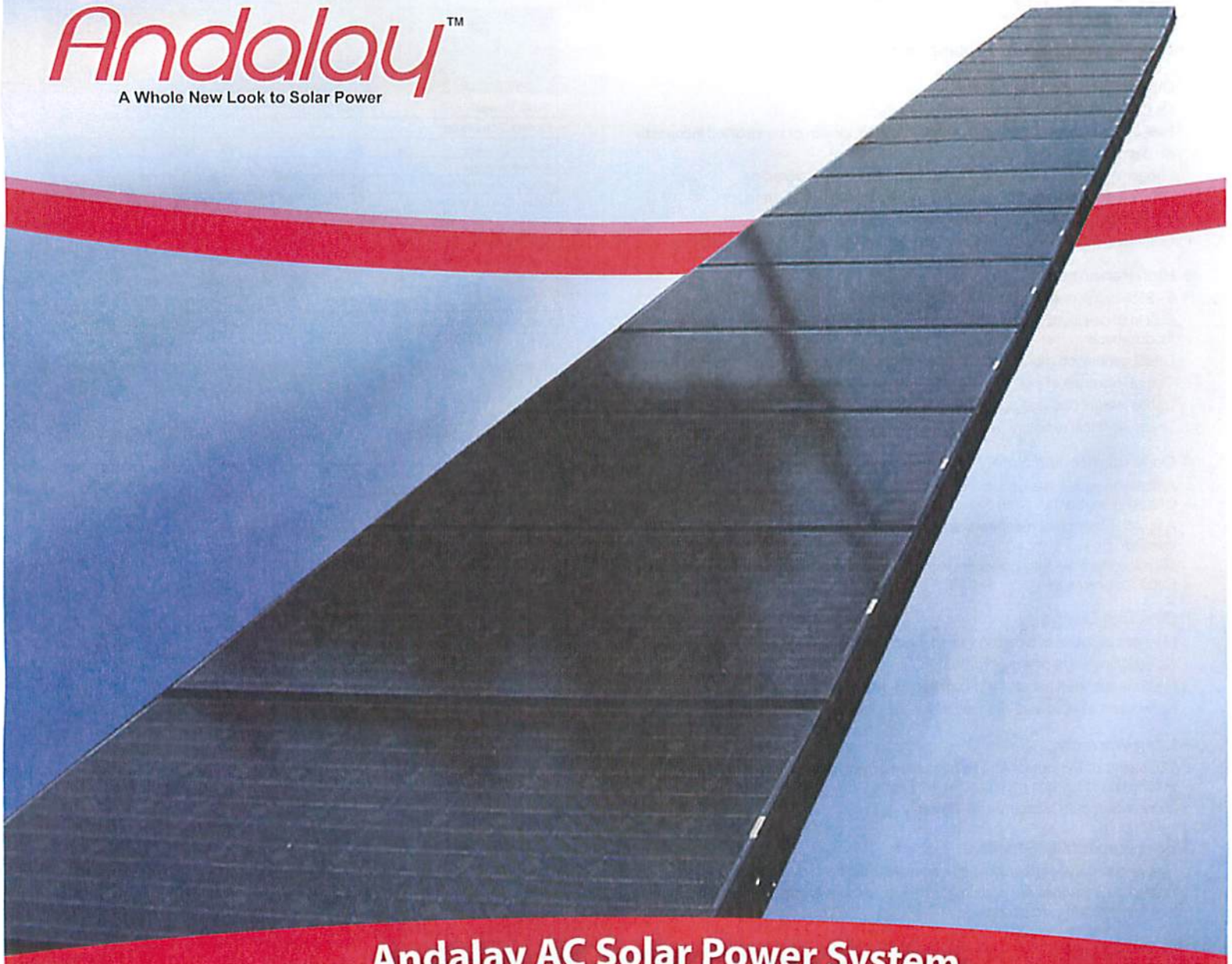
ST 175-1

Andalay™

A Whole New Look to Solar Power



Andalay AC Solar Power System

Designed for Maximum Reliability

Solar systems must last decades in the harsh environment of your roof. But years of sun, wind and rain can corrode the different metals and eat through unprotected wiring found on ordinary solar systems. Both lead to a failed investment. Andalay, the next generation in solar power systems, engineered away these flaws with its award-winning revolutionary design. Protected wiring, assembly in a quality-controlled factory environment, and superior framing, grounding and wiring deliver a system that is built to provide decades of reliable solar power performance.

Delivers Maximum Performance

With Enphase micro-inverters built right into each panel, Andalay delivers powerful performance over its 25 year lifetime. Unlike ordinary panels where their power production varies from hour to hour, each Andalay panel consistently operates at its maximum power potential. Additionally, these revolutionary panels continue to operate at maximum power even if one panel goes down compared to ordinary panels where the malfunction of one panel from shading or other failures takes down all of the panels. As a result, these revolutionary panels can perform 5% to 25% higher than ordinary panels.

Presents a Beautiful Design

In addition to its unparallel reliability, Andalay's award winning design showcases a sleek, beautiful, design that compliments your home. With 80% less parts and fewer penetrations to your roof, Andalay's slimmer panels, invisible electrical cabling and hidden mounting system take up less room on your roof while showing off a revolutionary design. The end result is an attractive system that ends electricity bills and fights green house gas.

Andalay™

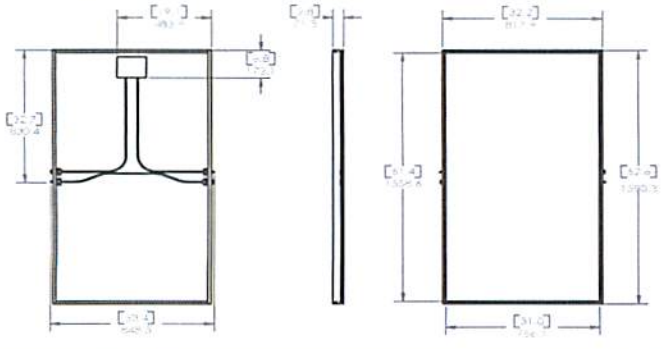
A whole new look to solar power

Andalay is an *integrated* solar power *system*

- **Built-in Reliability & Safety**
  - No single point of system failure
  - Built-in electrical and ground connectors cannot loosen or be installed incorrectly
  - No dangerous 600 volt DC wiring
  - Shorter wire lengths are less likely to fail by pinching or abrading
  - 70% fewer roof-assembled parts means a longer lasting system
  - 25% fewer roof attachment points means greater roof integrity
  - Grounding process cannot skip panels, connectors will not wear or corrode
- **High Performance**
  - 5 - 25% better performance than ordinary panels
  - Built in microinverter delivers greater production in low light conditions on a per module basis
  - Latest generation monocrystalline cell technology
  - Output tolerance of just 3% means the promised power is delivered
  - Lighter weight and less space between panels so more can fit on a roof
  - Lower electrical resistance losses due to shorter wire lengths
- **Convenience and Safety for Customer and Installer**
  - Andalay modules are UL listed and CSA certified and meet National Electrical Code requirements
  - A lighter system that requires a single hand tool to install makes it safer for the installer
  - Microinverters are fully compliant with UL 1703 solar test and National Electric Code requirements
- **Beautiful Design**
  - No external racks or dangling wires for a clean, uncluttered look
  - No bulky inverters or unsightly wiring
  - No gaps between panels for a contiguous, smooth appearance
  - Panels and all hardware are flat black – they look like skylights!
- **Long Warranty**
  - 12/25 year power output Andalay module warranty provides confidence in purchasing today and protection in the future
  - 15 Year Standard Microinverter Warranty
- **Environmentally Sensitive**
  - No external cardboard packaging means less waste to dispose
  - Lighter weight and fewer parts means fewer resources required to produce and less fuel needed to transport

Mechanical Specifications - Module

Length x Width	Thickness	Weight
62.6 x 32.2 inches	2.81 inches	45.7 lbs
159 x 82 cm	7.13 cm	20.7 kg



Electrical Characteristics at Standard Test Conditions

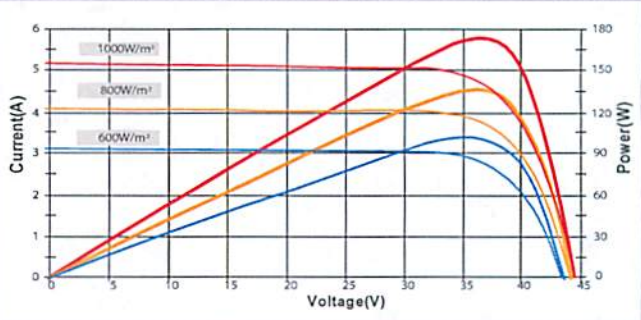
STC: irradiance of 1000W/m², spectrum AM 1.5g, and cell temperature of 25°C

		ST175-1	
Peak Power[1]	P_{max}	175W	
Output Tolerance		± 3%	
Rated Current	I_{mp}	4.95A	
Rated Voltage	V_{mp}	35.2V	
Short-Circuit Current	I_{sc}	5.20A	
Open-Circuit Voltage	V_{oc}	44.2V	
Series Fuse Rating		15A	
Maximum System Voltage		600V	
Temperature Coefficients	Power	-0.5 %/°C	(± 0.05)
	Voltage	-0.155 V/°C	(± 0.01)
	Current	-0.06 %/°C	(± 0.01)
Cell Technology		72 Cell Mono-Si, 125 x 125mm	

[1] Peak Power at Output Tolerance

Performance Characteristics

Current vs. Voltage at 22°C
ST175 -1



Mechanical Specifications - System

	ST175-1	Non-Andalay
Racking hardware	Integrated	External
Grounding wires	Integrated	External
Wiring connections	Factory-assembled	Installer-assembled
Module-module connections	Integrated (Threaded)	External (Friction Clips)
Space between modules	1/8"	Up to 3"
Roofing penetrations	25% Fewer	Standard

Micro-Inverter Technical Specifications

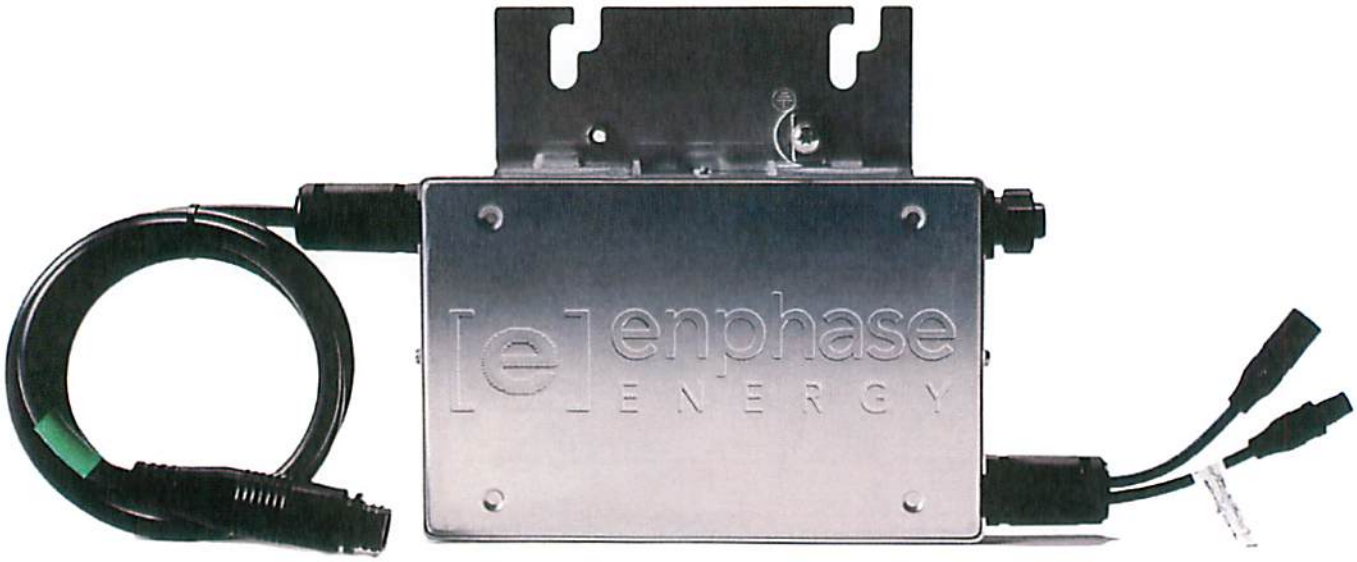
	M190-24-208-S01/2	M190-24-240-S01/2
Nominal output current	913mA	800mA
Nominal voltage/range	208V/183V-229V	240/211V-264V
Extended voltage/range	208V/179V-232V	240V/211V-269V
Nominal frequency/range	60.0/59.3-60.5	60.0/59.3-60.5
Extended frequency/range	60.0/59.3-60.5	60.0/59.3-60.5
Power factor	>0.95	>0.95
Maximum units per branch	21	15
Peak inverter efficiency	0.955	0.955
CEC weighted efficiency	0.95	0.95
Nominal MPP tracking	0.996	0.996
Operating temparature range	-40°C to +65°C	-40°C to +65°C
Night time power consumption	30mW	30mW
Cooling	Natural Convection - No Fans	
Enclosure environmental rating	Outdoor - NEMA 6	
Communication	Powerline	
Warranty	15 Years	
Compliance	UL1741/ieee1547	
	FCC Part 15 Class B	

Certified by c UL us C SP US

Andalay
A whole new look to solar power
16005 Los Gatos Blvd.
Los Gatos, CA 95032
www.andalaysolar.com /1.888.395.2248

ANDSURAC091409

ENPHASE MICROINVERTER M190



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 the web-based Enlighten monitoring and analysis website.

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

RELIABLE
- MTBF of 331 years
- System availability greater than 99.8%
- No single point of system failure

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

C US

MICROINVERTER TECHNICAL DATA

60 and 72 Cell Modules		
Input Data (DC)	M190-72-208-S11/2/3	M190-72-240-S11/2/3
Recommended input power (STC)	230W	230W
Maximum input DC voltage	54V	54V
Peak power tracking voltage	22V – 40V	22V – 40V
Min./Max. start voltage	28V/54V	28V/54V
Max. DC short circuit current	12A	12A
Max. input current	10A	10A
Output Data (AC)		
Maximum output power	190W	190W
Nominal output current	920mA	800mA
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 branch	21	15
Efficiency		
Peak inverter efficiency	95.5%	95.5%
CEC weighted efficiency	95.0%	95.0%
Nominal MPP tracking	99.6%	99.6%
Mechanical Data		
Operating temperature range	-40°C to +65°C	-40°C to +65°C
Night time power consumption	30mW	30mW
Dimensions (WxHxD)	8" x 5.25" x 1.25"	
Weight	4.4 lbs	
Cooling	Natural Convection – No Fans	
Enclosure environmental rating	Outdoor – NEMA 6	
Features		
Communication	Powerline	
Warranty	15 Years	
Compliance	UL1741/IEEE1547	
	FCC Part 15 Class B	

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