PACIFIC POWER
A DIVISION OF PACIFICORP

825 NE Multnomah, Suite 2000
Portland, Oregon 97232

January 16, 2019

VIA ELECTRONIC FILING

Public Utility Commission of Oregon
201 High Street SE, Suite 100
Salem, OR 97301-3398

Attn: Filing Center

RE: UM 1020—PacifiCorp 2018 Blue Sky Grant Funding

At the request of Public Utility Commission of Oregon Staff, PacifiCorp d/b/a Pacific Power provides for filing in the above-referenced docket the attached information regarding a project to which PacifiCorp proposes to provide Blue Sky grant funding. Staff is reviewing the project consistent with the processes outlined in Orders No. 17-289 and 17-455.

Please direct questions regarding this filing to Natasha Siores, Manager, Regulatory Affairs, at (503) 813-6583.

Sincerely,

Etta Lockey
Vice President, Regulation

CERTIFICATE OF SERVICE

I certify that I served a true and correct copy of PacifiCorp's 2018 Blue Sky Grant Funding on the parties listed below via electronic mail and/or overnight delivery in compliance with OAR 860-001-0180.

Service List
UM 1020

Michael Goetz
Citizens' Utility Board of Oregon
610 SW Broadway, Suite 400
Portland, OR 97205
mike@oregoncub.org

Renee M. France
Department of Justice
Regulated Utility & Business Section
1162 Court St. NE
Salem, OR 97301-4096
renee.m.france@doj.state.or.us

Wendy Simons
Oregon Department of Energy
550 Capitol St., NE
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wendy.simons@oregon.gov

Johanna Riemenschneider
Department of Justice
Business Activities Section
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pge.opuc.filings@pgn.com

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Portland OR 97204
silvia@renewablenw.org

John Lowe
Renewable Energy Coalition
12050 SW Tremont St
Portland, OR 97225-5430
jravenesanmarcos@yahoo.com

Dated this 16th day of January, 2019.

Katie Savarin
Coordinator, Regulatory Operations

Astoria Co-op — Astoria, OR

Project Summary			
Project Size	57.4 kW	Est. Annual Generation	60,000 kWh
Technology	Solar	Est. Generation as % of Usage	100%
Capacity Factor	12%	Anticipated on-line date	Jul-19
Project Cost Summary			
Total Project Cost	$138,243	Blue Sky Request	$48,385
Total Project Cost per Watt	$2.41/W	Portion of Total Cost Requested	35%
Applicant Summary			
Previous Recipient?	no	Community Participation Rate	12.8%

OVERVIEW SUMMARY STATEMENT

The Astoria Co-op is a private cooperative founded in 1974 as a small, community-owned grocery store with a mission and vision to build community through access to healthy and local foods. The Co-op currently has about 3,000 members from the local community and about 75% of shoppers are member-owners. The Co-op is located in Clatsop County, the second poorest county in Oregon. The Co-op is currently designing a new building to be constructed in 2019. The property is owned by Astor Venture, LLC, and will be leased to the Co-op for a 20-year term with two 5-year extension options. The new building will include energy efficiency features such as additional insulation, LED lights, and high efficiency refrigeration. The proposed solar PV project would help reduce operational costs.

Key Strengths:

- Demonstrated commitment to energy efficiency and sustainability.
- Experienced project team.
- The structure is being designed for the proposed solar PV system.

Key Weaknesses:

- Matching fund sources have not yet been secured.
- The timeline may be delayed due to construction of the new building.
- The solar array will not be physically visible.

Eligible Project Costs	$1,443	Engineering/design
	$77,001	Equipment
	$47,259	Labor
	$3,790	Permitting
	$200	Monitoring System, Kiosk
	$8,550	Other: travel and per diem
	$138,243	**Total Eligible Costs**
Secured Funding	$11,663.25	Energy Trust of Oregon
Unsecured Funding	$82,946	USDA REAP and ODOE RED grants
Blue Sky Request	**$48,385**	**35% of total costs**

PROJECT FEASIBILITY/ READINESS

- **Technology.** The 57.4 kW solar PV system will consist of 174 China Sunergy 330-Watt solar panels and will likely use Enphase micro inverters. Either a hybrid ballasted racking system or a fully attached system will be used, depending on results of engineering calculations.
- **Project Team.** The applicant's project team is highly qualified. The project host and building developer have experience managing contractors and different funding sources. The selected contractor, Elemental Energy, has installed similar Blue Sky funded systems and is an Energy Trust of Oregon Trade Ally.
- **Project Site.** The array will be installed on the flat roof of the new Co-op building and has been designed to maximize available un-shaded roof space. The structure is being designed to support the solar array.
- **Energy Estimate.** The energy estimate is based on industry-standard methods and includes a site-specific shade analysis. The array will be oriented south at a tilt of 10 degrees with virtually no shading or obstruction, resulting in a total solar resource fraction of 91%. The estimated net capacity factor of 12% is reasonable.
- **Timeline & Status.** The required structural, electrical, and interconnection applications will be submitted upon notice of funding. The building financing will close in December 2018 and construction is scheduled to being in January 2019. The solar installation is scheduled for June 2019 when the building envelope will be completed. This timeline is reasonable, but any delays in financing or construction will impact on the solar timeline.
- **O&M.** Elemental Energy will provide performance monitoring and repairs as needed during their 10-year workmanship warranty. The data monitoring system will send automatic notifications of faults to both Elemental Energy and the Co-op staff. A maintenance reserve would be set aside to cover any repairs and the equipment will be covered by the building's insurance policy.

PROJECT COSTS & FINANCIAL FEASIBILITY

- **Funding Sources.** The applicant is requesting 35% funding from Blue Sky, 8% from Energy Trust of Oregon (secured), and intends to apply for a 25% grant from the USDA Rural Energy for America Program and 35% grant from the Oregon Department of Energy.
- **Additionality.** Blue Sky funding is necessary for the project to proceed as specified and partial funding would result in delays while other sources of funds are sought. The building will still be constructed solar-ready.
- **Financial Stability.** The applicant is in good financial health and is able to pay for the entire upfront cost of the system until Blue Sky reimbursement is received.
- **Project Budget.** The proposed budget is within a reasonable range for this type and size of project. The budget is based on a single fixed-price bid.

COMMUNITY BENEFITS AND BLUE SKY EXPOSURE

- **Community Benefits.** The project provides economic benefits by hiring an installation contractor based in Oregon. The project will provide community benefits by reducing operating costs and passing those savings along to the co-op members through their annual dividend.
- **Educational Benefits.** The applicant will install a data monitoring display and educational sign in the building. Information about the project will be included in newsletters to about 4,000 members, new member information packets, annual reports, on the Co-op website, and in the local news media. Tours will be available upon request.
- **Community Acceptance.** A community meeting was held about the design of the new building and many members expressed a desire for solar on the new building. The applicant did not provide any letters of support.
- **Blue Sky Recognition.** The project will include Blue Sky recognition on the educational signage in the store, on the Co-op website, and in any news articles about the project. A ribbon cutting for the new building will be organized and can include solar recognition.
- **Blue Sky Exposure.** The solar array will not be visible from the street. There are two previously funded Blue Sky projects in this community. The Blue Sky participation rate is 12.8%.

DEREK CROPP

77722 Dugan Ln Cottage Grove OR 97424/ 503.475.3804/ derek.cropp@yahoo.com

OBJECTIVE

To obtain a position of responsibility enabling my continued pursuit of knowledge and experiences thereby enhancing my own personal and professional growth.

QUALIFICATIONS SUMMARY

- 9 years of Solar install experience (resi, comm, ind), commissioning, design, and troubleshooting
- North American Board of Certified Electrical Practitioners (NABCEP) Certified Six years
- Project/Construction Manager and Electrical Superintendent for a total of seven years
- Master Electrician license holder: Washington, Colorado, Wyoming, Texas, Idaho, New Mexico, Delaware, Oklahoma, Oregon (Sign Sup), Arizona, Montana, Alaska, California, and North Carolina
- Proficient with Microsoft Word, MS Project, Excel, Outlook, Power Point, One Note
- Excellent background in Electrical safety and safety in the construction field (hold OSHA 30 card), extensive knowledge of both the NFPA 70 and 70(E), have boom, fork lift (all terrain) experience
- Thorough understanding of licensing process, good rapport with permit and inspection community
- Author online continuing education courses for electricians (adept at summarizing technical content providing easier comprehension to the end user). **"LightwaveLearning"** for 3 code cycles (six years)
- Instruct prep course for master/journeyman electrician exams (keen ability for delivering intended subject matter via numerous avenues)
- Self-motivated (autonomous) yet team oriented, extremely well organized & thorough
- Sound decision making with ability to take risks, and accountable for actions
- Excellent communication skills (verbal and written)

PROFESSIONAL EXPERIENCE

Electrician Consultant, Roth Heating and Cooling, Sears Holdings

Oregon and Multiple other states *4 yrs. Presently Employeed by both*

- Available for answering electrician and technician installation questions
- Implement Electrical Safety Program, Lockout Tagout procedure, present electrical safety meetings
- Participate with legal team ascertaining the abilities of license holders in various states
- Work with estimating crew/ Project Managers reviewing estimates, bids, and contracts
- Coordinate with permitting specialist and inspectors of numerous jurisdictions

Assistant Project Manager, *EC Company, Gala Solar Project*

Portland, OR *8 months experience-2017 (50 hrs/ week)*

- Created written "Method of Procedure" protocols establishing direction of various project tasks
- Instructed/Trained personnel with regards to installation procedures and safe electrical practices
- Collaberated with Engineering team deriving increased efficiencies of installation methods
- Managed procurement of tools and material, vetted specialized tools used for project installation
- Managed inventory of owner/company provided electrical material ($75 million project, 300 acres)
- Attended Owner-Subcontractor meetings relaying project progress and scheduling updates
- Managed Union Labor force (30+ electricians and material handlers)/ Payroll/ Layoffs

Commercial Project Manager, Signing Supervisor Electrician, *SolarCity Corp*.

Portland, OR *4+ years experience (50 hrs/ week)*

- Managed numerous solar projects totaling 10 megawatts, including systems worth over $4 million
- Created & managed project budgets throughout project duration. All projects met budgetary goals
- Use of Microsoft Project creating schedules establishing critical paths, milestones, and deliverables
- Drafted and negotiated subcontractor Trade Scopes (SOWs) and Contracts
- Assisted Technical Sales with potential projects that involved initial design, infrastructure and costs.
- Managed material procurement for large commercial projects, vetted use of project equipment/ tools
- Participated in rules and regulation boards establishing installation requirements for rooftop solar
- Completed all projects on time with zero employee or subcontractor labor (time loss) accidents
- Managed numerous trade scope diverse projects demanding creative and out of the box thinking
- Managed Walmart pilot program involving battery storage that offset peak demand electrical usage
- Clients included Forbes 500 corperations, utility, and municipality agencies

Estimator and Electrical Contractor Signing Supervisor, *Angus Electric*

Tillamook, OR *8 months experience (30 hrs/ week)*

- Ensured safe electrical practices, created crew schedule, procured install equipment and materials
- Estimated projects, established customer contact, coordinated with utility and AHJ

Electrical and Solar Superintendent, Signing Supervisor Electrician, *SunEdison/Local Electric*

Portland, OR *4 years experience (40 hrs/ week)*

- ***LE Lead electrician***: 40+ custom homes & floating homes, Commercial Tenant Improvement including dental/medical offices, restaurants, and retail stores
- Service Electrician involving industrial motors, pools, services, residential and TI remodels
- ***SunEdison***: Site assessor- surveyed roofs at commercial sites of potential projects
- Designed roof mounted solar systems using information obtained from site assesments (surveys)
- Installed 50 plus residential solar systems as lead installer
- Electrical Superintendent: supervised electrical crews on projects totaling over a megawatt (Walgreens, Staples, Multnomah County, Kohls, Evergreen Water Reservoir- Hillsboro)
- Estimated for both Local Electric and SunEdison corporation using internal estimating software

IBEW Journeyman Electrician

Portland, OR *2 years experience (40 hrs/ week)*

- ***EC Company, Cochran Broadway***: Lighting Retrofit (Precision Cast Parts), Fred Meyer Remodel

IBEW Commercial Electrical Apprentice

Portland, OR *4+ years experience (40 hrs/ week)*

- ***Dryer and Sons Inc, Cherry City Electric***: Commercial TI & Const (tilt-ups, post tens.), New Homes

EDUCATION AND VOCATIONAL TRAINING

NECA IBEW Electrical Training Center, Electrical Apprenticeship, Portland, OR

- Lead class with highest gpa and finished 5 year program in just over 4 years

Emery Aviation College, Associates Degree Aeronautical Science, C. Springs, CO

- 4.0 gpa, Single engine land airplane, Commercial Certified, Instrument Rated

Portland State University, BS degree, Speech and Communication, Portland, OR

UNITED STATES DEPARTMENT OF LABOR

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

Pacific Northwest OSHA Education Center, Region X

Department of Environmental and Occupational Health Sciences

University of Washington

This is to certify that

Troy Nichols

has diligently and with merit completed training in

OSHA 500 Trainer Course in Occupational Safety and Health Standards for the Construction Industry

April 4, 2016 - April 7, 2016

26.0 Classroom Hours, 2.6 CEUs

OSHA Training Institute Education Centers
University of Washington

ACTING DIRECTOR, OSHA TRAINING AND EDUCATION

DIRECTOR, UW OSHA EDUCATION CENTER

UNITED STATES DEPARTMENT OF LABOR

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

Pacific Northwest OSHA Education Center, Region X

Department of Environmental and Occupational Health Sciences

University of Washington

This is to certify that

Troy Nichols

has diligently and with merit completed training in

OSHA 510 Standards for the Construction Industry

December 8, 2014 - December 11, 2014

26.0 Classroom Hours, 2.6 CEUs

OSHA Training Institute Education Centers
University of Washington

Henry E. Payne

DIRECTOR, OSHA TRAINING AND EDUCATION

Eric M Vigoren

ASSISTANT DIRECTOR, UW OSHA EDUCATION CENTER

Certificate of Completion

Awarded To

Troy Nichols

For Successful Completion of

Electrical Safety 4

Jun 12, 2014

BCD#: 104
WA#: 2012-423

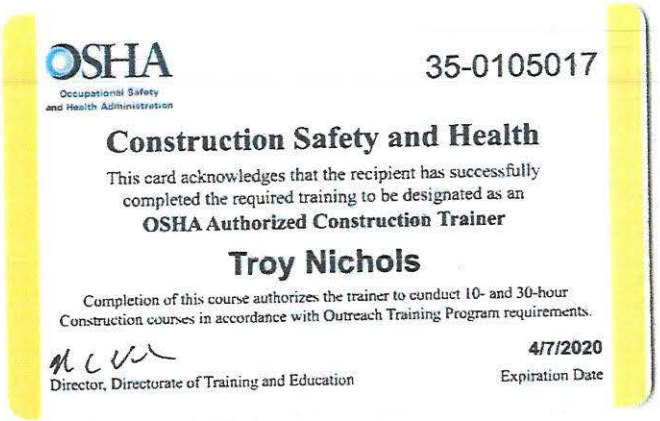
Rodney D. Belisle

Oregon: 4 CR
Washington: 4 IR

Location: Portland
16021 NE Airport Way, Portland, OR 97230

Instructor: Moreland, Barry

Classroom: 2



OSHA
Occupational Safety and Health Administration

35-0105017

Construction Safety and Health

This card acknowledges that the recipient has successfully completed the required training to be designated as an

OSHA Authorized Construction Trainer

Troy Nichols

Completion of this course authorizes the trainer to conduct 10- and 30-hour Construction courses in accordance with Outreach Training Program requirements.

Director, Directorate of Training and Education

4/7/2020
Expiration Date

OVERTON
Safety Training, Inc.

Card # 41444

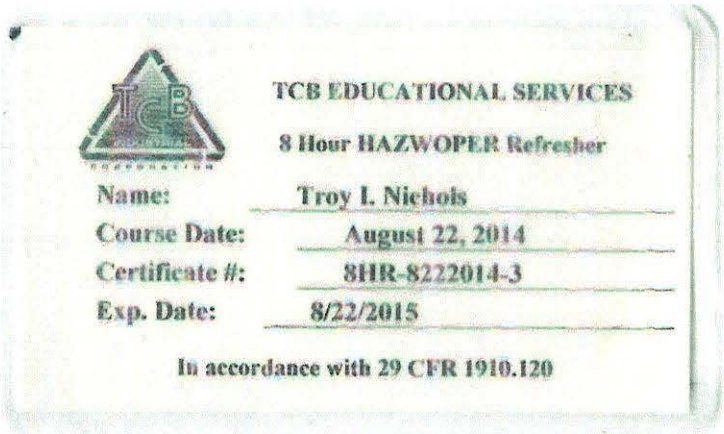
Crane Class Qualified to Signal For:
Mobile Lattice & Telescopic Cranes
Overhead Cranes
Tower Cranes
Pedestal & Portal Cranes

Signaling Modes:
Hand Signaling
Radio Signaling
Spotting for Hazards

Qualified Person — *Rigging & Signaling*

Troy Nichols
EC Company

Issued: 03/14/16
Expires: 03/13/21



TCB EDUCATIONAL SERVICES

8 Hour HAZWOPER Refresher

Name: Troy I. Nichols
Course Date: August 22, 2014
Certificate #: 8HR-8222014-3
Exp. Date: 8/22/2015

In accordance with 29 CFR 1910.120

OVERTON
Safety Training, Inc.

Card # 41444

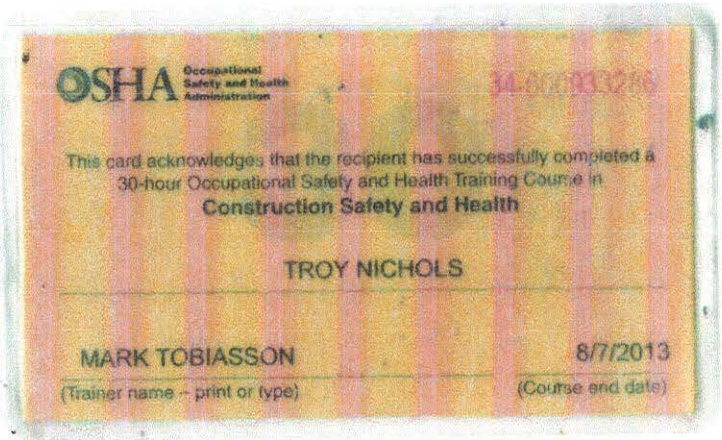
Crane Class Qualified to Signal For:
Mobile Lattice & Telescopic Cranes
Overhead Cranes
Tower Cranes
Pedestal & Portal Cranes

Signaling Modes:
Hand Signaling
Radio Signaling
Spotting for Hazards

Instructor/Evaluator — *Rigging & Signaling*

Troy Nichols
EC Company

Issued: 03/14/16
Expires: 03/13/21



OSHA Occupational Safety and Health Administration

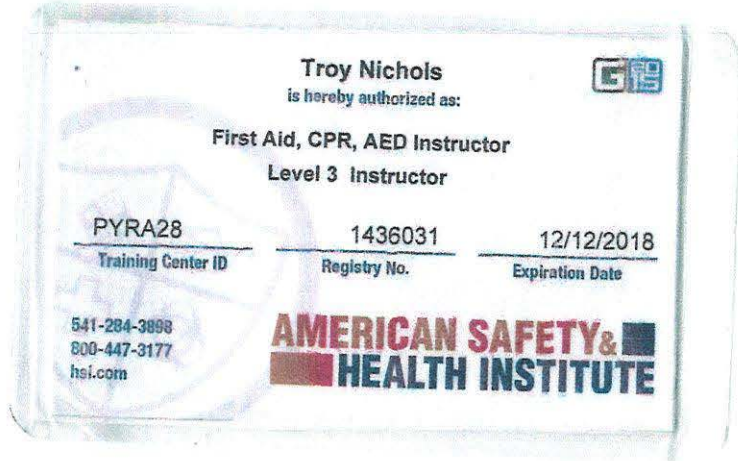
This card acknowledges that the recipient has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety and Health

TROY NICHOLS

MARK TOBIASSON
(Trainer name – print or type)

8/7/2013
(Course end date)



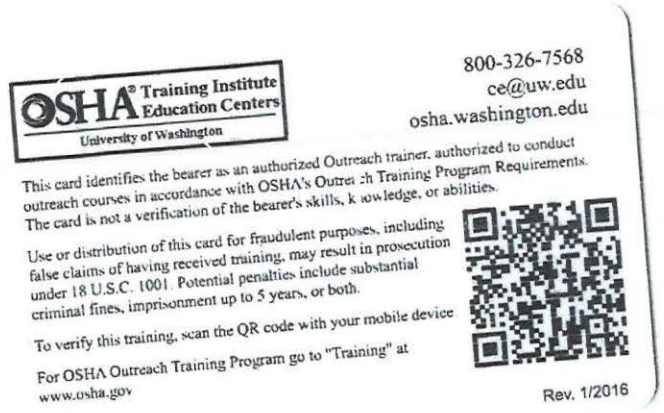
Troy Nichols
is hereby authorized as:

First Aid, CPR, AED Instructor
Level 3 Instructor

PYRA28	1436031	12/12/2018
Training Center ID	Registry No.	Expiration Date

541-284-3898
800-447-3177
hsi.com

AMERICAN SAFETY & HEALTH INSTITUTE



OSHA® Training Institute Education Centers
University of Washington

800-326-7568
ce@uw.edu
osha.washington.edu

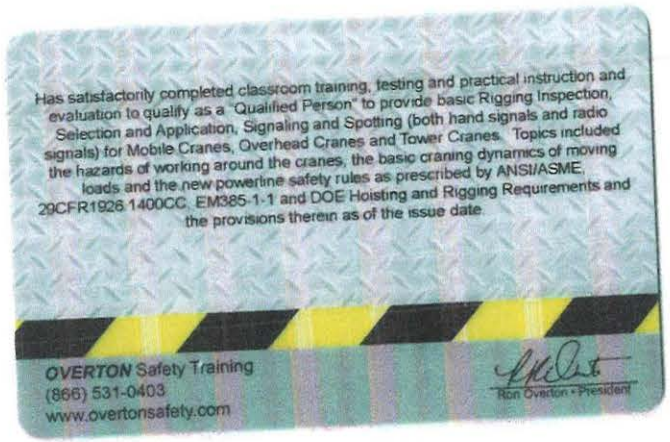
This card identifies the bearer as an authorized Outreach trainer, authorized to conduct outreach courses in accordance with OSHA's Outreach Training Program Requirements. The card is not a verification of the bearer's skills, knowledge, or abilities.

Use or distribution of this card for fraudulent purposes, including false claims of having received training, may result in prosecution under 18 U.S.C. 1001. Potential penalties include substantial criminal fines, imprisonment up to 5 years, or both.

To verify this training, scan the QR code with your mobile device

For OSHA Outreach Training Program go to "Training" at www.osha.gov

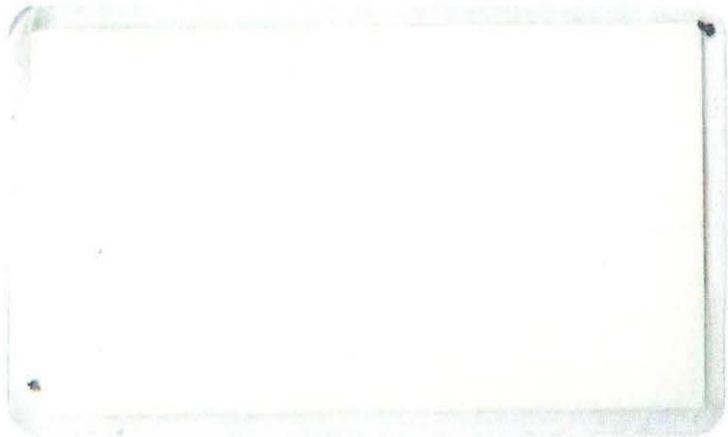
Rev. 1/2016

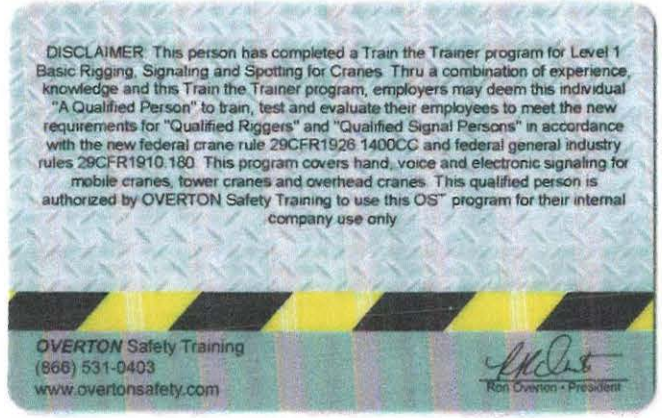


Has satisfactorily completed classroom training, testing and practical instruction and evaluation to qualify as a "Qualified Person" to provide basic Rigging Inspection, Selection and Application, Signaling and Spotting (both hand signals and radio signals) for Mobile Cranes, Overhead Cranes and Tower Cranes. Topics included the hazards of working around the cranes, the basic craning dynamics of moving loads and the new powerline safety rules as prescribed by ANSI/ASME, 29CFR1926.1400CC, EM385-1-1 and DOE Hoisting and Rigging Requirements and the provisions therein as of the issue date.

OVERTON Safety Training
(866) 531-0403
www.overtonsafety.com

Ron Overton • President

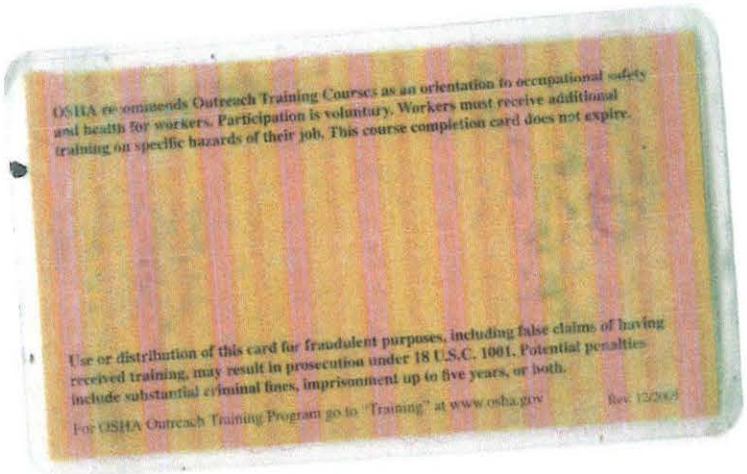




DISCLAIMER: This person has completed a Train the Trainer program for Level 1 Basic Rigging, Signaling and Spotting for Cranes. Thru a combination of experience, knowledge and this Train the Trainer program, employers may deem this individual "A Qualified Person" to train, test and evaluate their employees to meet the new requirements for "Qualified Riggers" and "Qualified Signal Persons" in accordance with the new federal crane rule 29CFR1926.1400CC and federal general industry rules 29CFR1910.180. This program covers hand, voice and electronic signaling for mobile cranes, tower cranes and overhead cranes. This qualified person is authorized by OVERTON Safety Training to use this OS" program for their internal company use only

OVERTON Safety Training
(866) 531-0403
www.overtonsafety.com

Ron Overton • President

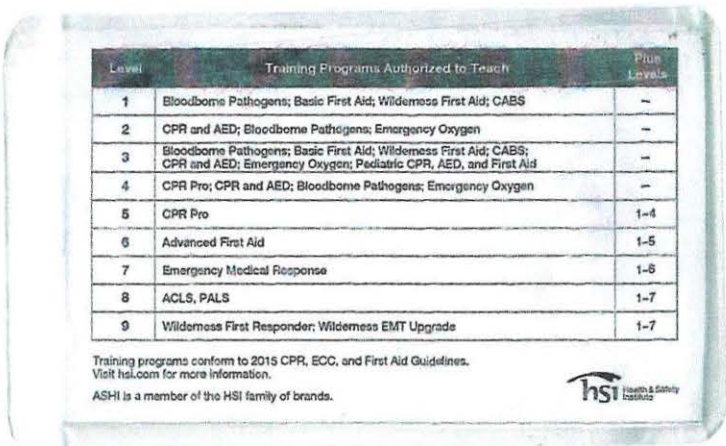


OSHA recommends Outreach Training Courses as an orientation to occupational safety and health for workers. Participation is voluntary. Workers must receive additional training on specific hazards of their job. This course completion card does not expire.

Use or distribution of this card for fraudulent purposes, including false claims of having received training, may result in prosecution under 18 U.S.C. 1001. Potential penalties include substantial criminal fines, imprisonment up to five years, or both.

For OSHA Outreach Training Program go to "Training" at www.osha.gov

Rev. 12/2015



Level	Training Programs Authorized to Teach	Plus Levels
1	Bloodborne Pathogens; Basic First Aid; Wilderness First Aid; CABS	--
2	CPR and AED; Bloodborne Pathogens; Emergency Oxygen	--
3	Bloodborne Pathogens; Basic First Aid; Wilderness First Aid; CABS; CPR and AED; Emergency Oxygen; Pediatric CPR, AED, and First Aid	--
4	CPR Pro; CPR and AED; Bloodborne Pathogens; Emergency Oxygen	--
5	CPR Pro	1–4
6	Advanced First Aid	1–5
7	Emergency Medical Response	1–6
8	ACLS, PALS	1–7
9	Wilderness First Responder; Wilderness EMT Upgrade	1–7

Training programs conform to 2015 CPR, ECC, and First Aid Guidelines.
Visit hsi.com for more information.

ASHI is a member of the HSI family of brands.

hsi Health & Safety Institute

Solar Feasibility Study
Project: Astoria Co-op
23rd & Marine Drive - New Construction

Prepared by

Zakir Hakim
Elemental Energy
6819 SE Foster Rd
Portland Oregon, 97206

Table of Contents

1. Executive Summary:

   Astoria Co-op seeks to construct a 57.4 kW Solar Array on the roof of their new location at the corner of 23rd and Marine Drive in Astoria Oregon. A helioscope solar analysis was performed to verify that the roof will be suitable for the array. The site is suitable for a solar array. The total solar resource is greater than 75% based on the plan set. Preliminary design has been reviewed and agreed upon.

2. Description of Solar Analysis:
   - 2.1. For this new construction project, EE reviewed the project drawings
   - 2.2. Building infrastructure requires no structural upgrades.
   - 2.3. There is little to no existing vegetation or buildings shading the solar area. Total Solar Resource Factor (TSRF) of greater than 75%
     - 2.3.1. The Total Solar Resource Factor is:
       - 2.3.1.1. The ratio of the sun's exposure in a given area throughout the day.
       - 2.3.1.2. A perfect 100% TSRF indicates there is no source of shade other than cloud cover for the entirety of the day
       - 2.3.1.3. Energy Trust of Oregon sets a 75% TSRF floor for their incentive structure

3. Summary of Solar Area:
   - 3.1. Total Roof Top Area: 11,468 ft²
   - 3.2. Total Solar Area: 3,675.75t² (57.4kW)

4. Solar Resource Available:
   - 4.1. >75% - No obstructions to the South, East, or West
   - 4.2. Shade analysis attached

5. Solar Array Design
   - 5.1. Site Plan and Single Line Diagram Attached

6. Project Financial Summary

6.1. System Price:

6.1.1. Solar Power Systems are quoted by the Price Per DC Watt (PPW)

6.1.2. For this array, Elemental Energy would charge $2.41 / W or $138,334 for a direct purchase with the ACO owning the array

6.2. Pacific Power's Blue Sky Grant:

6.2.1. Pacific Power's ratepayers fund this grant to assist the deployment of renewable energy projects throughout their service territory.

6.2.2. The ACO is an ideal candidate for Blue Sky Grant, some of the salient preferred criteria as follows:

6.2.2.1. Projects sited within Pacific Power service territory and/or owned by a Pacific Power customer

6.2.2.2. Projects hosted by a public or non-profit entity, or in partnership with such an entity.

6.2.2.3. Projects that provide a substantial educational benefit to the community.

6.2.2.4. Projects that provide significant environmental and economic benefits to local communities and Pacific Power customers.

6.3. Oregon Department of Energy Grant:

6.3.1. Oregon's taxpayers fund this grant to assist the deployment of renewable energy projects in the state of Oregon

6.3.2. The grant is competitive, criteria that will set The ACO apart are as follows:

6.3.2.1. Feasibility of the system: Points will be awarded by examining a number of factors, including technological, operational, schedule, and resource feasibility.

6.3.2.2. Net energy generated per grant amount requested: Net generation occurs when, over the course of the relevant period, the system generates more electrical power than is required to run the system.

6.3.2.3. Technological/resource diversity: Points will be awarded by comparing all proposals received during an opportunity period.

6.3.2.3.1. The ACO's competitiveness in this metric can be enhanced with the addition of Battery Energy Storage Systems at additional cost.

6.3.2.4. Demonstrates Community Benefits: Points will be awarded for systems that are structured to provide community ownership opportunities or demonstrate creative community financing models or convey other benefits to members of the local community.

6.3.2.4.1. The ACO may choose to enable its donors to purchase blocks of the array as a financing mechanism for the array's purchase in a "Community Solar" type arrangement (See Addendum for a press release from a similar project. Or click here)

6.4. Modelling Energy Savings:

6.4.1. Per Helioscope (attached), the system will generate 64.12MWh of electricity in year 1

6.4.1.1. To model the energy generated from a solar array, one must cross reference the solar panel and inverter data sheets with historical weather patterns in the area in which the system shall be installed.

6.4.1.2. With the modelled production of 64.12 MWh, we used the ACO's bill to arrive at their energy savings by multiplying their current effective $/kWh energy charge and the system's energy generation in year 1, yielding first year savings of 6,400$

6.4.1.2.1. For the simple return calculation, please note that solar panel output decreases by .55% / year. The value of the kWh credit, however, inflates with the utility inflation rate. For Pacific Power's commercial customers that rate has historically been more than 2% / year

6.5. ACO plans to pursue both a 2018 Blue Sky grant and an ODOE (35% of project cost each), project's simple return assuming one grant is awarded:

System Price (2.41$/W, 57.4kW)	$138,334
Investment Tax Credit*	($41,500)
75% Energy Trust Cash Incentive	($13,500)
Grant Funds	($48,416)
Net System Price	$31,918
Annual Average Power Value during payback period**	$7,200
Simple Return on Investment	4.5 Years
Percentage of Bill Offset***	TBD

*Assumes sufficient tax burden
**Includes Pacific Power inflation rate

7. Design, Permitting, and Zoning
   7.1. Per the Astoria Building Department, no special challenges are anticipated in design, permitting, or zoning. We are outside of the historical preservation district.
   7.2. Permitting may be done at the same time as the general construction permits or separately

8. Equipment:
   8.1. Solar Panels
      8.1.1. ACO Should ensure that Tier 1 Solar Modules (Sample specification/warranty Addendum D
         8.1.1.1. The Tier 1 ranking scale is compiled by Bloomberg New Energy Finance Corporation and is used to rank solar panel manufacturers in terms of their

bank-ability or financial stability. See below for a partial list

TIER 1 MODULE MAKER LIST, Q4 2016

Company/ brand	In-house module capacity (MW/year)
Jinko Solar	6,500
GCL	6,000
Trina	6,000
JA Solar	5,500
Canadian Solar	5,000
Hanwha Q Cells	4,800
First Solar	3,200
Risen Energy	3,100
Talesun	2,800
Suntech/ Shunfeng	2,400
Seraphim	2,100
Chint/ Astronergy	2,000
Hareon	2,000
SunPower	1,800
ZNShine	1,600
SolarWorld	1,500
Renesola	1,500
China Sunergy	1,450
REC Solar	1,300
HT-SAAE	1,200
LG	1,100
Solar Frontier	1,050
Phono Solar*	1,000
ET Solar	1,000
BYD	1,000
Hyundai Heavy	600
S-Energy	530
Waaree	500
Tata	500
AU Optronics	435
Aleo Solar	250
Anjitek	170
Winaico	150
Total	**70,035**

Source: Bloomberg New Energy Finance Note: Methodology here. Brands that do not own their own manufacturing capacity are not included here.

8.2. Solar Inverter

8.2.1. From a cost standpoint, a string inverter will be best for this installation. While most inverters have an option to purchase a 20 year, the life of the inverter's capacitors is expected to be 14 years. Elemental Energy suggests inverter inspection at year 10.

8.2.2. See Addendum E for sample specification and warranty

8.2.3. All commercial inverters may be integrated with a production monitoring system which may be integrated into the exhibit to educate consumers on the system's production, see below for illustration:

Image Courtesy of SOLEDOS GmbH

Key Findings

The Astoria Co-op (ACO) has a good solar resource and sufficient space and structural support to install 57.4 kW Solar Array on the to be constructed on its new location at the intersection of 23rd and Marine Drive. To minimize the cost of the solar array, Elemental Energy suggests pursuing ODOE ('19) and Blue Sky ('18) grants.

From a financial standpoint, the project's attractiveness as an investment is very much conditional on the successful receipt of grant funding. Without grant funding, The ACO may utilize a "Community Solar Model" to allow ACO patrons to purchase portions of the array and receive a dividend in so doing The ACO may find some additional support to minimize The ACO's out of pocket costs.

Regarding equipment, there are numerous quality options for Solar Panels and Solar Inverters. Elemental Energy provides a single example of specifications and warranties for some best value components. Both Higher and Lower panel efficiencies are available and may be used to fit into larger or smaller budgets.

Grant Submittal - Hybrid Astoria, 23rd avenue Astoria Oregon

Shading Heatmap

Shading by Field Segment

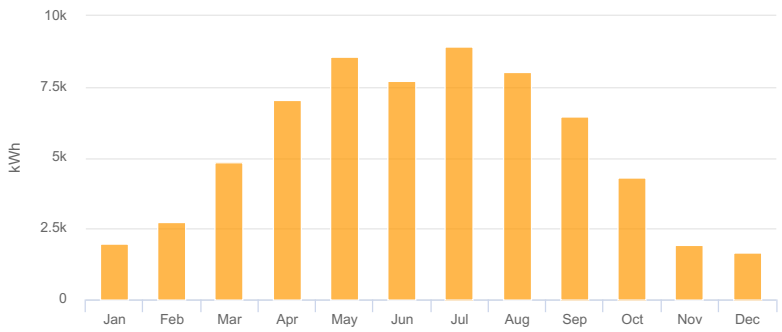
Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF[2]	Solar Access	TSRF [2]
Field Segment 1	10.0°	175.7°	174	57.4 kWp	1,273.8kWh/m^2	64.1 MWh[1]	92.4%	98.5%	91.0%
Totals, weighted by kWp			**174**	**57.4 kWp**	**1,273.8kWh/m^2**	**64.1 MWh**	**92.4%**	**98.5%**	**91.0%**

[1] approximate, varies based on inverter performance
[2] based on location Optimal POA Irradiance of 1,400.5kWh/m^2 at 35.2° tilt and 188.0° azimuth

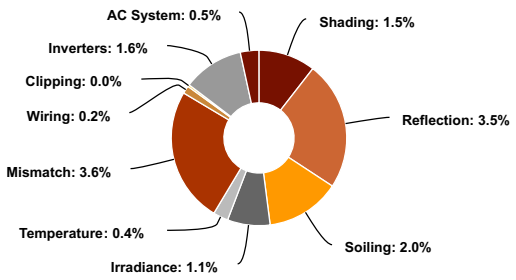
Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Field Segment 1	94%	98%	99%	99%	99%	99%	99%	99%	99%	99%	97%	91%
Solar Access, weighted by kWp	**93.9%**	**97.8%**	**98.8%**	**99.0%**	**99.0%**	**98.9%**	**99.1%**	**99.1%**	**99.0%**	**98.6%**	**96.6%**	**90.8%**
AC Power (kWh)	**1,957.2**	**2,720.5**	**4,856.5**	**7,019.9**	**8,570.9**	**7,721.4**	**8,937.7**	**8,011.3**	**6,442.9**	**4,290.1**	**1,924.0**	**1,663.0**

Monthly Production



Sources of System Loss



Southwestern Angle

Southeastern Angle

Grant Submittal - Hybrid Astoria, 23rd avenue Astoria Oregon

Report

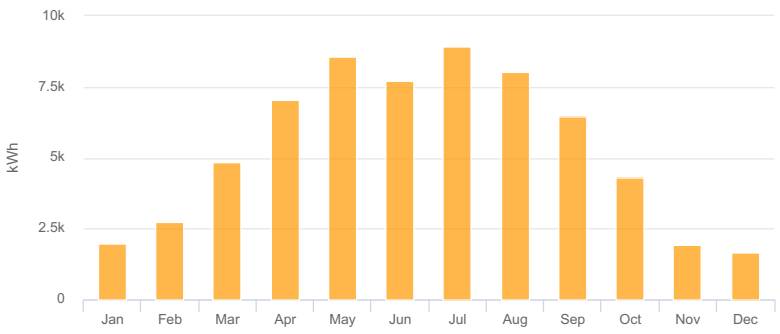
Project Name	Astoria
Project Address	23rd avenue Astoria Oregon
Prepared By	Zak Hakim daniel@elementalenergy.net

System Metrics

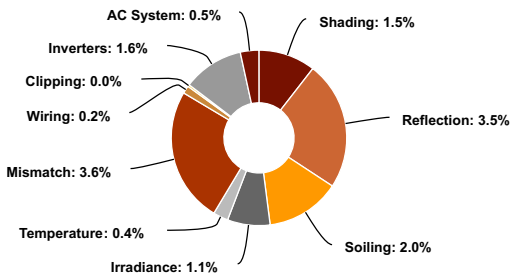
Design	Grant Submittal - Hybrid
Module DC Nameplate	57.4 kW
Inverter AC Nameplate	50.0 kW Load Ratio: 1.15
Annual Production	64.12 MWh
Performance Ratio	86.3%
kWh/kWp	1,116.6
Weather Dataset	TMY, 10km Grid (46.15,-123.85), NREL (prospector)
Simulator Version	02438dc84d-15065d270a-ca63df14a5-d5d7833a30

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,204.5	
	POA Irradiance	1,293.6	7.4%
	Shaded Irradiance	1,273.8	-1.5%
	Irradiance after Reflection	1,229.7	-3.5%
	Irradiance after Soiling	1,205.2	-2.0%
	Total Collector Irradiance	**1,205.2**	**0.0%**
Energy (kWh)	Nameplate	69,229.5	
	Output at Irradiance Levels	68,435.9	-1.1%
	Output at Cell Temperature Derate	68,160.3	-0.4%
	Output After Mismatch	65,679.7	-3.6%
	Optimal DC Output	65,541.9	-0.2%
	Constrained DC Output	65,509.3	0.0%
	Inverter Output	64,437.5	-1.7%
	Energy to Grid	**64,115.3**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		11.1 °C
	Avg. Operating Cell Temp		17.4 °C
Simulation Metrics			
	Operating Hours		4638
	Solved Hours		4638

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, 10km Grid (46.15,-123.85), NREL (prospector)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Characterization
CSUN330-72M (CSUN)	Spec Sheet Characterization, PAN

Component Characterizations

Device	Characterization
CSI50KTL-CT (Canadian Solar)	Default Characterization

Components

Component	Name	Count
Inverters	CSI50KTL-CT (Canadian Solar)	1 (50.0 kW)
Strings	10 AWG (Copper)	10 (1,246.0 ft)
Module	CSUN, CSUN330-72M (330W)	174 (57.4 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	7-19	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	175.711°	1.5 ft	1x1	174	174	57.4 kW

Detailed Layout

FOR IMMEDIATE RELEASE

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Mazama Mountaineers Climb to the Peak of Clean Energy

Commissioner Vega Pederson and Rep. Rob Nosse to join celebration

FEATURED: A 39.6kW solar PV system now powers the outdoor education programming at the Mazama Mountaineering Center in SE Portland.

Portland, OR (July 6, 2017) - Established on the summit of Mt. Hood in 1894, the Mazamas was founded on the principles of protecting and enjoying our beloved native environments. Continuing to live out these values over 100 years later, the Mazama community recently solarized its Mountaineering Center (MMC) in SE Portland. Outfitted with 39.6kW worth of Canadian Solar modules on top of the widely recognizable bright blue roof, the new solar PV system will offset 29.5 metric tons of CO_2 annually. The Mazamas will host a commissioning event on Tuesday, July 11, 2017 from 6:30–8:00 PM to celebrate its newfound energy independence. This casual gathering is free to attend and open to the community—includes food, drink, and an information session on how to bring solar energy to your home, business, or community.

The Mazamas' path to solar began back in 2006, when the effects of climate change were becoming more evident with each passing day. Inspired to be a part of the solution, the Mazamas Conservation Committee assumed a new urgency and sought to reduce its carbon footprint. "Melting glaciers make climate change very apparent to the Mazamas so we are doing what we can through our tree planting program, energy efficiency upgrades, purchasing renewable power, and now solar electric," noted Jeff Hawkins, the Mazama Solar Project Manager.

In partnership with the Oregon Clean Power Cooperative and Elemental Energy, a local solar PV design and installation firm, the Mazamas' goal of "going solar" became a reality this spring. "We're very proud to be a part of Oregon Clean Power Coop's first community solar project and to assist the Mazamas in reducing their environmental impact. Through the community solar model, we were able to cost-

effectively empower the non-profit Mazamas organization," noted John Grieser, owner of Elemental Energy. "Solar not only provides clean, reliable, and lower cost electricity for homes and businesses alike, but it's critical to battling pollution at the source, helping to protect the places we love." The Mazama installation is the first of many community solar projects the Oregon Clean Power Cooperative has set for 2017, including a 38kW PV system on the First Unitarian Church in downtown Portland and a 30kW PV system on the Public Works Building in Hood River, Oregon.

###

Elemental Energy

Elemental Energy is a highly experienced design and installation firm of solar PV systems for residential and commercial clients in Oregon. The owners and staff at Elemental Energy received tailored renewable energy engineering education, allowing us to offer unparalleled expertise. Locally owned and operated, we pride ourselves on providing creative solutions to your home or business energy needs, and aim to make the process of going solar simple and efficient. **To learn more about the benefits of solar PV, current incentives, or to schedule a free site assessment, visit: www.elementalenergy.net**

- Selected one of the nation's *Top Solar Contractors* by Solar Power World in 2013, 2014, 2015, and 2016
- Featured contractor for residential installation at the NW Natural Street of Dreams in 2014
- Specializing in creative solutions for all energy needs, including: small and large residential roof- and ground-mounted arrays, off-grid boat houses, solar awnings and patio coverings, mobile units (trailers, trucks, vans, buses, etc.), and energy-storage.
- In 2015, Elemental Energy employees formed Twende Solar, a 501c3 non-profit organization dedicated to empowering energy-deficient communities by implementing renewable energy systems in the world's most neglected areas.

Mazamas

The Mazamas promote mountaineering, responsible recreation, and conservation through outdoor education, youth outreach, and advocacy programs. Founded on the summit of Mt. Hood, and headquartered in Portland, Oregon, the Mazamas has been working to represent and support everyone who loves to play in and protect the mountains of the Pacific Northwest for more than 120 years. The Mazamas operate the one of the largest centralized mountaineering training schools in the country graduating over 500 people per year with basic to intermediate level climbing skills. You can learn more about the Mazamas and start your adventure here: mazamas.org

Oregon Clean Power Cooperative

The Oregon Clean Power Cooperative believes that people want to invest in their communities. Owned by its members, the Co-op is dedicated to helping them do that, so communities can finance their own solar, wind, micro-hydro and other renewable energy projects, keep capital circulating locally, and build projects that would otherwise be passed over by large institutional investors.

MONO

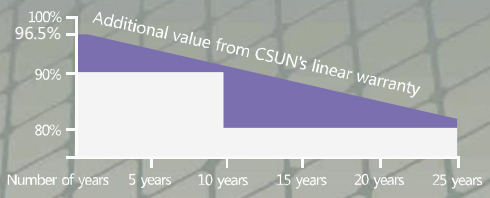
PowerGuard
SPECIALTY INSURANCE SERVICES

Powerguard Insurance Global Coverage

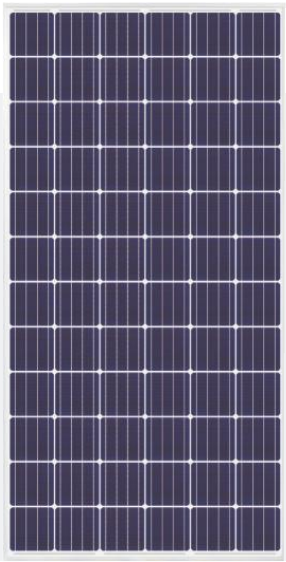
The power output shall not be less than 96.5%of the minimum power output stated in the product data sheet in the first year of the product' s life cycle. The loss of power output shall not exceed 0.68% per year thereafter, ending with 80.18% in the 25th year.

CSUN Standard Warranty

CSUN's **NEW** linear performance warranty



CSUN
energy for today



CSUN340-72M

The Large Scale Project Solution

CSUN340-72M CSUN335-72M CSUN330-72M
CSUN325-72M

17.56%
Module efficiency

340W
Highest power output

10years
Material & Workmanship warranty

25years
Liner power output warranty

- PID-free
- World class mono efficiency
- Tighter porduct performance distribution and current sorting reduces the mismatch power loss in system operation
- Positive tolerance offer
- Good temperature coefficient enables higher output in high temperature regions
- Excellent performance under low light conditions
- Certified for salt/ammonia corrosion resistance
- Load certificates: wind to 2400Pa and snow to 5400Pa

- China Sunergy Co., Ltd. designs, manufactures and delivers high efficient solar cells and modules to the world from its production centers based in China, Turkey, South Korea and Vietnam.
- Founded in 2004, China Sunergy is well known for its advanced solar cell technology reliable product quality and excellent customer service.
- As one of leading PV enterprises, China Sunergy has delivered more than 4.0GW of solar products to residential, commercial, utility and off-grid projects all around the word.

- Note:
  All specifications, warranties, certifications about module of "CSUN" series also apply to that of "SST".

  All information and data are subject to change without notice.

Right 2017

www.csun-solar.com

Electrical characteristics at Standard Test Conditions(STC)

Module Type	CSUN340-72M	CSUN335-72M	CSUN330-72M	CSUN325-72M
Maximum Power - Pmax (W)	340	335	330	325
Open Circuit Voltage - Voc (V)	46.5	46.3	46.1	46
Short Circuit Current - Isc (A)	9.41	9.32	9.23	9.12
Maximum Power Voltage - Vmpp (V)	38.3	38.1	37.9	37.7
Maximum Power Current - Impp (A)	8.89	8.79	8.72	8.62
Module Efficiency	17.56%	17.30%	17.04%	16.78%

Standard Test Conditions (STC): irradiance 1,000 W/m²; AM 1,5; module temperature 25°C. Tolerance of Pmpp: 0~+3%.

Measuring uncertainty of power: ±3%. Certified in accordance with IEC 61215, IEC 61730-1/2 and UL 1703.

Electrical Characteristics at Normal Operating Cell Temperature(NOCT)

Module Type	CSUN340-72M	CSUN335-72M	CSUN330-72M	CSUN325-72M
Maximum Power - Pmax (W)	250	246	242	238
Open Circuit Voltage - Voc (V)	43.2	43	42.8	42.7
Short Circuit Current - Isc (A)	7.59	7.52	7.44	7.36
Maximum Power Voltage - Vmpp (V)	35.5	35.2	35.1	34.9
Maximum Power Current - Impp (A)	7.05	6.97	6.91	6.82

Normal Operating Cell Temperature((NOCT) : irradiance 800W/m^2; wind speed 1 m/s ; cell temperature 45℃; ambient temperature 20℃.

Measuring uncertainty of power: ±3%. Certified in accordance with IEC 61215, IEC 61730-1/2 and UL 1703.

Temperature Characteristics

NOTC	45℃ (±2℃)
Voltage Temperature Coefficient	-0.307%/K
Current Temperature Coefficient	+0.039%/K
Power Temperature Coefficient	-0.423%/K

Maximum Ratings

Maximum System Voltage [V]	1000
Series Fuse Rating [A]	20

Material Characteristics

Dimensions	1956×990×40mm (L×W×H)
Weight	22kg
Frame	Anodized aluminum profile
Front Glass	White toughened safety glass, 3.2 mm
Cell Encapsulation	EVA (Ethylene-Vinyl-Acetate)
Back Sheet	Composite film
Cells	6×12 pieces monocrystalline solar cells series strings (156mm×156mm)
Junction Box	Rated current≧13A, IP≧67, TUV&UL
Cable&Connector	Length 900 mm, 1×4 mm^2, compatible film

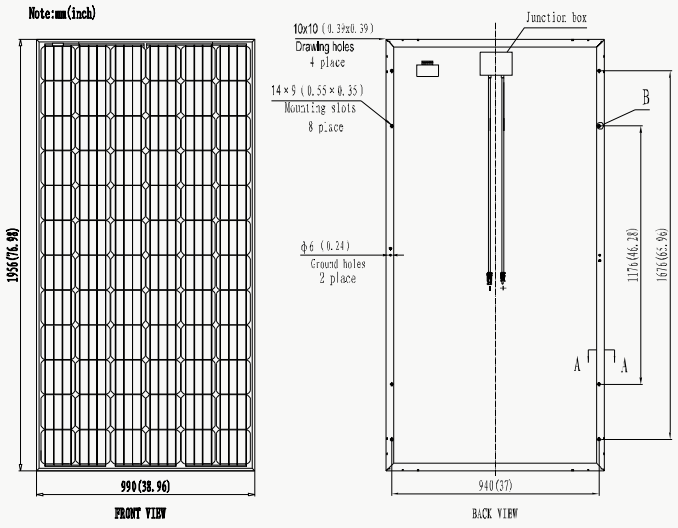
Packaging

Dimensions(L×W×H)	1990×1120×112mm
Container20'	260
Container40'	624
Container40'HC	684

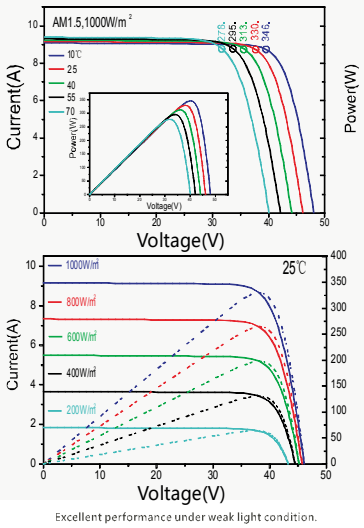
System Design

Temperature Range	-40 °C to + 85 °C
Withstanding Hail	Maximum diameter
Maximum Surface	5,400 Pa
Application class	class A
Safety class	class Ⅱ

Dimensions

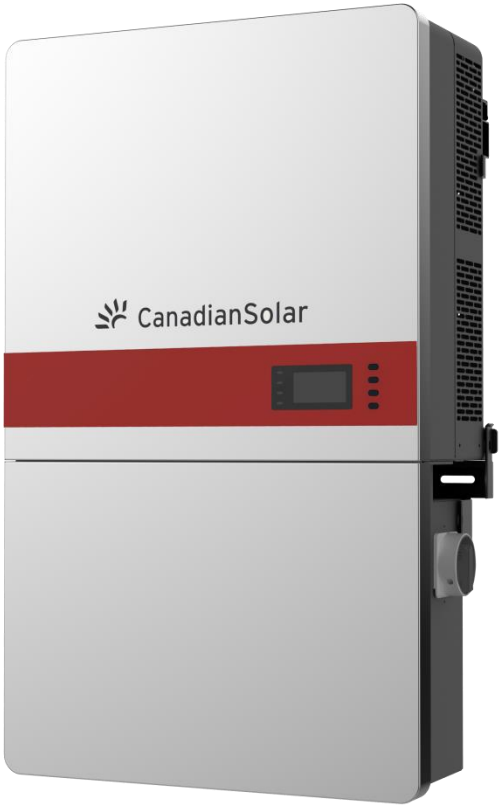


IV-Curves



Excellent performance under weak light condition.

CSI SERIES GRID-TIED PV Inverter
CSI-50KTL-CT & CSI-60KTL-CT
INSTALLATION AND OPERATION MANUAL
VERSION 1.3



CANADIAN SOLAR INC.
Canada, 545 Speedvale Avenue West, Guelph, Ontario, Canada N1K 1E6
www.canadiansolar.com

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Table of Contents

Before You Start…

This Installation and Operation manual contains important information, safety guidelines, detailed planning and setup information for installation, as well as information about configuring, operating and troubleshooting the CSI-50KTL-CT and CSI-60KTL-CT 3-Phase String Inverters. Be sure to read this manual carefully before operating or servicing the inverters.

Thank you for choosing a CSI 3-Phase String Inverter. These PV Inverters are high performance and highly reliable products specifically designed for the North American Solar market.

Installation, commissioning, troubleshooting, and maintenance of the inverter must only be performed by qualified personnel. If you encounter any problems during installation or operation of this unit, first check the user manual before contacting your local dealer or supplier. This user manual is applicable for the following models:

CSI-50KTL-CT and CSI-60KTL-CT

Instructions inside this user manual will help you solve most installation and operation difficulties. Contact your local supplier if the problem still exists.

Please keep this user manual on hand for quick reference.

Chapter 1 IMPORTANT SAFETY INSTRUCTIONS
(SAVE THESE INSTRUCTIONS)

Please read this user manual carefully before installation of the product. CSI reserves the right to refuse warranty claims for equipment damage if the user fails to install the product according to the instructions in this manual.

Warnings and symbols in this document

	**DANGER:** DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	**WARNING:** WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	**CAUTION:** CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	**NOTICE:** NOTICE indicates a hazardous situation which, if not avoided, could result in the inverter working abnormally or property loss.
	**INSTRUCTION:** INSTRUCTION indicates important supplementary information or provides skills or tips that can be used to help you solve a problem or save you time.

Markings on the product

	**HIGH VOLTAGE:** This inverter operates with high voltages. All work on the inverter must only be performed as described in this document.
	**HOT SURFACE:** The inverter is designed to meet international safety standards, but surfaces can become hot during operation. Do not touch the heat sink or peripheral surfaces during or shortly after operation.
	**EARTH GROUND:** This symbol marks the location of the grounding terminal, which must be securely connected to Ground through the AC EGC (Equipment Grounding Conductor) to ensure operational safety.

WARNING:

All the installation and wiring connections should only be performed by qualified technical personnel. Disconnect the inverter from the PV modules and the AC grid before maintaining or servicing the equipment.

Risk of electric shock and fire. Use only with PV modules that have a maximum system voltage of rating of 1000V or higher.

Electric shock Hazard. The DC conductors of this photovoltaic system are normally ungrounded but will become intermittently grounded without indication when the inverter performs the PV array isolation measurement.

Shock Hazard. The inverter is energized from both AC and DC sources. Disconnect all sources before servicing.

For continued protection against risk of fire, replace only with same type and ratings of fuse.

DANGER:

Disconnect the inverter from the AC grid and PV modules before removing covers or opening the equipment. Ensure hazardous high voltage and energy inside the inverter has been discharged prior to servicing. Wait at least 5 minutes after disconnecting from the DC and AC sources before servicing or maintaining the inverter.

NOTICE:

The inverters are designed to only interconnect with an AC power source as part of the public electric utility grid. Do not connect the AC output of the inverters directly to any private electric utility power equipment.

CAUTION:

CSI-50KTL-CT and CSI-60KTL-CT inverters weigh approximately **56kg (123.5 pounds)**. The wirebox portion weighs approximately **15kg (33 pounds)**.

Ensure the mounting bracket is properly installed before hanging the inverter and wirebox on the bracket. A team of two is recommended to lift and place the inverter and wirebox into position.

INSTRUCTION:

Please check with your local electric utility supply company before selecting a grid standard. If the inverter is operated with an incorrect grid standard, the electric utility supply company may cancel the interconnection agreement.

Placing the inverter into operation before the overall system complies with the national codes, rules and safety regulations of the application is also not permitted.

Chapter 2 Overview

2.1 Inverter for grid-tied PV systems

CSI-50KTL-CT and CSI-60KTL-CT 3-Phase String Inverters are designed for use with carport, commercial rooftop, and large utility scale PV grid-tied systems. The system is generally made up of PV modules, a 3-Phase String Inverter with a fused combiner/disconnect, and AC power distribution equipment (Figure 2-1). The inverter converts the available DC energy from the PV modules to AC power by synchronizing the output current to the same frequency and phase as the AC grid. All or part of the AC power is supplied to local loads, and the surplus power is exported to the electric utility grid.

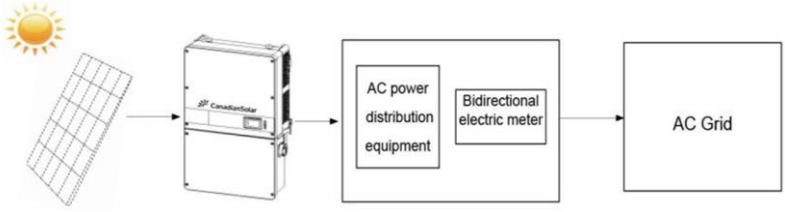


Figure 2-1 Grid-tied PV system

2.2 Product Features

- **High conversion efficiency:** Advanced 3-level conversion topology with SVPWM; Max. efficiency: 98.8% ; CEC efficiency: 98.5%
- **Grid adaptability:** IEEE 1547, Rule 21, and HECO SRDs applicable; Reactive Power; >0.99 PF (±0.8 adjustable), Remote Active Power Curtailment.
- **Flexible communication:** Supports standard Modbus RS485, *SunSpec Modbus, and TCP/IP communications to ensure compatibility with 3rd party monitoring and control systems.

*Sunspec Modbus is expected in the future. Please check with your CSI representative regarding availability for this option.

- **Wide DC input voltage range:** Operating DC Input Voltage Range: 200-950Vdc; Max DC input voltage: 1000V
- **Long Service Life:** Uses thin-film capacitors to extend inverter's service life
- **3 MPPTs:** Multi-channel MPPT (Maximum Power Point Tracker) enable maximum design flexibility and energy harvest optimization over the life of the system.
- **Wirebox option:** The wirebox enables fused input of discrete wiring using the Standard wirebox.
- **High protection degree:** Powder coated aluminum NEMA 4X enclosure meets the demanding needs of both indoor and outdoor use.
- **Intelligent Integration:** Integrated load-break rated DC/AC disconnect switches, and up to 15 fused string inputs eliminate the need for external DC combiner boxes, simplifying installation.

2.3 Product Protection Functions

- ✓ Reverse polarity protection of DC input
- ✓ AC and DC Short circuit protection
- ✓ Arc-fault detection and circuit interruption
- ✓ Anti-islanding detection with bi-directional frequency perturbation
- ✓ DC Input and AC output over-voltage protection
- ✓ DC Input over-current protection
- ✓ DC input insulation against ground monitoring
- ✓ DC injection of AC output
- ✓ AC output voltage and frequency monitoring
- ✓ Leakage current against ground monitoring
- ✓ Internal enclosure temperature monitoring
- ✓ IGBT power module temperature monitoring

2.4 Schematic Diagram and Circuit Design

The basic electrical schematic diagram of CSI-50KTL-CT and CSI-60KTL-CT inverters are shown in Figure 2-2.

The input from PV source circuits passes through surge protection circuitry, DC EMI wave filters, and independent DC-DC boost circuitry to achieve maximum power point tracking and boost the voltages to a common DC bus. The inverter uses line voltage and frequency measurements to synchronize to the grid and converts the available PV energy to AC power by injecting balanced 3-phase AC current into the electric utility grid. Any high frequency AC component is removed by passing through a two-stage relay and EMI wave filter to produce high quality AC power.

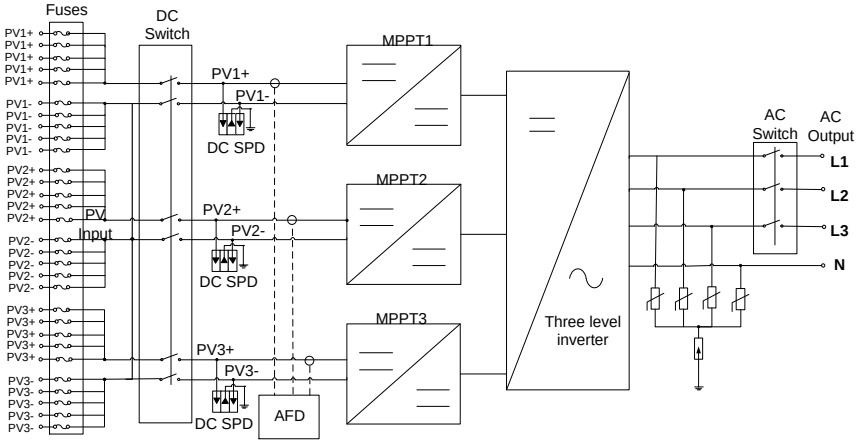


Figure 2-2 Schematic Diagram of the CSI-50/60KTL-CT Inverter

2.5 Appearance and Main items Description

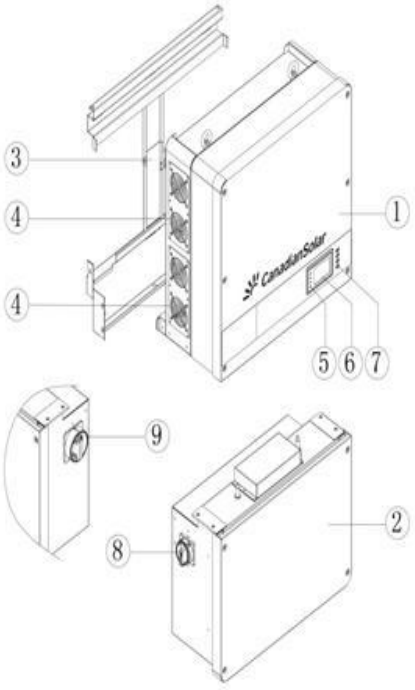


Figure 2-3 Diagram of the CSI-50KTL-CT and CSI-60KTL-CT Inverters

Main items of the Inverter:

1) Main inverter enclosure
2) Inverter wirebox
3) Inverter mounting bracket
4) Cooling fans
5) LED indicator lights
6) User LCD display
7) User Key buttons
8) DC switch: DC power on/off
9) AC switch: AC power on/off

2.6 Anti-islanding Detection

The CSI-50KTL-CT and CSI-60KTL-CT inverters include Unintentional Islanding detection as required by UL1741/IEEE1547. The inverter will

continuously make bi-directional perturbations to the frequency of the output current by injecting a small amount of reactive power in order to detect a possible islanding condition. If the grid is stable, these small perturbations will have negligible effects on the system voltage frequency. However, in an islanded condition the changes in reactive power will force the frequency of the system voltage to deviate significantly, which will trigger the inverter to cease operation and disconnect from the grid.

2.7 DC Ground Fault Protection

The inverters include residual current detection as part of the DC ground fault detection method required by UL1741. If there is a ground fault in the PV array, the ground fault detection circuitry will detect leakage current and trigger an alarm. The inverter will cease operation if the leakage current exceeds 500mA.

2.8 Surge Suppression

Surge suppresors are located in the wiring box and can be replaced in the field by a qualified electrician.

Standard Waveform Peak Values		
Surge Category	Ring Wave	Combination Wave
B	6kV/0.5kA	6kV/3kA

"Standard 1.2/50 μs - 8/20 us Combination Wave"

"Standard 0.5 μs - 100 kHz Ring Wave"

2.9 DC Arc-fault Protection

The inverters include DC Arc-fault detection compliant with UL 1699B. The inverter will detect electrical noise that is indicative of a DC series arc. Upon detection of an acr-fault, the inverter will cease operation.

Chapter 3 Installation

This chapter describes the planning and installation procedures for the CSI-50KTL-CT and CSI-60KTL-CT inverters. Please read carefully and install the products following the step-by-step instructions.

The inverter and other main items are shipped in two separate packages, consisting of A.) the main inverter enclosure and B.) the wirebox, mounting bracket, user manual, and accessory kit. Before installation, please check that the following items are included in the packages:

Table 3-1 Main Items

No.	Item	Q'ty	Note	Box
(1)	Main enclosure of the PV inverter	1		A
(2)	Wiring box of the PV inverter	1		B
(3)	Mounting bracket	1	Bracket upon which the PV inverter is hung and mounted	B
(4)	User manual	1	PV inverter installation and operation manual	B
(5)	Accessory kit	1	Kit contains all necessary hardware and accessories for installation	B

Table 3-2 Accessory Kit (Standard wirebox)

No.	Item	Q'ty	Note
(1)	M8 Expansion Anchors	8	For attaching the mounting bracket to a concrete wall or surface
(2)	M8×25mm machine bolts with integrated lock washer	8	Used with M8 expansion anchors
(3)	M6 X18mm Phillips screw	11	4 for securing the wiring box to the main enclosure; 6 for securing the inverter to the mounting bracket; 1 for the External Ground connection
(4)	5 pin PCB connector plug	1	For the RS485 communication
(5)	#10 AWG Wire ferrules	33	30 for PV conductors, includes 3 spares
(6)	M8 Nut	4	For the AC terminal block
(7)	M8 Flat washer	4	For the AC terminal block
(8)	M8 Spring washer	4	For the AC terminal block

INSTRUCTION:

The items in the Accessory Kit Table 3-2 and Table 3-3 above are for the standard configuration. The accessories provided may vary if optional parts are purchased.

3.1 Recommendations before Installation

See Chapter 8, Technical Data for specification ranges and limits

NOTICE:

The allowable ambient temperature range for the CSI-50KTL-CT and CSI-60KTL-CT inverters is defined based on the following conditions;

Condition 1: -40C to 70C, Inverter not installed, and in storage (in packaging or unpackaged).

Condition 2: -30C to 60C, Inverter installed, connected to electric utility grid and operating during daylight hours.

Condition 3: No low temp limit to 70C, Inverter installed, connected to electric utility grid but non-operating (daylight or nighttime hours).

- ✓ Check that the inverter environmental specifications (protection degree, operating temperature range, humidity and altitude, etc) meet the requirements of the specific project location.
- ✓ Make sure that the electric utility grid voltage is within range for the grid standard chosen.
- ✓ Ensure that the local electric utility grid authority has granted permission to connect to the grid.
- ✓ Installation personnel must be qualified electricians or those who have received professional training.
- ✓ Wear and use proper PPE (personal protective equipment) during installation.
- ✓ Sufficient space according to Figure 3-3 and 3-4 must be provided to allow the inverter cooling system to operate normally.
- ✓ Install the inverter away from flammable and explosive substances.
- ✓ Avoid installing the inverter in locations that exceed the temperature limits specified for the inverter to prevent undesirable power loss.
- ✓ Do not install the inverter near an electromagnetic source which can compromise the normal operation of electronic equipment.

3.2 Mechanical Installation

1) Dimensions

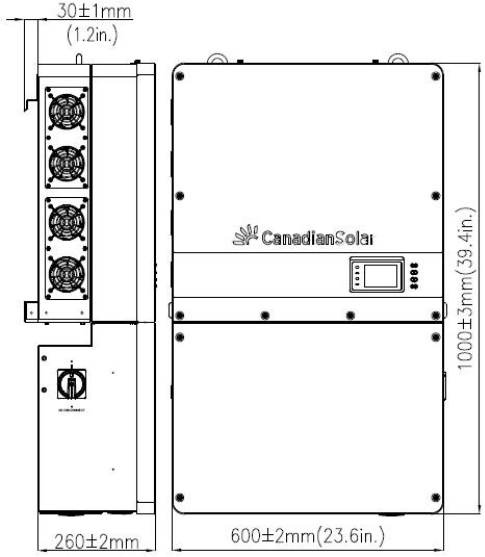


Figure 3-1 Dimensions of CSI-50KTL-CT and CSI-60KTL-CT Inverter

2) Installation Method (see Figure 3-2):

Ensure that the mounting structure (wall, rack, roof, etc) is suitable to support the weight of the inverter. Follow the mounting guidelines below:

(a) If the location permits, install the inverter vertically.

(b) If the inverter cannot be mounted vertically, it may be tilted backward to horizontal.

(c) Do not mount the inverter leaning forward.

(d) Do not mount the inverter upside down.

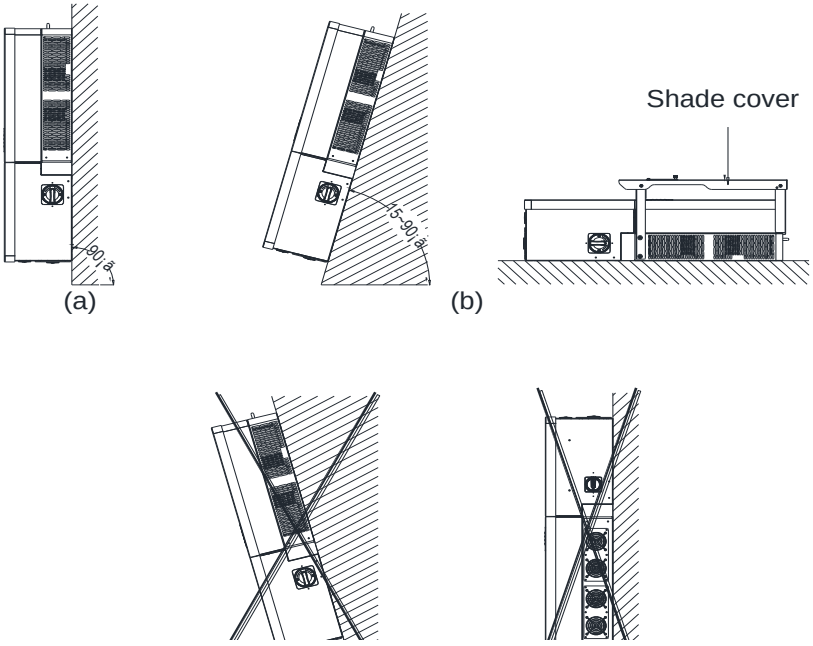


Figure 3-2 Inverter Mounting Options

NOTICE:

When the inverter is mounted backwards by ≤30° in an outdoor environment, the CSI shade cover accessory must be installed on the inverter to avoid direct sunlight.

3) Installation Space Requirement (see Figure 3-3):

The distances between the inverters or the surrounding objects should meet the following conditions:

NOTICE:

The spacing between two adjacently mounted inverters must be ≥500mm (19.7 inches). Spacing should be enlarged for installation locations with ambient temperature higher than 45°C. Ensure that the air space around the inverter is well ventilated. The spacing below the inverter is intended to ensure the LCD and Keypad height are well positioned for the user, and may be descreased, however consideration must be taken for locations known to flood or have seasonal snow build up.

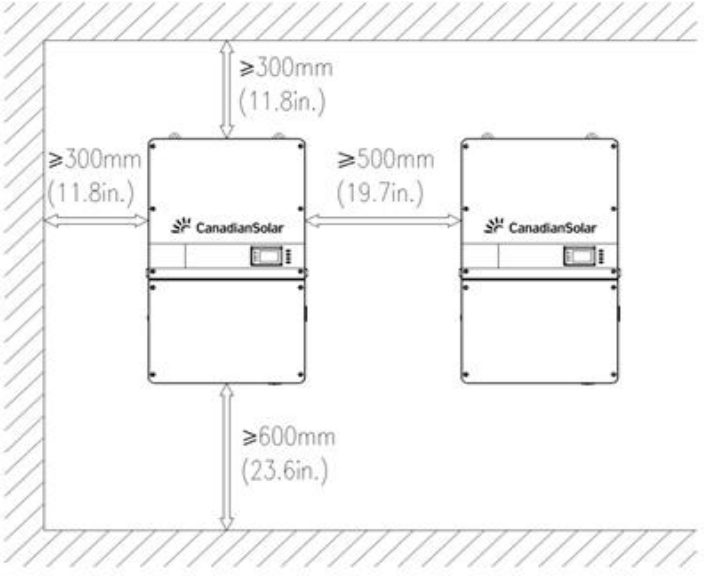


Figure 3-3 Inverter Wall Mounting Dimensions

INSTRUCTION:

If the inverter is installed on Unistrut or the array racking (instead of solid wall), the space from the bottom of one inverter to the top of the

inverter below may be as small as 100mm (3.9in). The spacing below may be as small as 300mm (11.8in).

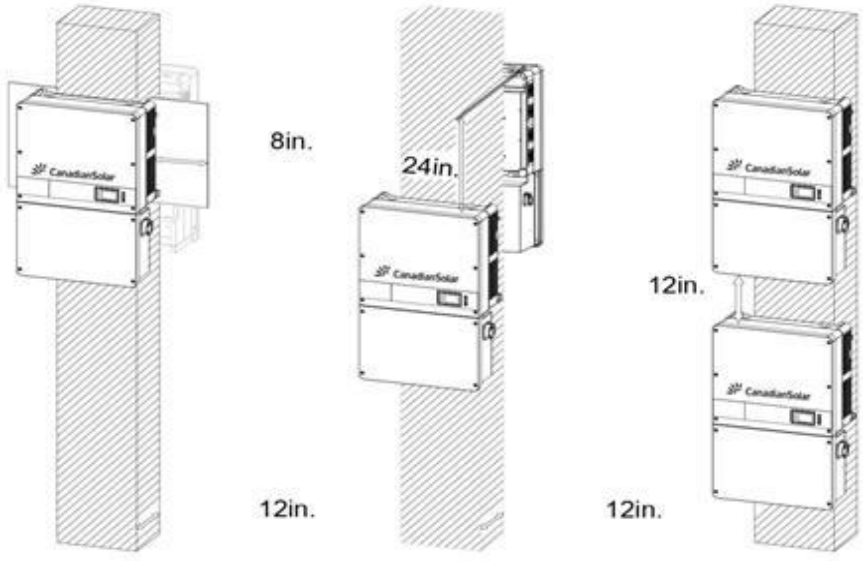


Figure 3-4 Inverter Pillar or Column Mounting Dimensions

INSTRUCTION:

If the inverter is installed on a pillar or column (instead of solid wall), the space from the bottom of one inverter to the top of the inverter below may be as small as 12in (300mm).

4) Mounting the Inverter onto the Bracket

(1) Mark the 8 holes on the wall or bearing surface for attaching the inverter mounting bracket as shown in **Figure 3-5**.

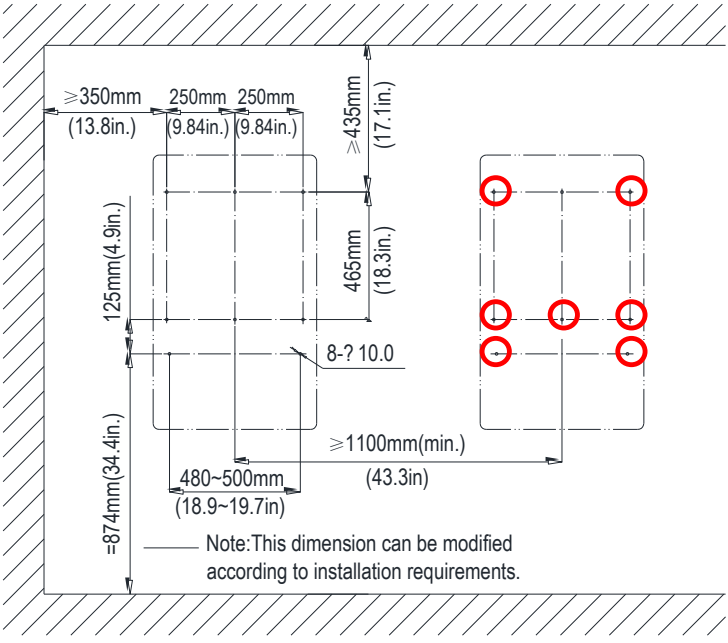


Figure 3-5 Dimensions of the bracket anchoring holes for wall mounting

(2) Drill holes at the marked positions with a 10mm (0.4in.) masonry bit and insert the **M8 Expansion Anchors** ① into the holes; Fasten the **Mounting Bracket** ② with the **M8x25 Assembling Bolts** ③ supplied with the Accessory Kit. Figure 3-6 and 3-7.

Tools Required: Electric drill (Φ10mm/0.4in. masonry bit), No. 13 wrench

Figure 3-6 Drill holes, set Anchors, and tighten Assembling Bolts

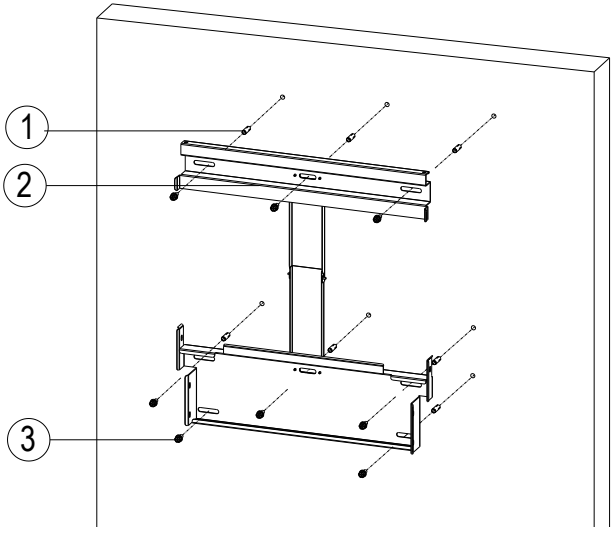


Figure 3-7 Secure the Mounting Bracket

(3) Hang the inverter onto the mounting bracket as shown in Figure 3-8 and Figure 3-9;

Lift mounting: Locate the lifting eyes at the top of the inverter. Use sling rope or bar (inserted through both lifting eye nuts) to lift the inverter onto the bracket. The minimum angle between the two sling ropes should be less than 90 degrees.

Manual mounting: Two people are required to safely lift the inverter by the handle positions marked in Figure 3-9, and mount it onto the bracket.

CAUTION:

The main enclosure of the CSI-50KTL-CT and CSI-60KTL-CT inverters is approx **56kg (123.5 pounds)**.

Ensure the mounting bracket is properly installed and secured before hanging the inverter on the bracket. It is recommended to have at least 2 people to mount the inverter due to the weight of the equipment.

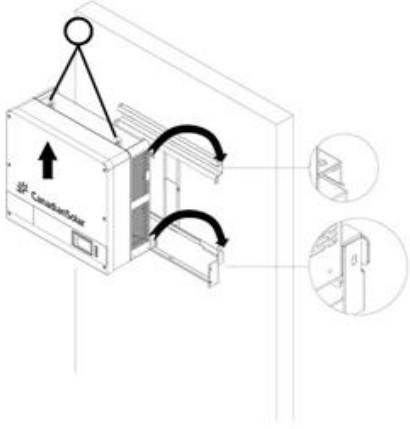


Figure 3-8 Mount the Main Enclosure on the Bracket by Lifting Sling

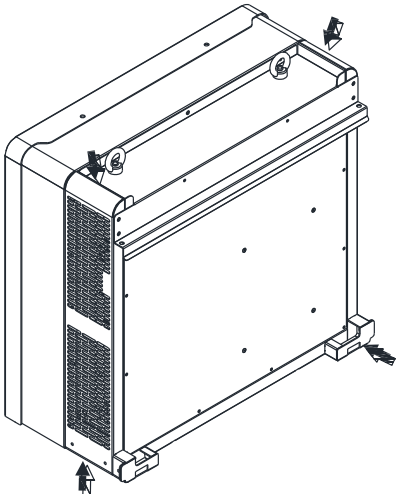


Figure 3-9 Grab Handle Position

(4) Install the wiring box

① Remove the cover plate at the bottom of the main enclosure. (see Figure 3-10)

Tool required: No.2 Phillips head screwdriver

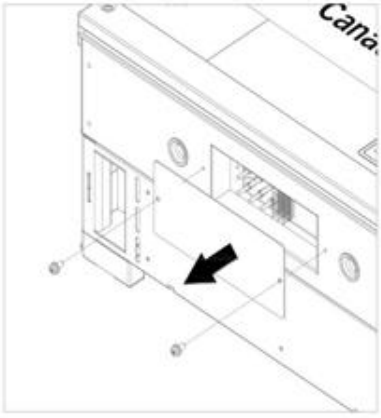


Figure 3-10 Main Enclosure Cover Plate

② Remove screws securing the bulkhead cover at the top of the wiring box. (see Figure 3-11)

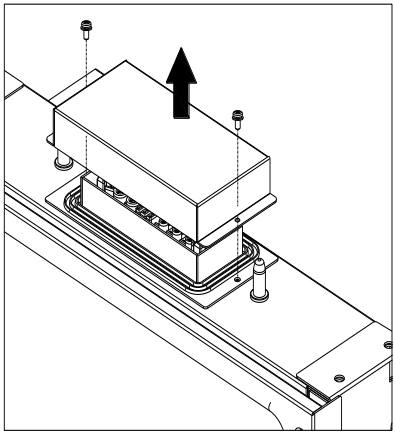


Figure 3-11 Wiring Bulkhead Cover

Save the bulkhead cover and screws, and attached the cover to the left side of the wiring box after the wiring box is attached to the inverter enclosure (see step 6, Figure 3-13)

Tool required: No.2 Phillips head screwdriver

③ Secure the wiring box to the main enclosure by using the **M6x18 screws** (4pcs) to fasten the wiring box. (see Figure 3-12)

Tool required: No. 10 Wrench, torque value of 4 N.m (35.4in-lbs)

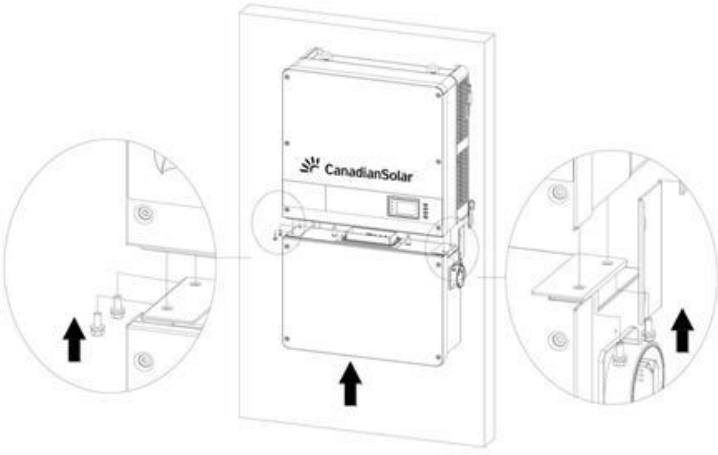


Figure 3-12 Installation of the Wiring Box

(5) Attach the main enclosure and the wiring box to the mounting bracket with the **M6x18 screws** (6 pcs). (see Figure 3-13)

Tool required: No.3 Phillips head screwdriver, torque value of 4N.m (35.4in-lbs)

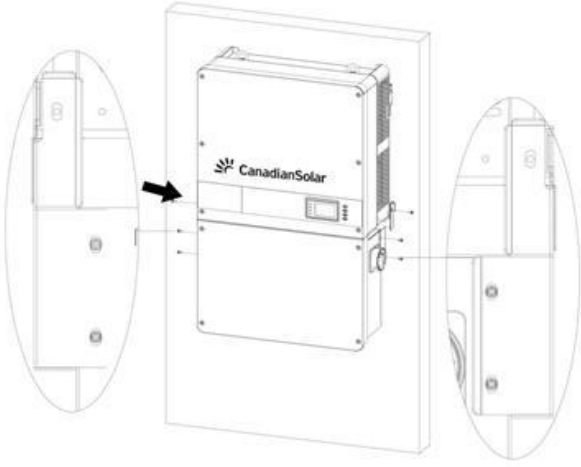
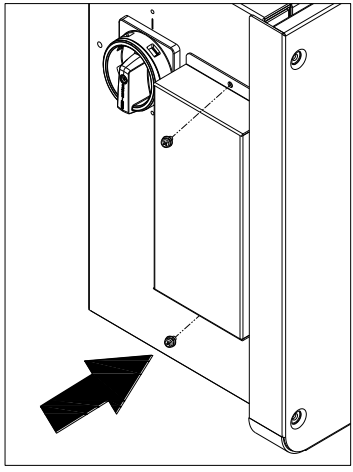


Figure 3-13 Secure the Main Enclosure and Wiring Box to the Bracket

(6) Attach the cover shown in Figure 3-11 to the left side of the wiring box. (see Figure 3-14)

Tool required: No.2 Phillips head screwdriver, torque value of 1.6N.m (14.2in-lbs)



Standard wirebox

Figure 3-14 Attach the Cover to the left side of the Wiring Box

(7) Optional - Install an anti-theft padlock when the installation is complete. The anti-theft padlock is used to prevent the inverter from being stolen when the equipment is installed outdoors. The inverter may be locked to the bracket, as shown in Figure 3-15:

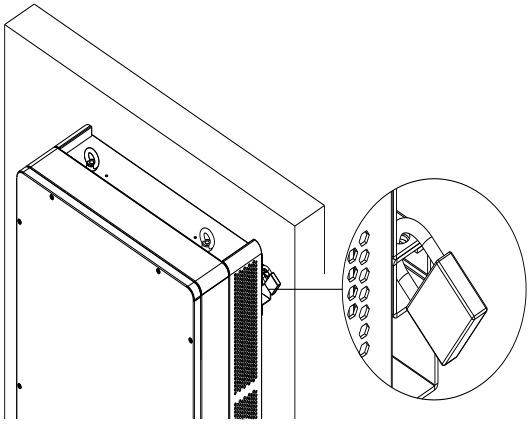
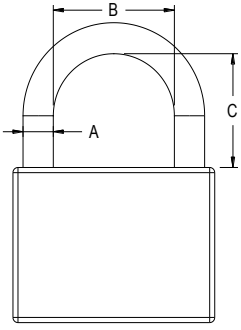


Figure 3-15 Location of the Anti-Theft Padlock

The anti-theft padlock shackle should meet the requirements of the dimensions shown in Figure 3-16:



Recommended lock size:

A: Shackle diameter 3~6mm

B: Shackle width 20~50mm

C: Shackle height 20~50mm

Figure 3-16 Dimensions of Anti-Theft Padlock Shackle

3.3 Electrical Installation

3.3.1 Removing/Replacing the Wiring Box Cover:

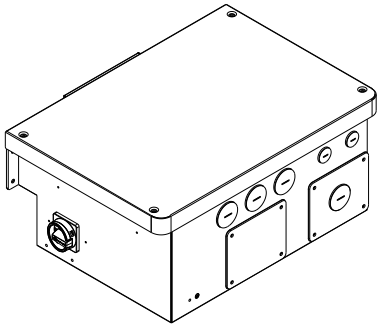


Figure 3.17 (a) Standard wirebox

(1) Use a No.3 Philips head screwdriver to remove the 4 screws on the wiring box and remove the cover. (See Figure 3-18)

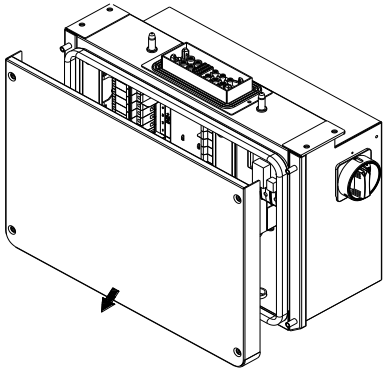


Figure 3-18 Removing the Wiring Box Cover

(2) To replace the cover, install the cover and align the screws. Use a No.3 Philips head screwdriver to secure the 4 screws on the cover.

INSTRUCTION:

It is important to use hand tools (e.g. Screwdriver or T-handle, #3 Phillips) and not power drivers or other types of screw drivers. During cover installation, it is recommended to hold the cover in alignment with balanced force. Partially engage the screws into the threaded inserts before tightening. Maintain alignment to avoid thread damage, and after screws are fully engaged torque to 35.4 in-lbs (4N.m).

3.3.1.1 Bypass Terminal option for standard wirebox

Fuse Bypass Terminals are available as an optional accessory when external PV string fused combiners are used. The Bypass Terminals allow for larger single conductors to be terminated at each MPPT within the wirebox, bypassing the input fuses as shown in Figure 3-19.

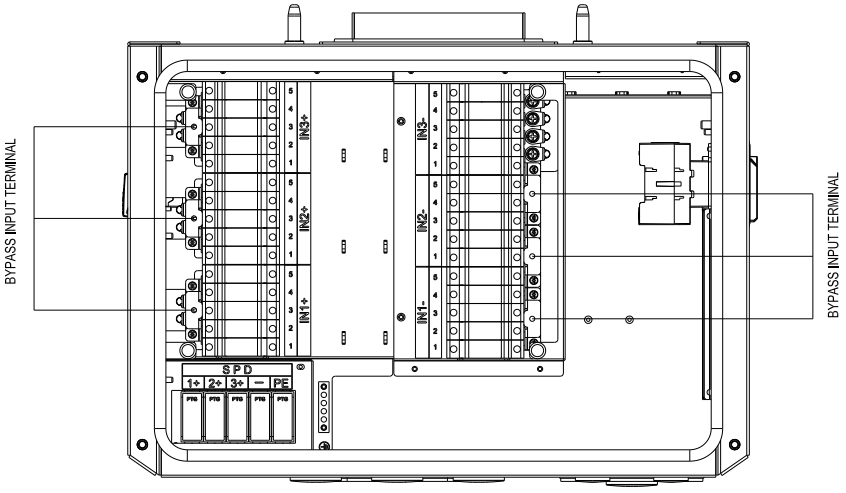


Figure 3-19 Bypass Terminal option installed within the Standard wirebox

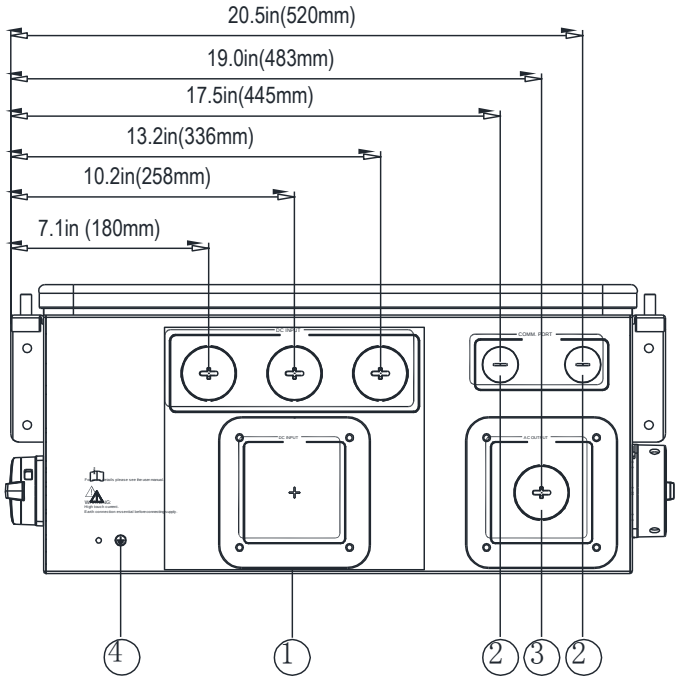


Figure 3-20(a) Conduit Knock-out Locations on the Standard wirebox

① Knock-outs for DC input, 1-1/2 inch Trade Size with removable gland plate for custom size conduit (i.e. when use of 2 inch or 2-1/2 inch Trade Size conduit is required) .

② Knock-outs for communication, 3/4 inch Trade Size

③ Knock-out for AC output, 1-1/2 inch Trade Size with removable gland plate for custom size conduit (i.e. when use of 2 inch or 2-1/2 inch Trade Size is required)

④ External ground connection point

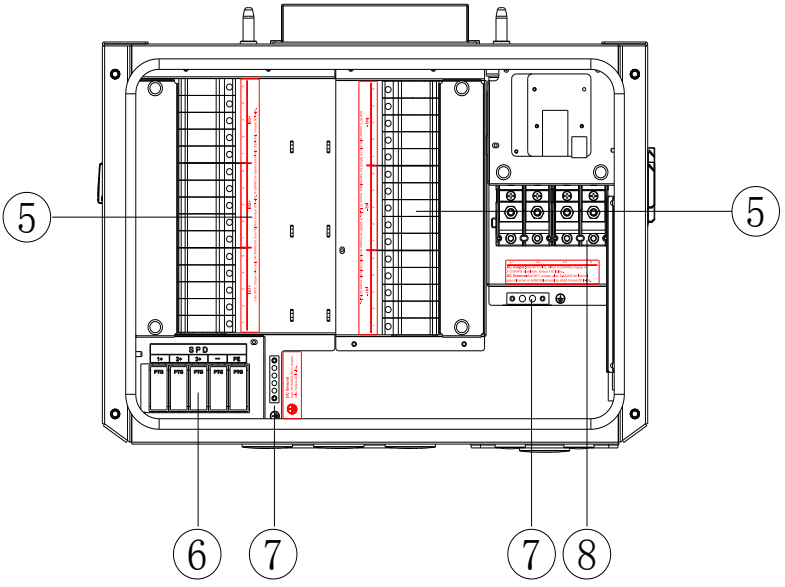


Figure 3-21(a) Internal Connection Points within the Standard wirebox

⑤ DC Input fuse holder/terminal

⑥ DC SPD (Surge Protective Device)

⑦ Internal ground terminal

⑧ AC output terminal block

When using the Standard wirebox, choose the DC conductor size and material for the inverters according to the following configuration table:

Table 3-3 DC Cable Specifications

Terminal	Cable
DC input (+ / -)	#14-6AWG (Copper only) when terminating to the fuse holders #6~2AWG (Copper or Aluminum) when using the Bypass Terminal kit

The CSI-50KTL-CT and CSI-60KTL-CT inverters operate with ungrounded

arrays, although the PV system requires a DC EGC (equipment grounding conductor) to ensure operational safety.

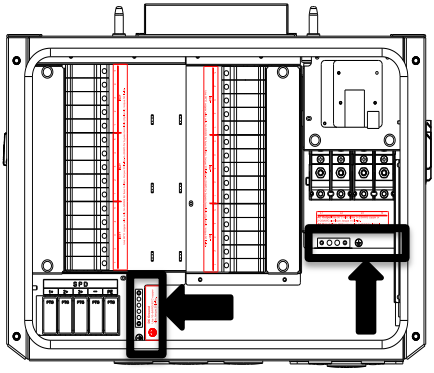


Figure 3-22(a) Internal Grounding Points within the Standard wirebox

3.3.2 DC Connection

1) Working mode

The CSI-50KTL-CT and CSI-60KTL-CT inverters include three MPPTs that are electrically divided into separate PV input zones: PV Input-1, PV Input-2, and PV Input-3. Each 5 string PV input zone operates as a separate and independent MPP Tracker. Each MPPT employs a method known as perturb and observe for seeking and tracking the maximum power point along the I/V curve of the PV array. During operation each MPPT will make small adjustments to the PV voltage and then executes a power measurement; if the PV power increases, further voltage adjustments in that same direction are performed until the PV power no longer increases.

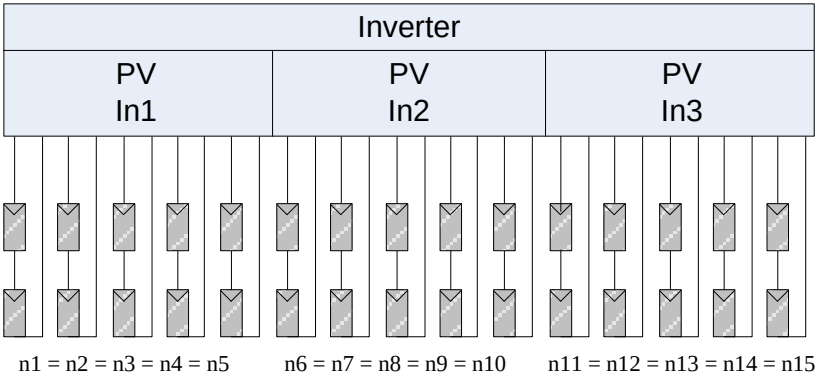


Figure 3-23 Independent Mode

Table 3-4 DC Input Specifications

Specification	**(Independent - per MPPT)**	
Model	CSI-50KTL-CT	CSI-60KTL-CT
Max PV Power	25kW	30kW
Max PV Voltage	1000Vdc	1000Vdc
Start-up Voltage / Power	330 / 80W	330 / 80W
Operating Voltage	200-950Vdc	200-950Vdc
MPPT Voltage Range	480-850Vdc	540-850Vdc
Max Operating Current	32A	38A
Maximum PV Current (Isc x 1.25)	60A	60A

INSTRUCTION:

When designing and configuring the PV system ensure each PV string within a single PV input zone includes the same module type (Mfg and ratings), series module count, and module orientation (tilt and azmuth) in order to maximize MPPT performance and energy harvest.

2) DC fuse configuration

The CSI-50KTL-CT and CSI-60KTL-CT inverter wireboxes include touchsafe fuseholders and 15A DC fuses as a factory standard. Ensure that the appropriate fuse values are used depending on the configuration of PV string and by performing PV fuse sizing calculations for each string.

1） Each DC input for the PV strings requires fuse protection.

2） The voltage rating of the fuse must be at least 1000Vdc.

3） The ampere rating of the fuse is generally selected as $\geq$ 1.56 × Isc of the PV string.

3) DC fuse selection

Verify and select the appropriate fuses for installation depending on the configuration of the PV strings.

Table 3-5 DC Fuse selection

50-60 kW	Brand	Standard fuses	20A	25A	30A
	Littelfuse	SPF015	SPF020	SPF025	SPF030
		15A/1000V	20A/1000V	25A/1000V	30A/1000V

INSTRUCTION:

The 1000VDC Littelfuse KLKD fuse series are recommended as replacement fuses if neccessary. Detailed fuse information is available at http://www.littelfuse.com/.

The touchsafe fuse holders and wirebox internal factory wiring are designed to accept either a 20A, 25A, or 30A rated fuse for combined input strings if needed. CSI allows replacement of the factory installed 15A fuses with appropriate ampere ratings, however CSI does not provide nor stock these fuses.

When using either 25A or 30A fuses, the fuses should not be installed in adjacent fuse holders.

NOTICE:

Use of different fuses or incorrectly sized fuses can cause damage to equipment or create unsafe working conditions. Any damage resulting from incompatible fuses is not covered by the CSI warranty.

4) DC Cable Connection

To ensure the optimum performance of the inverter, please read the following guidelines before performing any DC connections:

(a) Confirm the DC configuration referring to Table 3-5 and ensure that the maximum open circuit voltage of the PV modules is lower than 1000Vdc under any conditions;

(b) Confirm that the PV strings for each MPPT of the inverter are of the same type and specification before connection. The number, orientation, and tilt of PV strings may differ for different applications.

(c) Configure the external wiring according to the following conditions:

Table 3-6 DC Input Configuration

PV String Inputs	Configuration for each MPPT zone PVIn1, PVIn2, PVIn3	DC Wire Range	Terminal Torque	Connect to:
15	5/5/5	#14-6AWG	30 in-lbs	PV Fuseholder
14	5/5/4	#14-6AWG	30 in-lbs	PV Fuseholder
13	5/4/4	#14-6AWG	30 in-lbs	PV Fuseholder
12	4/4/4	#14-6AWG	30 in-lbs	PV Fuseholder
11	4/4/3	#14-6AWG	30 in-lbs	PV Fuseholder *
10	4/3/3	#14-6AWG	30 in-lbs	PV Fuseholder *
9	3/3/3	#14-6AWG	30 in-lbs	PV Fuseholder *
8	3/3/2	#14-6AWG	30 in-lbs	PV Fuseholder *
7	3/2/2	#14-6AWG	30 in-lbs	PV Fuseholder *
6	2/2/2	#14-6AWG	30 in-lbs	PV Fuseholder *
5	2/2/1	Mixed**	Mixed**	Mixed**
4	2/1/1	Mixed**	Mixed**	Mixed**
3	1/1/1	#6~2 AWG	50 in-lbs	Bypass terminals
2	1/1/0	#6~2 AWG	50 in-lbs	Bypass terminals
1	1/0/0	#6~2 AWG	50 in-lbs	Bypass terminals

*Note that the provided fuse is 15A, your string combination may require a larger rated fuse. Always verify the I_{sc} rating of the input prior to connecting to the fuse holder.

**Mixed input signifies a combination of fuse holder connections and fuse bypass terminal utilization. Such combinations are very rare, but possible.

NOTICE:

Note 1: The temperature rating of the input wiring should be no less than 90°C (194°F).

Note 2: The recommended fuse values are configured based on the condition that the input strings are the same (module type and length).

(d) Ensure correct polarity of the PV Strings before terminating the DC cables. Referring to Figure 3-24, the wiring from the PV string pairs must be checked according to the following steps:

i. Use a multi-meter to measure the PV strings' cable ends and check the polarity.

ii. The positive (+) terminal of cable should match the positive (+) terminal of inverter's DC input.

iii. The negative (-) terminal of cable should match the negative (-) terminal of inverter's DC input.

NOTICE:

It is important to use a multi-meter to check the polarity of the DC input cables to avoid any risk of reverse polarity.

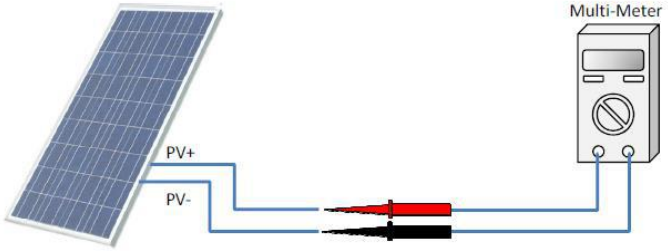


Figure 3-24 Polarity Check

3.3.2.1 DC connection for Standard wirebox

(a) Remove the factory installed liquid-tight hole plugs from the DC knockout holes in the wiring box, and install 1-1/2 inch Trade Size conduit and conduit fittings Ensure all fittings are properly tightened, and route the DC cables through the conduit into the wiring box.

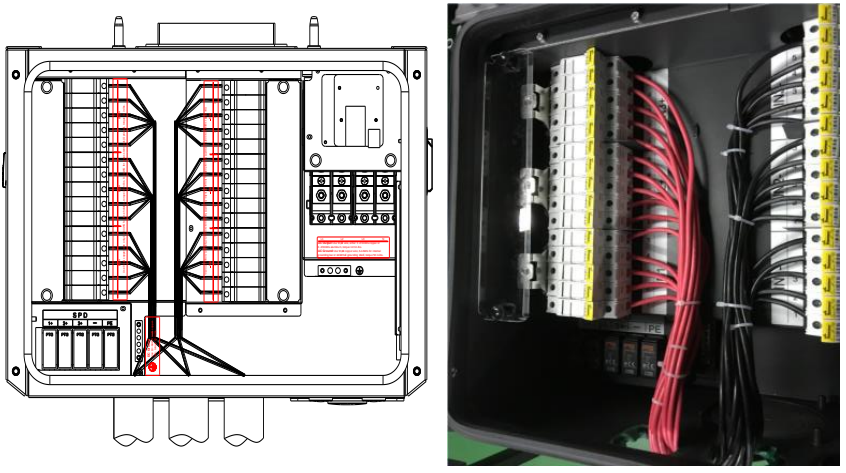


Figure 3-25 DC Input Cable Connection of Standard wirebox

(b): Terminate the DC cables from the PV string pairs to the fuse holders for each MPPT (PVIn1, PVIn2, PVIn3). Installation and proper crimp of wire ferrules are recommended prior to termination. Tighten the screw clamps, as shown in Figure 3-25.

Note: If you are using the fuse bypass- skip this step

Tools required: #2 Phillips bit, Torque driver, and Ferrule crimp tool.

Torque value: 2.3Nm (20 in-lbs).

(c): Optionally all DC input cables from the PV string pairs may be routed through a single larger knock-out hole inside the wiring box. The wiring box includes removable gland plates that may be drilled or punched for up to 2 -1/2 inch Trade Size conduit. Refer to Fig 3-26.

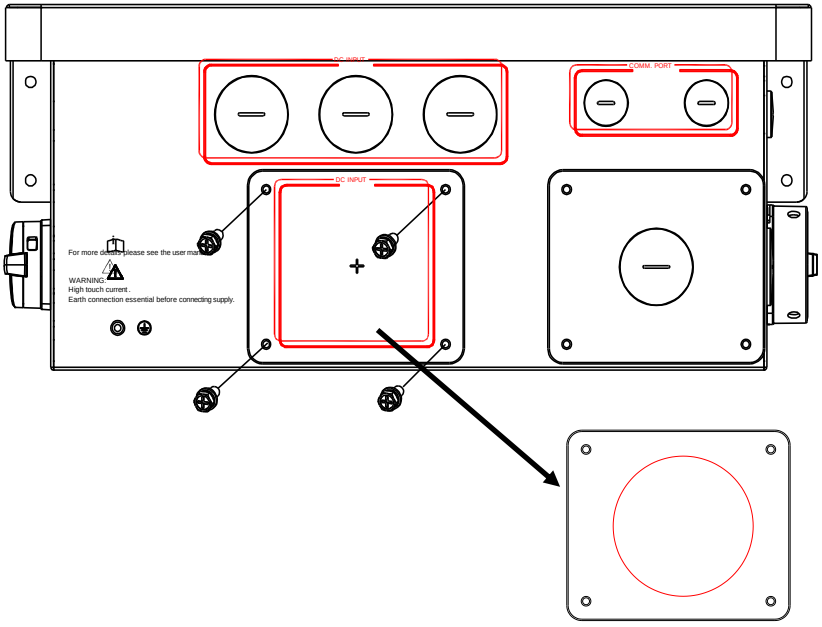


Fig 3-26 DC input through single knockout hole

(1) Remove the **M6x18 screws** (4 pcs) securing the DC gland plate to the wiring box. (see Figure 3-26)

(2) Remove the DC gland plate and rubber gasket

(3) Use a punching tool to create desired hole size in the gland plate.

(4) Reattach the rubber gasket and DC gland plate to the wiring box with the **M6x18 screws** (4 pcs).

(5) Tool required: No.3 Phillips head screwdriver, torque value of 4Nm (35.4in-lbs)

(6) 4) Individual Maximum Power Point Tracking

The inverter is designed with three separate MPP Trackers (MPPT) which operate independently. Independent mode can be very useful for sites with partial shading of the array or with arrays consisting of different tilt or azmuth.

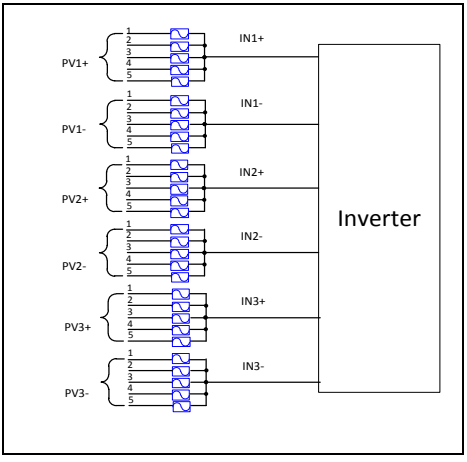


Figure 3-30 Three MPPTs Operating Independently

INSTRUCTION:

The three MPPT zones can be considered as three separate inverters, however PV power should be balanced as much as possible between the three MPPT zones. See Table 3-6 for string/zone combinations.

NOTE 1: Always attempt to connect an equal number of PV source circuits to PVIn1, PVIn2 and PVIn3 in order to optimize the individual MPPT zone as well as total inverter operation and energy harvest.

NOTE 2: Connecting all of the inputs at zone “PVIn1” will result in only utilizing 33% of the inverter power.

3.3.3 AC and Ground Connection

The following describes how to connect the AC and ground cables between the inverter and the AC grid:

1) Remove the liquid-tight hole plug from the AC input of the wiring box and install 1-1/2 inch conduit and conduit fittings into the hole. Then route the cables through the conduit inside the wiring box.
2) The inverter supports 2 kinds of cable connection on the AC side depending on the grounding connection method chosen. The cable set-up procedures are illustrated below.

Table 3-8 Tools Required for Cable termination

No.	Tools	Remark
1	5mm flat screwdriver	Internal grounding bar
2	#3 Phillips head screwdriver	External grounding
3	14mm hex socket wrench	AC terminal block
4	Diagonal pliers	Cut cable
5	Wire stripping pliers	Remove jacket
6	Crimping pliers	Crimp terminal

Table 3-9 Torque value

AC output terminal block	15 N-m （132 in-lbs）
Internal grounding bar	5.65 N-m （50 in-lbs）
Internal grounding stud	5.65 N-m （50 in-lbs）
External grounding point	5.65 N-m （50 in-lbs）

Choose the cables for inverters according to the following configuration table:

Table 3-10 Cables specifications

Position	Cable	
AC output (L1/L2/L3/N)	#3~2/0AWG(Copper) #2~2/0AWG(Aluminum)	#2AWG recommended(Copper) #1AWGrecommended(Aluminum)
Gnd (EGC)	#6~4AWG(Copper)	#6AWG recommended (Copper)

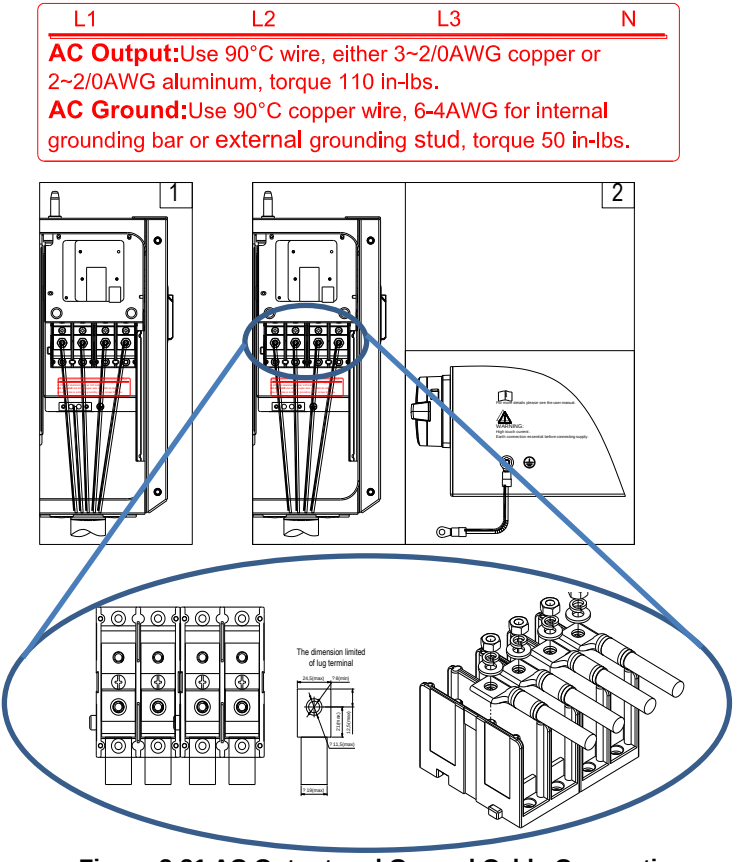


Figure 3-31 AC Output and Ground Cable Connection

Use the OT type terminal to connect the Connect the AC (L1, L2, L3, N) cables to the AC terminal block and connect the PE cable to the internal grounding terminal block. (See the 1st graph in Figure 3-31) Set up the cables referring to Figure 3-32.

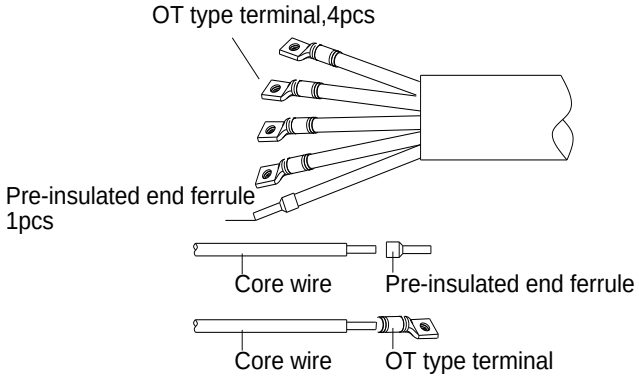


Figure 3-32 AC output and ground cable set up

NOTICE:

Please connect the Ground cable before AC cable.

It is required to use the AL9CU OT type terminal if you chosen the aluminum cable for AC output.

Use the OT type terminal to Connect the AC (L1, L2, L3, N) cables to the terminal block and use the OT type terminal to connect the ground cable to the external grounding point at the bottom of the wiring box. (see the 2nd image in Figure 3-31) The grounding point is located at the bottom of the **Standard wirebox** as shown in Figure 3-34(a).

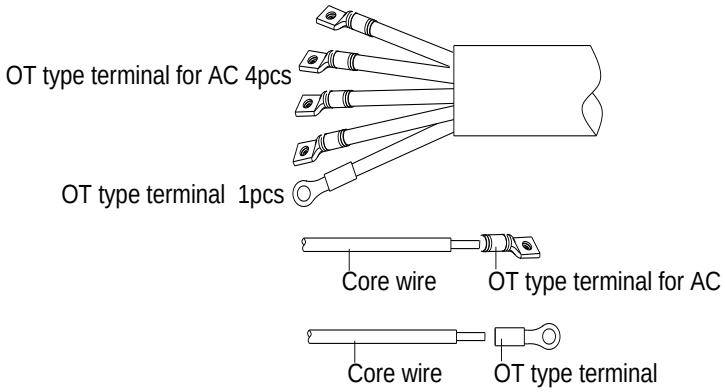


Figure 3-33 AC output and ground cable set up

NOTICE:

Please connect the Ground cable before AC cable.

It is required to use the AL9CU OT type terminal if you chosen the aluminum cable for AC output.

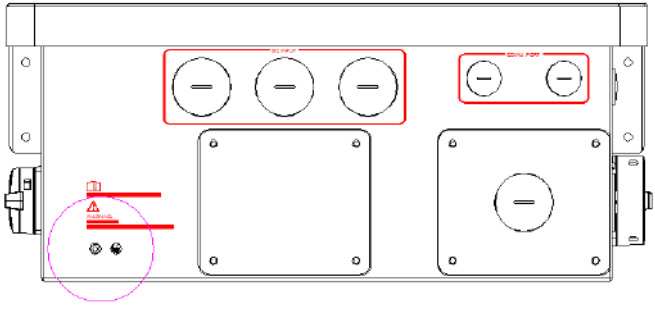


Figure 3-34(a) External Ground point Location of Standard wirebox

(1) Optionally all AC input cables may be routed through a single larger knock-out hole inside the wiring box. The wiring box includes removable gland plates that may be drilled or punched for up to 2 -1/2

inch conduit. Refer to Fig 3-35.

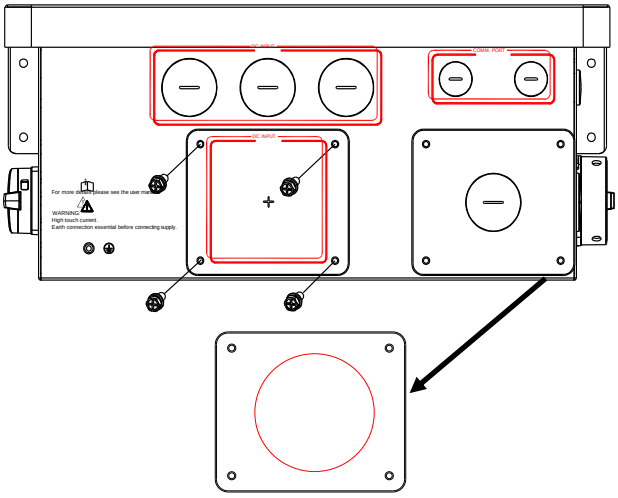


Fig 3-35 AC Input through single knock-out hole

(7) Remove the **M6x18 screws** (4 pcs) securing the AC gland plate to the wiring box. (see Figure 3-35)

(8) Remove the AC gland plate and rubber gasket

(9) Use a punching tool to create desired hole size in the gland plate.

(10) Reattach the rubber gasket and AC gland plate to the wiring box with the **M6x18 screws** (4 pcs). Tool required: No.3 Phillips head screwdriver, torque value of 4N.m (35.4in-lbs)

(11) When the output of the inverter is connected to the grid, an external AC circuit breaker is required to be installed to safely disconnect the inverter from the grid should an overcurrent occur.

(12) The Grid connection type must be a 4-wire Wye, grounded neutral (L1, L2, L3, N, PE).

Either 3 pole or 4 pole AC circuit breaker may be selected as per the following recommendation. Selecting a breaker of another size may either

result in nuisance tripping or rejection from the AHJ.

Table 3-10 Specification of AC breaker selection

Inverter	AC breaker rated current (A)
CSI-50KTL-CT	80
CSI-60KTL-CT	100

Acceptable transformer configurations:

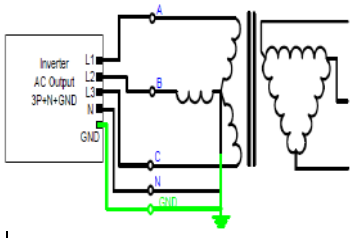
Description	Configuration	Inverter Compatibility
4 Wire WYE (3 phase + Neutral +GND) *Note that there are no restrictions to the connection type on the secondary (grid side) transformer winding.*		Compatible with CSI-50/60KTL-CT
Other Configurations	All other configurations not mentioned in this document, such as Corner Grounded Delta	Not compatible with CSI-50/60KTL-CT

Fig 3-36AC Acceptable Transformer Winding Configurations

When interfacing with a Wye-grounded transformer winding, a neutral is required. Since the neutral is used by the inverter for voltage sensing only, the neutral does not carry current. The size of the neutral may be reduced to a conductor no smaller than the EGC or 8 AWG.

When installing multiple inverters for parallel operation connected to a single

transformer winding, the kVA rating of the transformer must be at least 125% of the total connected inverters 'combined kVA rating. Up to 70 inverters may be connected in parallel for use with a single transformer.

Note: If aluminum conductors are being used CSI recommends the following steps to prepare each conductor prior to landing and terminating to the AC terminal block:

a) Strip the outer insulating jacket from the conductor and use care so as not to nick any of the strands.
b) Using a utility knife, gently strip the top layer of the aluminum conductors

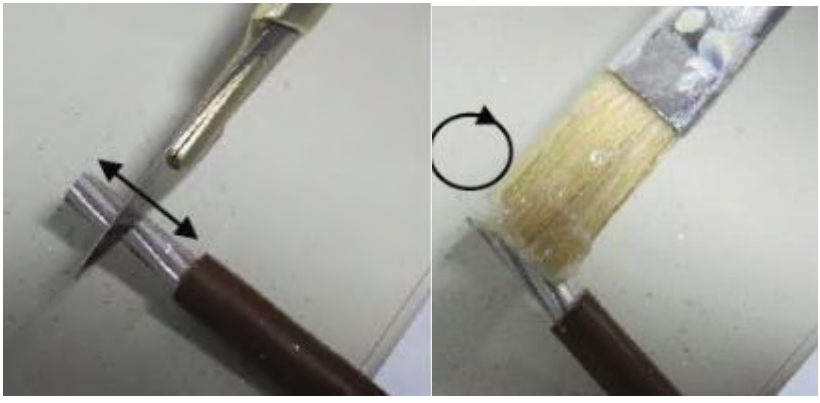


Figure 3-37 Preparing Aluminum Conductors prior to connecting

c) After removing the oxidized layer immediately apply neutral grease (Noalox or an acid- and alkali-free Vaseline) and connect the cable immediately to the terminal. Perform these steps on one cable at a time. If the process is stopped or delayed before applying the grease, and continue later- the conductor must be scraped again. It takes roughly 30-60 seconds for an oxidized layer to form on top of the conductors.

3.3.4 Communication Connection

CSI-50KTL-CT and CSI-60KTL-CT inverters support industry standard Modbus RS485 communication.

1. Communication board description

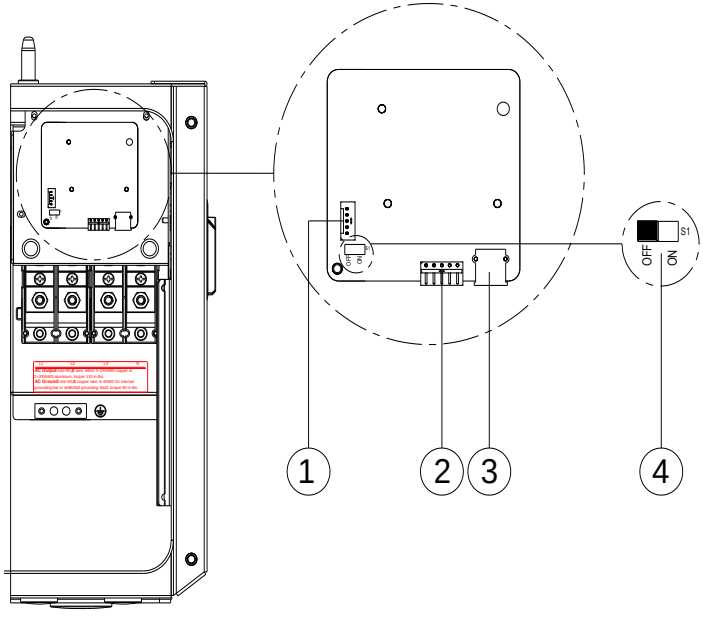
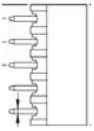
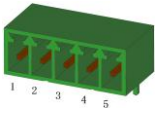


Figure 3-38(a) Communication Board of Standard wirebox

Table 3-10 Communication Connection Interfaces

Item	Picture	Configuration description
① RS485 (Debug only)		1 -----12V+ 2 -----12VGND 3 -----RS485+ 4 -----RS485- 5 -----COM
② RS485 port (5pin connector)		1 -----12V+ 2 -----12VGND 3 -----RS485+ 4 -----RS485- 5 -----COM
③ USB port S200		Firmware upgrade via USB disk
④ Selector switch for setting the 120Ω terminal resistor of the RS485 communication S1		1-----Enable the termination resistance 2-----Disable the termination resistor

② **RS485 communication cable connection:**

Choose the RS485 communication cables according to the following table:

Table 3-11 Cables specifications

	Cable
RS485 communication	UTP CAT-5e or 3x#22~18AWG communication cable (e.g. Belden 3106A)

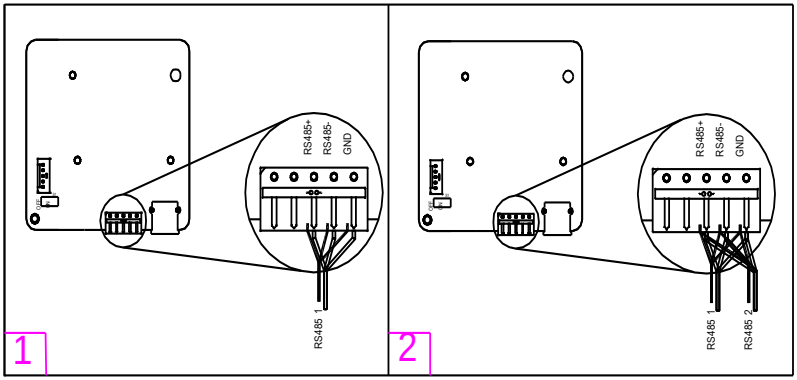


Figure 3-39(a) RS485 Connection of Standard wirebox

1. Cable connection of RS485 communication: 5 pin connector

2. Cable connection of RS485 network communication: 5 pin connector

It is recommended that industrial grade RS485 cable be used in lieu of unshielded twisted pair. Communication cable such as (CAT5) or Belden 3106A cable for RS485 5 pin connector is preferred.

RS485 network connection:

When the inverters are monitored via the RS485 communication, a unique RS485 address for each inverter can be set up through the LCD interface. Up to 32 inverters can be connected together in the RS485 communication network. The daisy-chain topology is recommended for the RS485 network connection, as shown in Figure 3-33. Other communication topologies, such as the star networks, are not recommended.

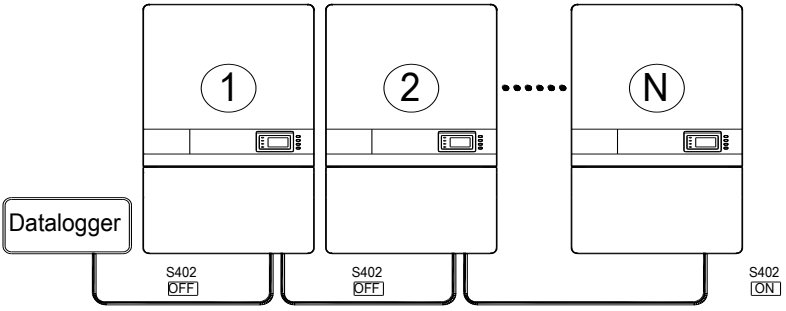


Figure 3-40 RS485 Network Connection

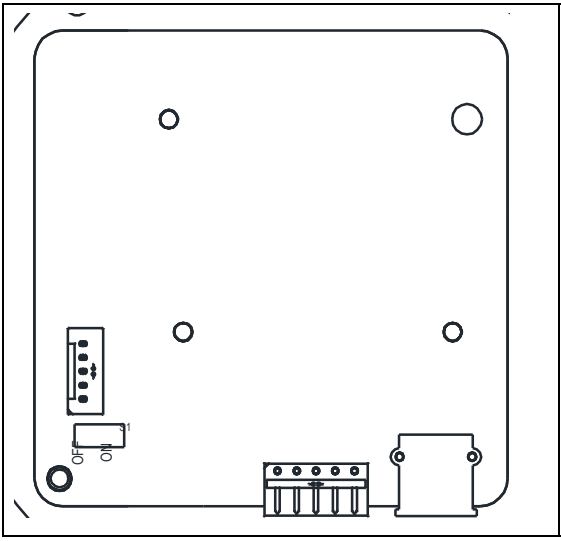
If there are multiple inverters in the RS485 network, the selector switch S1 of the last inverter in the daisy-chain should be in ON position, to have the 120ohm terminal resistor enabled. The selector switch S1 of all other inverters should be in the OFF position to disable the terminal resistor.

It is important to daisy chain the inverter RS485 connections to minimize noise and bus reflections. All RS485 connections must be terminated in a serial fashion and not to exceed 32 in total.

Warning: Risk of Electric Shock.

Make sure all DC and AC power to the unit has been disconnected before opening the inverter wiring box and ensure that hazardous high voltage and power inside the equipment has been discharged. Wait at least 5 minutes before opening the wiring box.

1. Open the inverter wiring box.
2. Bring the communication cables into the wiring box through the provided knockout holes at the bottom.
3. Connect the RS485 wires to the green Phoenix connector ensuring correct polarity and using a shielded twisted pair cable.
4. If the inverter is the **last** Modbus device in the daisy chain, make sure the Modbus termination switch S1 is in the ON position enabling Modbus termination. Do **not** turn the switch to the ON position in any other inverters of the daisy chain.



S1 - Selector switch for the 120Ω RS-485 termination resistor

On - Enable the Modbus (RS-485) bus termination (Applies only for the last inverter in the daisy chain)

Off - Disable the Modbus (RS-485) bus termination. (Factory default)

Figure 3-41. The Modbus (RS485) Termination Switch (S1) Location and Settings on the LCD/Communication Board.

Chapter 4 Commissioning

WARNING:

Please follow the guidelines below before on-grid operation to eliminate possible dangers to ensure safety.

4.1 Commissioning Checklist

4.1.1 Mechanical Installation

Make sure that the mounting bracket is secure and all the screws have been tightened to the specified torque values.

(Please refer to 3.2 Mechanical installation)

4.1.2 Cable Connections

- Make sure that all cables are connected to the right terminals.
- The appropriate cable management is important to avoid physical damage.
- The polarity of DC input cables must be correct and the DC Switch should be in the “OFF” position.

  (Please refer to 3.3 Electrical installation)

4.1.3 Electrical Check

- Make sure that the AC circuit breaker is appropriately sized.
- Test whether the AC voltage is within the normal operating range.
- Make sure the DC open circuit voltage of input strings is less than 1000V.

4.2 Commissioning Steps

Complete the checklist above before commissioning the inverter as follows:

1.) Turn on the AC circuit breaker.

2.) Turn on the DC circuit breaker.

(Skip these two steps if there are no circuit breakers.)

3.) Switch the DC Switch to the “ON” position. When the energy supplied by the PV array is sufficient, the LCD screen of inverter will light up. The inverter will then start up with the message “sys checking”.

When the inverter completes “**sys checking**”, the LCD will show the screen as Figure 4-1 below. Press the ENT key to access the menu for selecting the grid standard, as shown in Figure 4-2.

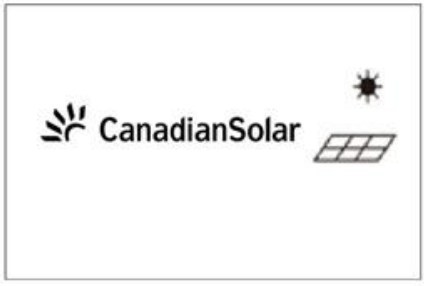


Figure 4-1 System Checking Logo

4.) Set up the grid standard:

INSTRUCTION:

Please check with your local electricity supply company before selecting a grid standard. If the inverter is operated with a wrong grid standard, the electricity supply company may cancel the interconnection agreement.

Placing the inverter into operation before the overall system complies with the national rules and safety regulations of the application is not permitted.

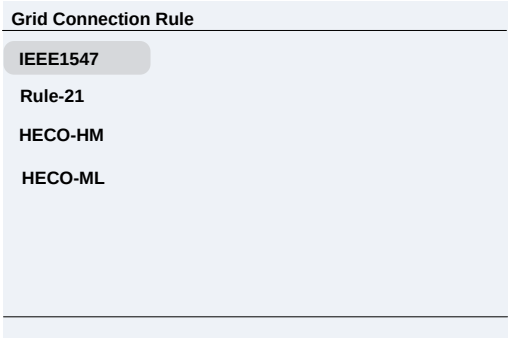


Figure 4-2 Set up Grid Standard

(5) Choose PV Input working mode : The working mode of the DC input connection and MPP Tracker may only be configured for **Independent.**

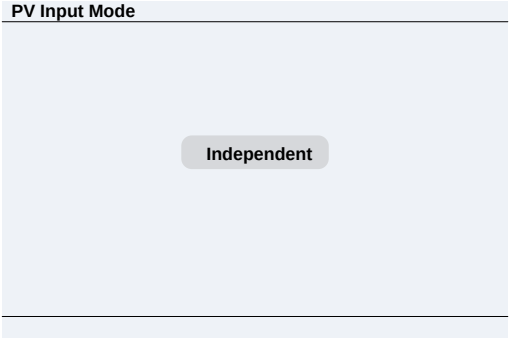


Figure 4-3 Independent mode setting

(6.) Neutral Line Setting : Setting the neutral line connect or not as Figure 4-4:

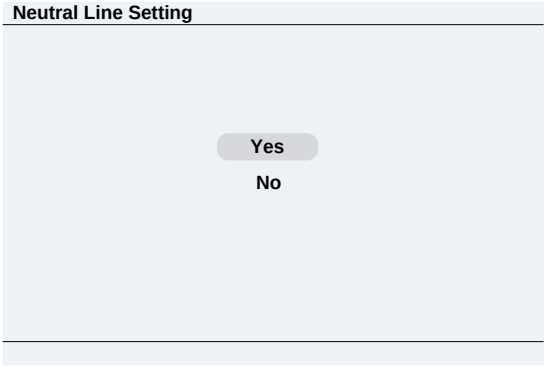


Figure 4-4 Setting the Neutral Line

(7.) Choosing the communication data below to the Figure 4-5:

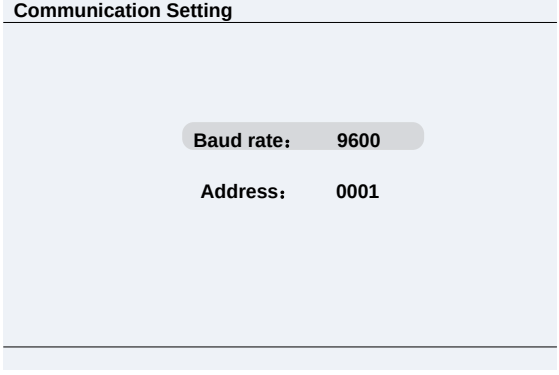


Figure 4-5 Communication Setting

(8.) Time Setting as shown in Figure 4-6:

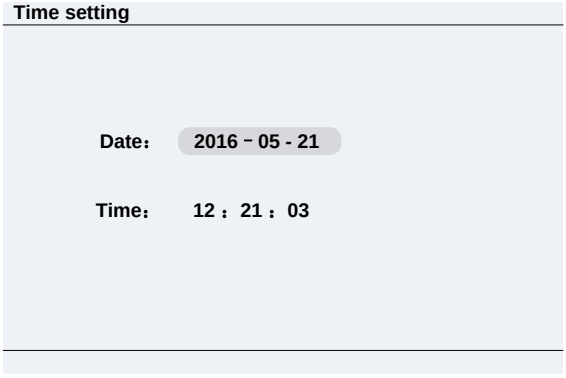


Figure 4-6 Time Setting

(9.) When the LCD screen shows the normal operation status (Figure 4-7) and the “RUN” light on the LED panel is illuminated, this is an indication that the grid connection and power generation are successful.

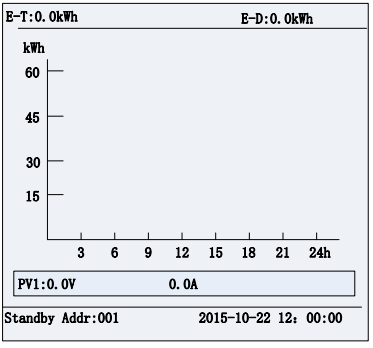


Figure 4-7 Normal Operation Status

REMARK : The Running status cycle displays include: NoErr (Error information), Pdc(kW), Udc(V), Idc(A), Pac(kW) and Q(kvar).

(10.) If the inverter fails to operate normally, the “FAULT” light will illuminate and the fault information will show on the LCD screen as shown in the Figure 4-8.

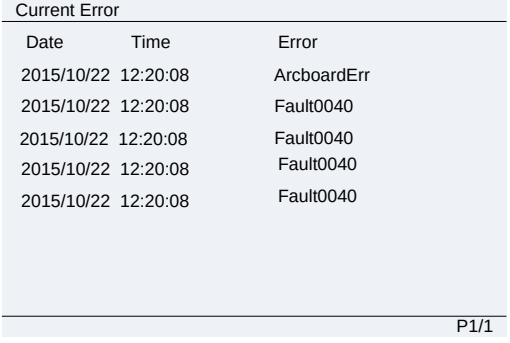


Figure 4-8 Fault Information Interface

Chapter 5 User Interface

5.1 Description of LCD Panel

The inverter's LCD panel consists of the LCD screen, four LED status indicator lights, a buzzer, and four user keys, as shown in Figure 5-1.

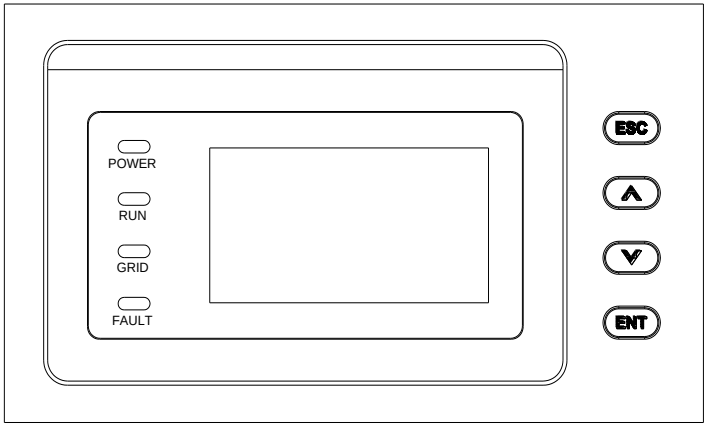


Figure 5-1 LCD Panel

The LCD panel includes a screen-saver function to increase the service life of the display. If there is no user activity or operation (key press) for greater than 1 minute, the display will enter the screen-saving mode in order to protect the screen and prolong the service life.

During normal inverter operation, a key press or any warnings or system faults that may occur will cause the LCD to exit screen-saver mode.

Interpretation for the indicator lights is shown in Table 5-1 and function of the keys is shown in Table 5-2.

Table 5-1 LED Indication

LED light	Name	Status	Indication
POWER	Working power light	Light on	Energized (control panel starts to work)
		Light off	Power supply not working
RUN	Grid-tied operation indication light	Light on	In grid-tied power generation state
		Flash	Derated running status (light up 0.5s, light off 1.6s)
		Light off	In other operation status or power supply not working
GRID	Grid status indication light	Light on	Grid is normal
		Flash	Grid fault (light up 0.5s, light off 1.6s)
		Light off	Power supply not working
FAULT	Fault status indication light	Light on	Indicates a Fault
		Slow flash	Indicates Alarm (light up 0.5s, light off 2s)
		Fast flash	Protective action (light up 0.5s, light off 0.5s)
		Light off	No fault or power supply not working

Table 5-2 Definition of the Keys

Key	Description	Definition of function
	Escape key	Back/end/mute
	Enter key	Confirm entering the menu/confirm set value/Switch to parameter setting mode
	Up	Page up in selection menu/+1 when setting parameters
	Down	Page down in selection menu/-1 when setting parameters

5.2 Operation State

Table 5-1 indicates the definitions of LED, i.e. indicates the information of the inverter's operation state. It indicates that the system is energized and under DSP control when "POWER" lights up.

The "RUN" LED will illuminate when the inverter detects that the grid connection conditions meet the requirements and power is being fed into the grid. The "RUN" LED will blink if the grid is in a de-rated running state while feeding power into the grid.

The "GRID" LED will illuminate when the grid is normal during inverter operation. Otherwise, the "GRID" LED will continue to blink until the grid restores to normal.

The "FAULT" LED will blink quickly as a fault (except grid fault) occurs. The "FAULT" LED will stay illuminated until the fault is eliminated. The LED will blink slowly when an alarm occurs. The "FAULT" LED remains illuminated when an internal fault occurs.

The buzzer will give an alarm if a fault (involving power grid fault) occurs.

5.3 Interface Types

Users can perform the corresponding operations with the 4 function keys according to the indications of the LCD display.

The LCD screen will display different interfaces based on the operation modes of the inverter. There are three operation modes: **Logo** interface mode (as shown in Figure 5-2), **Normal operation** mode as shown in Figure 5-3, and **Fault** mode (as shown in Figure 5-4).

The default indication interface indicates PV voltage, PV current, Grid voltage, instant power, daily generated power and time information under normal operation.

The fault information of the most recent or current fault will be indicated on the LCD screen when the inverter is in fault mode.

(1) The LCD interface starts with the company logo once the system is energized, as shown in Figure 5-2.

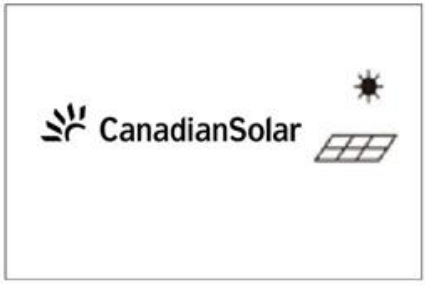


Figure 5-2 LOGO Interface

(2) Indication of inverter operation mode:

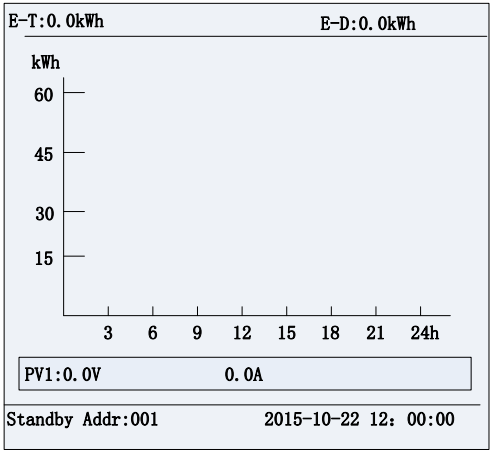


Figure 5-3 Default Display Interface for Normal Operation

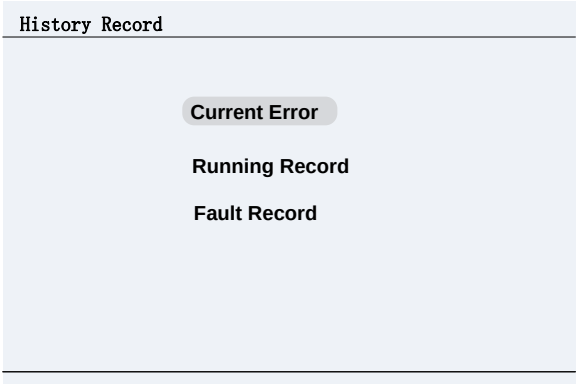


Figure 5-4 History Record Interface

5.4 Main Menu

LCD screen displays “default indication interface” when the inverter is in operation mode. Press **ESC** in this interface to escape the default interface and Press **ENT** to access the main operation interface. The main operation interface is shown in Figure 5-5.

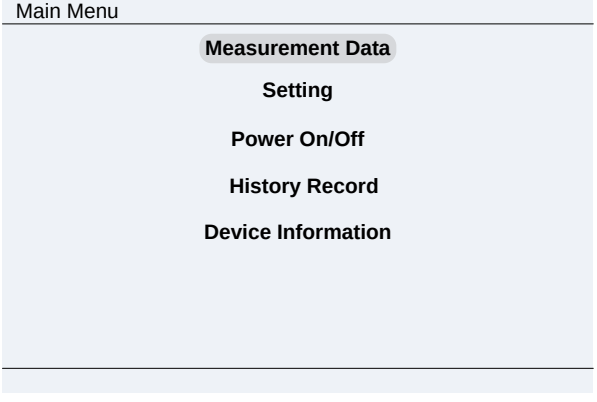


Figure 5-5 Main Menus on the LCD Screen

The main menu of LCD screen has 5 menus, i.e. “1 **Measurement Data**”, “2 **Setting**” , “3 **Power ON/OFF**”, “4 **History Record**”, and “5 **Device Information**”. The users may select options with ⌃ and ⌄, and then press the **ENT** key to confirm the selection. The users can return to the default indication interface by pressing the **ESC** key.

5.4.1 Operation Information

When the cursor moves to "**Measurement Data**" in the main screen, pressing the **ENT** key selects the operation information as shown in Figure 5-8. Check the information by pressing ⌃ and ⌄. Return to the previous menu by pressing the **ESC** key.

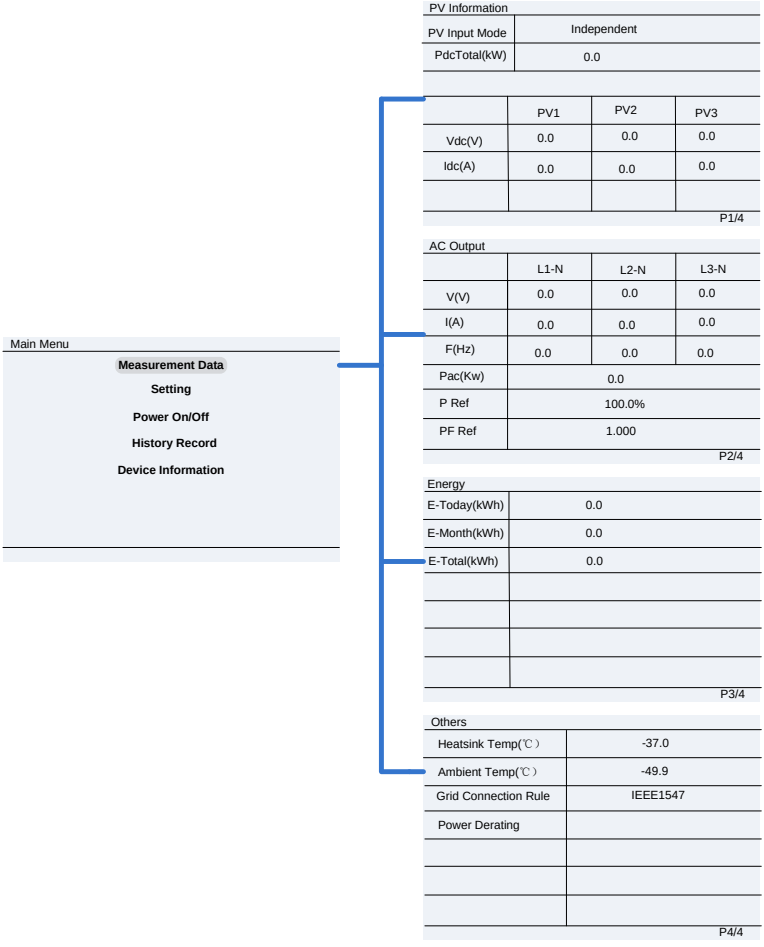


Figure 5-6 Operation Information

5.4.2 Setting

Move the cursor to "**Setting**" in the main interface. Press the **ENT** key to be prompted for the password: "**1111"** as shown in Figure 5-7. Enter the password number by pressing ⌃ and ⌄, selecting the numeral, and pressing the **ENT** key to input and proceed to the next digit of the password number. Once all four digits are entered, press the **ENT** key to confirm the password or Press the **ESC** key to go back to **Setting**.

.

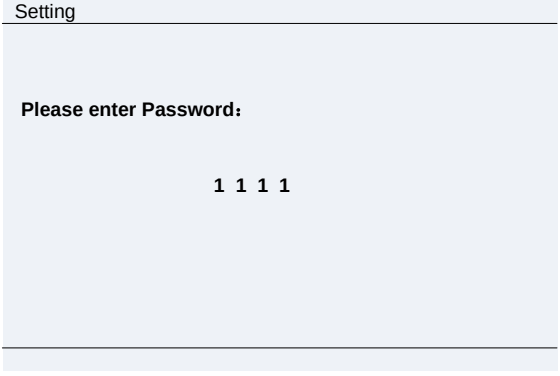


Figure 5-7 Input Password Number

Press **ENT** to confirm, and set the current system parameters, as shown in Figure 5-8. There are 8 submenus in "**Parameters Setting**": "1 **System Parameters**", "2 **Control Command**", "3 **Protection Parameters**", "4 **L/HVRT Setup**","5 **Power Derating Setting**", "6 **Reactive Power Derating Setup**","7 **ARC Parameters**", and "8 **Other Parameters**".

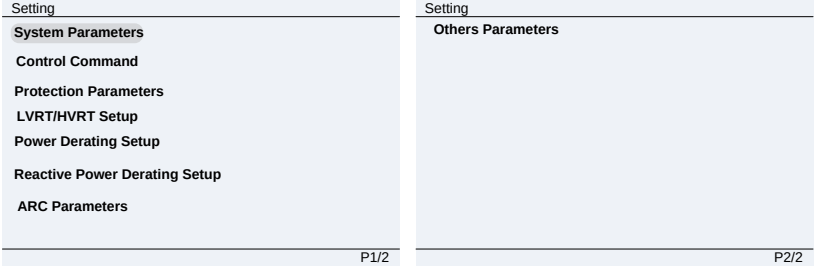


Figure 5-8 System Setup Menu and Submenus Overview

5.4.2.1 System Parameters

(1) "**Language Setting**" Two languages, i.e. Chinese and English are available in " Language" menu.

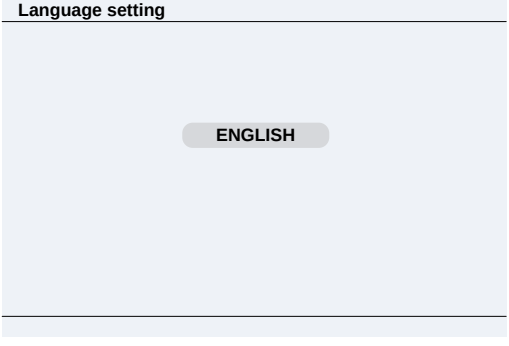


Figure 5-9 Language Setting

(2) “**Grid Rule**”: There are multiple grid standards available. Press ∧ and ∨, and select the corresponding grid standard and press the **ENT** key**.**

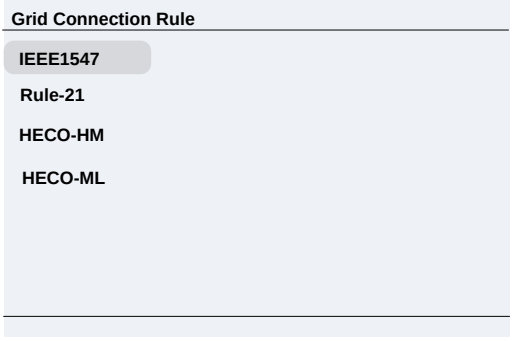


Figure 5-10 Setting Grid Rule

INSTRUCTION:

Please check with your local electricity supply company before selecting a grid standard. If the inverter is operated with a wrong grid standard, the electricity supply company may cancel the interconnection agreement.

Placing the inverter into operation before the overall system complies with the national rules and safety regulations of the application is not permitted..

(3) “**PV Input Mode**”: This allows the user to read the inverter working mode as “**Independent**” mode

(4) “**Neutral Line Setting**”: Check the neutral line be connected or not.

(5) “**Com Setting**”: This interface is used to set the address and baud rate for communication.

(6) “**Time**”: Move the cursor to the “**Time**” menu to set the system time. Press “(∧)” or “(∨)” to select the numerical value, then press **“ENT**” to go to next option. e.g.: Year to Month. Finally Press the **“ENT**” key to confirm the setting.

(7) “**LCD Contrast Setting**”: Setting the LCD contrast grade.

5.4.2.2 “Control Command”

There are 8 submenus in the “**Control Command**” menu:

1 “**Restart**” menu: If a fault shutdown happens, a severe fault may have occurred inside the inverter. The user can perform a force reboot for one time in this menu if the user needs to restart the inverter.

INSTRUCTION:

This function is effective only when the faults “IntFault0010~0150” in the troubleshooting table occur. The inverter may restore to normal operation automatically if alarm or protection faults occur. This function will not respond when the inverter is in operation mode and a “FaultOperated” alarm interface will be indicated.

2 “**Factory Default**” menu: The manufacturer’s parameter default values can be restored when the inverter is not in operation mode. Otherwise “Fault Operated” will be reported.

3 “**Auto Test**” menu is only used by authorized CSI personnel.

4 “**MPPT Scan**” menu: “**MPPTScan**” is used to execute the MPPT scanning manually. Move the cursor to this item, and press the **ENT** key to initiate the scanning. The LCD screen will skip to normal operation interface if the MPPT scanning succeeds, or remain on the “**MPPTScan menu**” interface if the scanning fails.

MPPT scan function is used for multi-MPP tracking, and is useful if the PV panels are partially shadowed or installed with different angles. The factory default setting for "MPPTScan" is set to <**Enabled**, yet can also be set to Disabled. When the MPPT scan function is enabled, the scan period is every 60 minutes. The inverter will scan the maximum power point in the MPPT range, according to the following condition:

While in independent mode (3 MPPTs), the input power must be lower than 75% of the rated power for each MPPT tracker.

Once this MPPT scan function is activated on LCD, it will search the maximum power point at a voltage step of 5V in the MPPT range for full load, and retrieve the maximum power point.

5. “**ARC Detect**” In the “Parameters Setting”→”Control Command” menu, execute the “**ARC Detect**”, the inverter will cease operation and will perform an ARC Detect check.

Arcing check and protection is mainly divided into two parts, the Arcing check board is responsible for whether there is Arcing in line, and transfer Arcing protection signal to the DSP in the dominating control board. The control board DSP is responsible for the control of inverter off the grid after receiving Arcing signal to ensure safety. The Arcing board failure will cause ‘arc board err’ shown on the LCD and it will not connect to the grid until the arc board is OK. If there is Arcing fault, the LCD displays the fault which can only be cleared manually.

6. “**ARC Clear**” is used to clear the ARC fault. Move the cursor to this menu, and press **ENT**. The operation result will appear on the LCD, i.e. “Succeed” or “Failed”.

7. “**PID Check Enable**” is used to enable/disable the PID Check function. Press ENT and use **UP** and **DOWN** to enable/disable the Island PID Check function, and press ENT to confirm the setting.

8. **“CEI Frq Enable”** is used to enable/disable the CEI frequency control function.

5.4.2.3 Protect Parameters

This interface is used to display and set the Protect parameters of the AC grid voltage, frequency and recovery, etc, as shown in Figure 5-10.

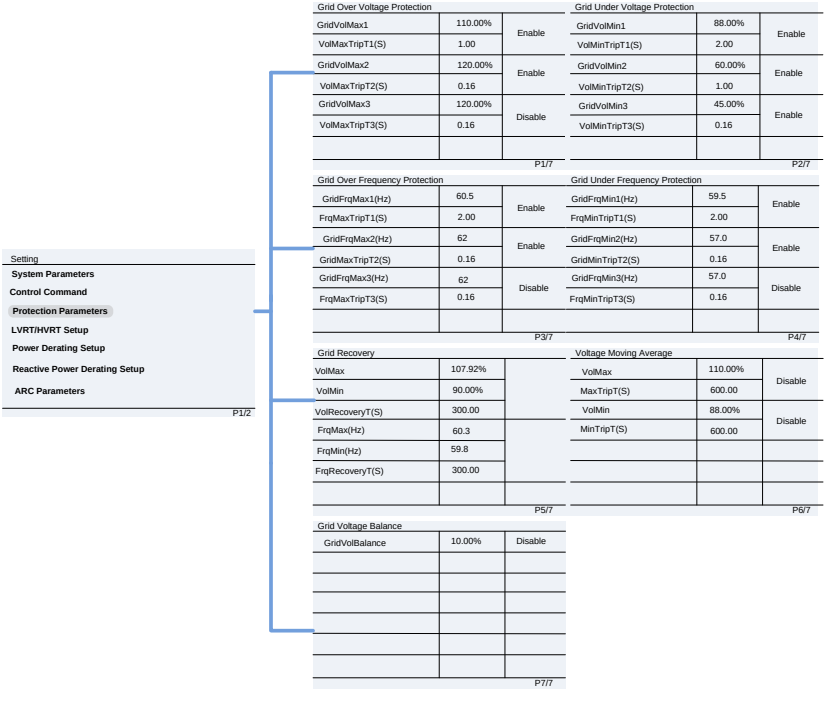


Figure 5-10 Protection Parameters Setting

Navigate to the parameters by pressing ^ and v. Then press **"ENT"** to select it, and change the parameter value by pressing ^ and v then press**"ENT"** to confirm the parameter setting. The LCD will display new parameters if the setting is successful, otherwise the old parameters will display on the LCD.

Table 5-2 The Protection Parameters (IEEE1547)

Grid Over Voltage Protection		
Parameter name	Description	Setup range (lower limit, default & upper limit)
GridVoltMax1	Threshold value of Level 1 Max. grid voltage	{100.00%, 110.00%, 135.00%}
VoltMaxTripTime1(S)	Threshold value of Level 1 Max. grid trip voltage	{0, 1.00, 655}
GridVoltMax2	Threshold value of Level 2 Max. grid voltage	{100.00%, 120.00%, 135.00%}
VoltMaxTripTime2(S)	Threshold value of Level 2 Max. grid trip voltage	{0, 0.16, 655}
GridVoltMax3	Threshold value of Level 3 Max. grid voltage	{100.00%, 120.00%, 135.00%}
VoltMaxTripTime3(S)	Threshold value of Level 3 Max. grid trip voltage	{0, 0.16, 655}

Table 5-2 The Protection Parameters (IEEE1547) cont'd

Grid Low Voltage Protection		
Parameter name	Description	Setup range (lower limit, default & upper limit)
GridVoltMin1	Threshold value of Level 1 Min. grid voltage	{30.00%, 88.00%, 100.00%}
VoltMinTripTime1(S)	Threshold value of Level 1 Min. grid trip voltage	{0, 2.0, 655}
GridVoltMin2	Threshold value of Level 2 Min. grid voltage	{30.00%, 60.00%, 100.00%}
VoltMinTripTime2(S)	Threshold value of Level 2 Min. grid trip voltage	{0, 0.16, 655}
GridVoltMin3	Threshold value of Level 3 Min. grid voltage	{30.00%, 45.00%, 100.00%}
VoltMinTripTime3(S)	Threshold value of Level 3 Min. grid trip voltage	{0, 1.2, 655}

Table 5-2 The Protection Parameters (IEEE1547) cont'd

Grid Low Frequency Protection		
Parameter name	Description	Setup range (lower limit, default & upper limit)
GridFrqMin1	Protection threshold value of Level 1 Min. grid frequency	{90.00%, 99.17%, 100.00%}
FrqMinTripT1(S）	Trip time of Level 1 Min. grid frequency	{0, 2, 655}
GridFrqMin2	Protection threshold value of Level 2 Min. grid frequency	{90.00%, 95.00%, 100.00%}
FrqMinTripT2(S）	Trip time of Level 2 Min. grid frequency	{0, 0.16, 655}
GridFrqMin3	Protection threshold value of Level 3 Min. grid frequency	{90.00%, 95.00%, 100.00%}
FrqMinTripT3(S）	Trip time of Level 3 Min. grid frequency	{0, 0.16, 655}

Table 5-2 The Protection Parameters (IEEE1547) cont'd

Grid Over Frequency Protection		
Parameter name	Description	Setup range (lower limit, default & upper limit)
GridFrqMax1	Protection threshold value of Level 1 Max. grid frequency	{100.00%, 100.83%, 110.00%}
FrqMaxTripT1(S)	Trip time of Level 1 Max. grid frequency	{0, 2, 655}
GridFrqMax2	Protection threshold value of Level 2 Max. grid frequency	{100.00%, 103.33%, 110.00%}
FrqMaxTripT2(S)	Trip time of Level 2 Max. grid frequency	{0, 0.16, 655}
GridFrqMax3	Protection threshold value of Level 3 Max. grid frequency	{100.00%, 103.33%, 110.00%}
FrqMaxTripT3(S)	Trip time of Level 3 Max. grid frequency	{0, 0.16, 655}

Table 5-2 The Protection Parameters (IEEE1547) cont'd

Grid Recovery		
Parameter name	Description	Setup range (lower limit, default & upper limit)
VolMax(V)	Recovery Maxthresholdgrid voltage protection	{80.00%, 107.92%, 135.00%}
VolMin(V)	Recovery Min threshold. grid voltage protection	{20.00%, 90.08%, 100.00%}
VolRecoveryT(S)	Recovery time of grid voltage protection	{0, 300, 655}
FrqMax(Hz)	Recovery Max thresholdgrid Frequency protection	{90.00%, 100.50%, 110.00%}
FrqMin(Hz)	Recovery Min threshold. grid Frequency protection	{80.00%, 99.67%, 100.00%}
FrqRecoveryT(S)	Recovery time of grid frequency protection	{0, 300, 655}
Grid Voltage Balance		
Parameter name	Description	Setup range (lower limit, default & upper limit)
GridVolBalance	Threshold value of grid voltage unbalance	(0.01%,2.6%,10%)

5.4.2.4 “L/HVRT Parameters”

“L/HVRT” is used to set the LVRT and HVRT parameters. Move the cursor to this item, and press the **ENT** key to set the parameters. Setting the parameters as shown in Figure 5-11. The LVRT curve as shown in Figure 5-12 and HRVT curve as shown in 5-13.

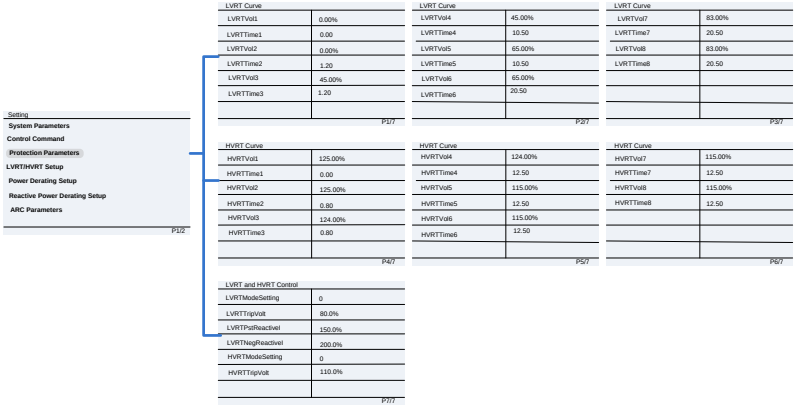


Figure 5-11 L/HRVT Parameters Setting

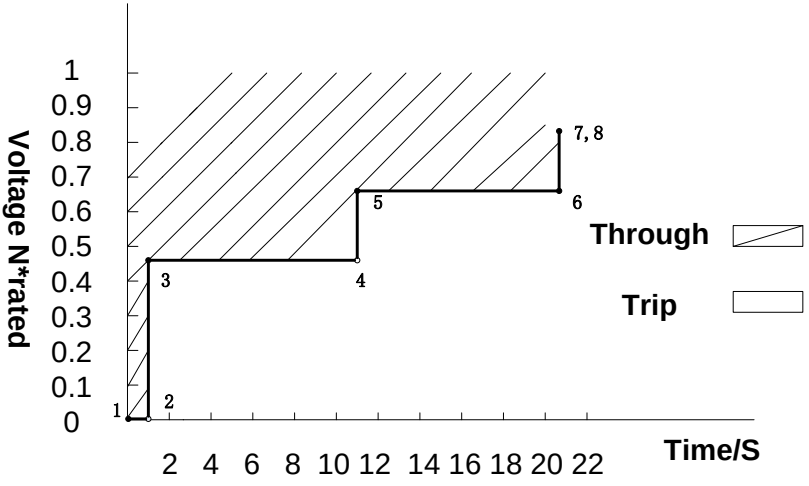


Figure 5-12 The LVRT Curve

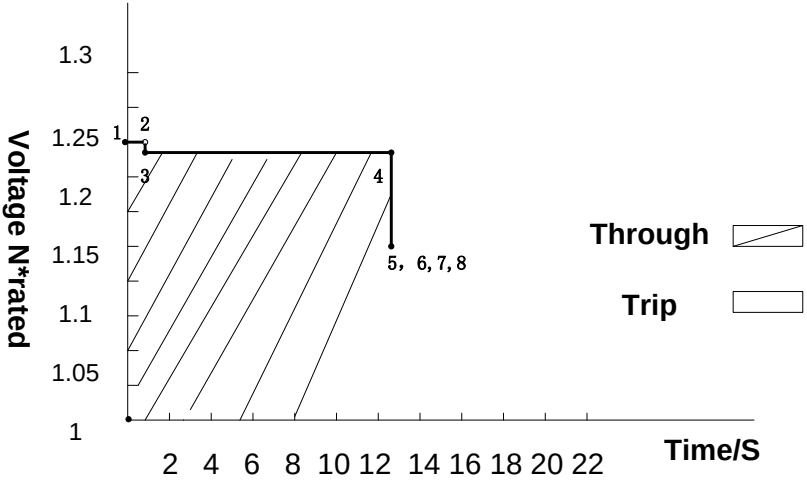


Figure 5-13 The HVRT Curve

Table 5-3 LVRT and HVRT Parameters

LVRT		
Parameter name	Description	Setup range (lower limit, default & upper limit)
LVRTVolt (1,2)	Threshold value of Low voltage ride through(first or second point)	{0%, 0%, 100%} {0%, 0%, 100%}
LVRTTime(1,2)	Time of Level Low voltage ride through(first or second point)	{0, 0, 655} {0, 1.2, 655}
LVRTVolt (3,4)	Threshold value of Low voltage ride through(third or fourth point)	{0%, 45%, 100%} {0%, 45%, 100%}
LVRTTime(3,4)	Time of Level Low voltage ride through(third or fourth point)	{0,1.2, 655} {0, 10.5, 655}
LVRTVolt (5,6)	Threshold value of Low voltage ride through(fifth or sixth point)	{0%, 65%, 100%} {0%, 65%, 100%}
LVRTTime(5,6)	Time of Level Low voltage ride through(fifth or sixth point))	{0, 10.5, 655} {0, 20.5, 655}
LVRTVolt (7,8)	Threshold value of Low voltage ride through(seventh or eighth point)	{0%, 83%, 100%} {0%, 83%, 100%}
LVRTTime(7,8)	Time of Level Low voltage ride through(seventh or eighth point)	{0, 20.5, 655} {0, 20.5, 655}

HVRT		
HVRTVolt(1,2)	Threshold value of high voltage ride through(first or second point)	{100%, 125%, 135%} {100%, 125%, 135%}
HVRTTime (1,2)	Time of Level high voltage ride through(t first or second point)	{0, 0, 655} {0, 0.8, 655}
HVRTVolt(3,4)	Threshold value of high voltage ride through(third or fourth point)	{100%, 124%, 135%} {100%, 124%, 135%}
HVRTTime (3,4)	Time of Level high voltage ride through(third or fourth point)	{0, 0.8, 655} {0, 12.5, 655}
HVRTVolt (5,6)	Threshold value of high voltage ride through(fifth or sixth point)	{100%, 115%, 135%} {100%, 115%, 135%}
HVRTTime(5,6)	Time of Level high voltage ride through(fifth or sixth point))	{0, 12.5, 655} {0, 12.5, 655}
HVRTVolt (7,8)	Threshold value of high voltage ride through(seventh or eighth point)	{100%, 115%, 135%} {100%, 115%, 135%}
HVRTTime(7,8)	Time of Level high voltage ride through(seventh or eighth point)	{0, 12.5, 655} {0, 12.5, 655}

LHVRT Control		
LVRTTripVol	Threshold value of LOW voltage trip	(70.0%,80.0%,100.0%)
LVRTPstReactive1	ThefactorLVRT Positive Reactive Current	(0.0%,150.0%,300.0%)
LVRTNegReactive1	The factor LVRT Negative Reactive Current	(70.0%,200.0%,100%)
HVRTTripVol	Threshold value of HIGH voltage trip	(100.0%,110.0%,135.0%)

5.4.2.5“Power Derating Setup”

“Power Derating Setup” menu is used to set the active power derating parameters including Active Power Derating, Over frequency derating, Low frequency derating and High temperature frequency derating, etc. The parameters are shown in Table 5-3.

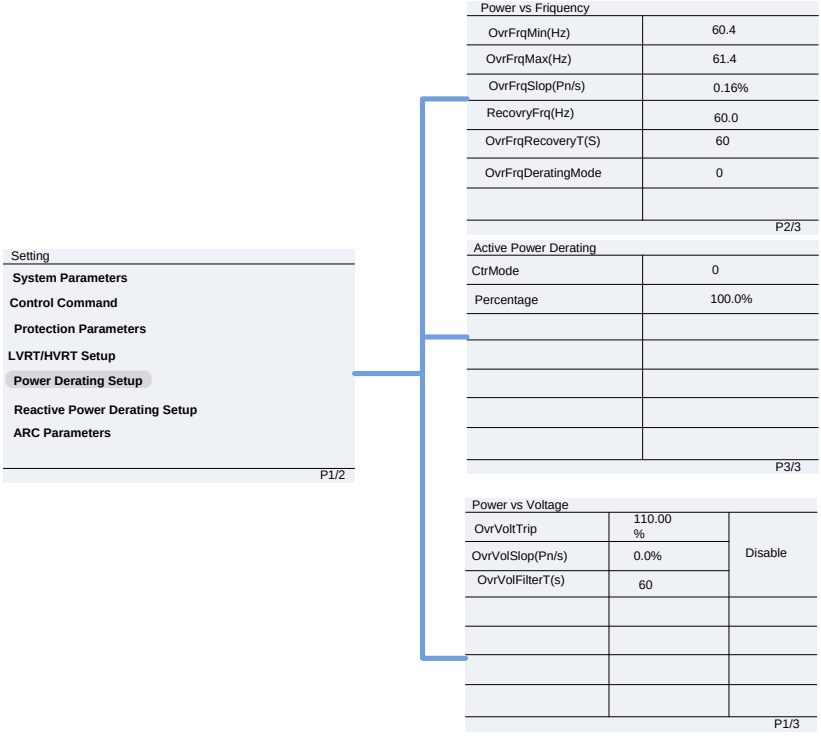


Figure 5-14 Power Derating Setup

Table 5-3 Power Derating Setup

Voltage-Watt Over		
Parameter name	Description	Setup range (lower limit, default & upper limit)
OvrVoltTrip	Threshold value of grid over voltage derating	{100%,110%,135%}
OvrVoltRecovery	Threshold value of grid over voltage derating recovery	{100%,100.5%,110%}
OvrVoltSlop	Slop of grid over voltage derating	{0,0,1}
OvrVoltFilterT(s)	Recovery time of grid over voltage derating	{1,60,90}

Table 5-3 Power Derating Setup cont'd

Grid Over Frequency Derating		
Parameter name	Description	Setup range (lower limit, default & upper limit)
OvrFrqMin(Hz)	Min Threshold value of grid over Frequencyderatingstarted	{60,60.2,72}
OvrFrqMax(Hz)	Max Threshold value of grid over Frequencyderating over	{60,61.4,72}
OvrFrqSlop	Slop of grid over Frequencyderating	{0,0.16%,1}
RecoveryFrq(Hz)	Recovery value of grid over Frequencyderating	{58.8,60,66}
OvrFrqRecoveryT(s)	Recovery time of grid over Frequencyderating	{0,60,655}

5.4.2.5 “Reactive Parameters”

“Reactive Power Derating Parameters” menu is used to set the Grid reactive power derating parameters including PF parameters and Qu parameters, etc. The parameters as shown in Table 5-4

Note: The PF and Q value can be adjusted by remote software if the “Remote” is selected.

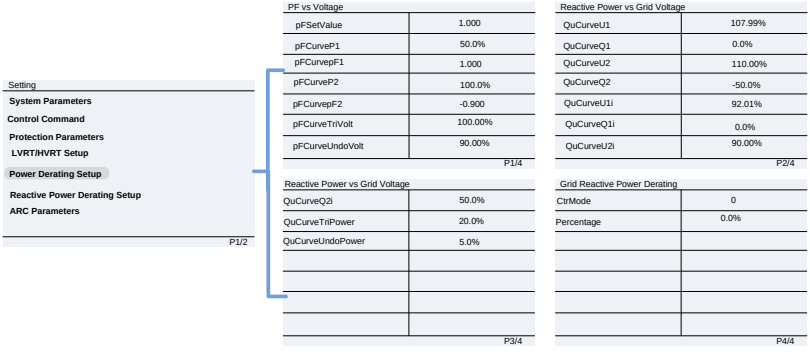


Figure 5-15 Reactive Derating Setting

(1). PF Set：Set the PF value

Note: Change the reactive power by adjusting the Power Factor

(2). PF(P) Curve：PF curve mode

Note: The power factor changes according to the power change, as shown in Figure 5-16:

INSTRUCTION:

The PF (P) Curve function is only available for IEEE-1547 grid standards.

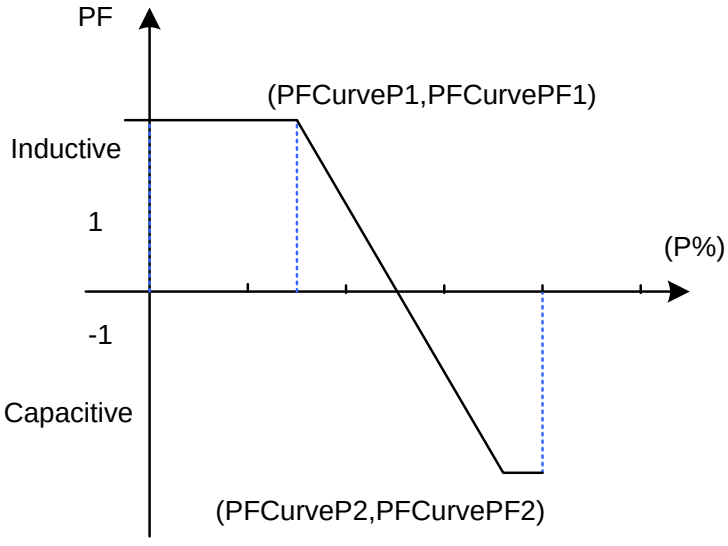


Figure 5-16 PF(P) Curve Mode

(3). Q(U) Curve：Q(U) curve mode

Note: The reactive compensation changes according to the grid voltage change, as shown in Figure 5-17.

INSTRUCTION:

The Q(U) curve function is only available for IEEE-1547 grid standards.

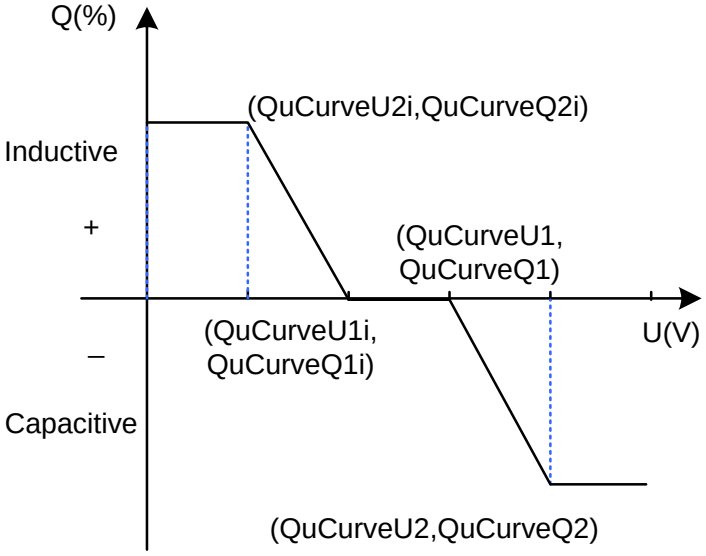


Figure 5-17 Q(U) Curve Mode

Table 5-4 lists the parameters of PF Set, PF(P) Curve and Q(U) Curve modes. Press **ENT** to start up the modes after the parameters are set up.

Table 5-4 Parameters of reactive power control (IEEE-1547)

Grid Reactive Power Derating		
Parameter name	Setup range (lower limit, default & upper limit)	Description
Parameter name	Setup range (lower limit, default & upper limit)	Description
pFSetValue	{-0.8,-1},{1},{0.8,1}	Figure 5-16
pFCurveP1（%）	{0,50%,100%}	Figure 5-16
pFCurvepF1	{-0.8,-1},{1},{0.8,1}	Figure 5-16
pFCurveP2（%）	{0,100%,100%}	Figure 5-16
pFCurvepF2	{-0.8,-1},{-0.9},{0.8,1}	Figure 5-16
pFCurveTriVol(V)	{100%,100%,110%}	PF curve trip voltage
pFCurveUndoVol(V)	{90%,90%,100%}	PF curve revocation voltage
QuCurveU1(V)	{100%,107.99%,110%}	Figure 5-17
QuCurveQ1(%)	{-100%,0,100%}	Figure 5-17
QuCurveU2(V)	{108%,110%,110%}	Figure 5-17
QuCurveQ2	{-100%,50%,100%}	Figure 5-17
QuCurveU1i(V)	{90%,92%,95%}	Figure 5-17
QuCurveQ1i	{-100%,0,100%}	Figure 5-17
QuCurveU2i(V)	{80%,90%,92%}	Figure 5-17
QuCurveQ2i	{-100%,-50%,100%}	Figure 5-17
QuCurveTriPower	{5%,20%,100%}	Qu curve trip power

5.4.2.7“Arc Parameters”

“ARC Parameters” is used to enable/disable the ARC function and set the ARC parameters.

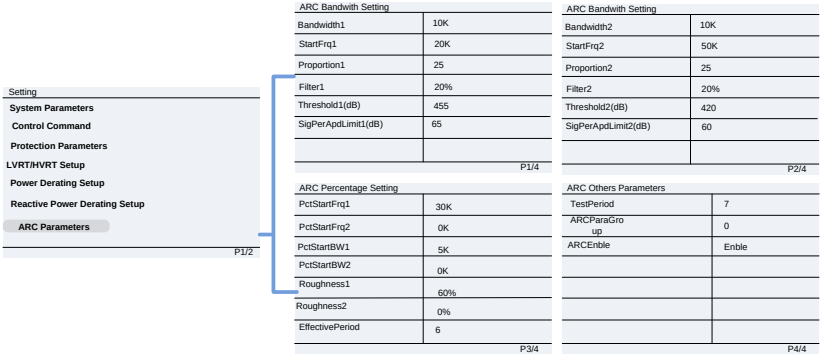


Figure 5-18 Arc Parameters Setting

5.4.2.8“Other Parameters”

“Other Parameters” is used to set the other parameters including MPPT scan period, nominal derating step and GFCI, DCI parameters. Press **ENT** and use **UP** and **DOWN** to set parameters and enable/disable the function, and press ENT to confirm the setting. The parameters as shown in Figure 5-13 and Table 5-5

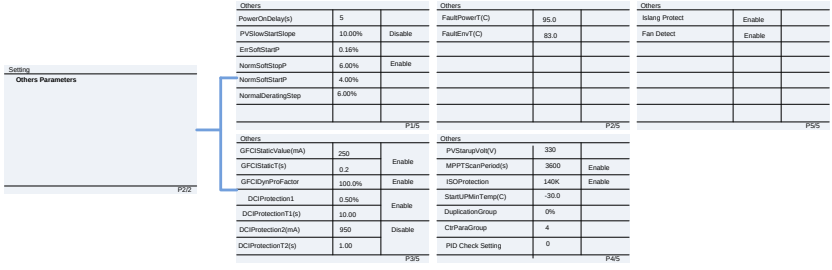


Figure 5-19 Other Parameters Setting

5.4.2.9 “File Export”

“File Export” is used to export the data including “**Running History**” and “**Fault Record**”. Press ENT and use **UP** and **DOWN** to export the data, and press ENT to confirm the setting. The parameters as shown in Figure 5-13.

5.4.2.10 “Firmware update”

“File Export" is to update the versions of firmware include “LCD Firmware” and “DPS Firmware”. Press ENT and use **UP** and **DOWN** to update the data, and press ENT to confirm the setting as shown in Figure 5-13.

5.4.3 Power ON/OFF

Manual Turn ON/OFF: Manual Power ON/OFF is required after regulation setting or manual (fault) shut-down. Press **ESC** or **ENT** to Main Menu, then Press **ENT** and go to submenu “Power ON/OFF”. Then move the cursor to “ON” and press **ENT** to start the inverter, the inverter will start up and operate normally if the start-up condition is met. Otherwise, the inverter will go to stand-by mode.

Normally, it is not necessary to Turn OFF the inverter, but it can be shut down manually if regulation setting or maintenance is required.

Move the cursor from the main operation interface to “Setting”. Press **ENT** and go to submenu “Power ON/OFF”. Move the cursor to “OFF” and press **ENT**, and then the inverter will be shut down.

Automatic Turn ON/OFF: The inverter will start up automatically when the output voltage and power of PV arrays meet the set value, AC power grid is normal, and the ambient temperature is within allowable operating range.

The inverter will be shut down automatically when the output voltage and power of PV modules are lower than the set value, or AC power grid fails; or the ambient temperature exceeds the normal range.

5.4.4 History

Move the cursor to “4 **History**” in the main interface. Press **ENT** to check the history information, as shown in Figure 5-20. There are 2 submenus in the “2 **History**” menu: “**Running History**” and “**Fault Record**”.

(1) The error log can store up 100 running history messages in “**Running History**” menu.

(2) The last record can store up 100 fault record in “**Fault Record**” menu.

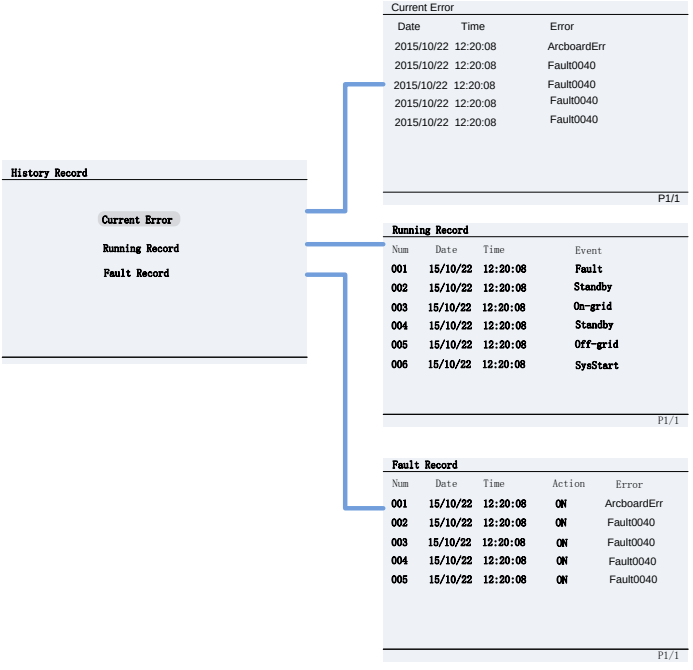


Figure 5-20 History Menu and Submenu

5.4.5 Device Information

Move the cursor from the main operation interface “Main Menu” Press **ENT** and go to submenu “Device Information” and press **ENT** to check the device information as shown in Figure 5-15.

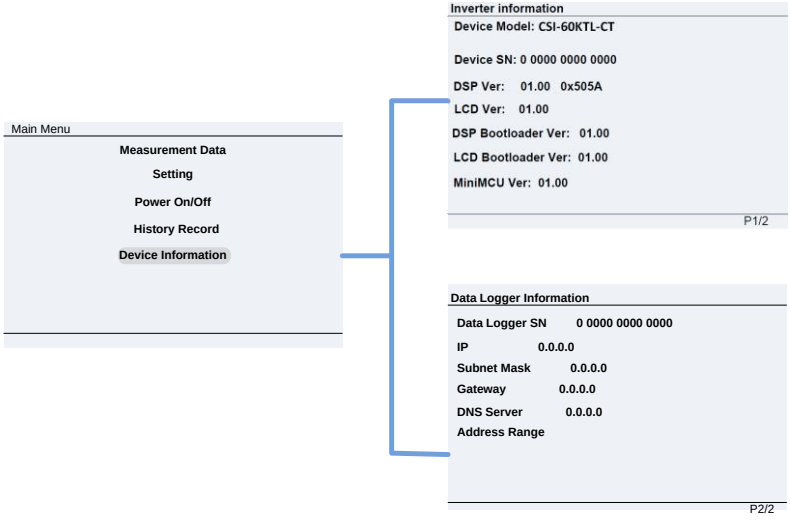


Figure 5-15 Device Information

Chapter 6 Operation

6.1 Start-Up

Manual Turn ON/OFF: Manual Power ON/OFF is required after regulation setting or manual (fault) shut-down. Press **ESC** to Main Menu , then Press **ENT** and go to submenu “Power ON/OFF”. Then move the cursor to “ON” and press **ENT** to start the inverter. Then the inverter will start up and operate normally if the start-up condition is met. Otherwise, the inverter will go to stand-by mode.

Automatic start-up: The inverter will start up automatically when the output voltage and power of PV arrays meet the set value, AC power grid is normal, and the ambient temperature is within allowable operating range.

Normally, it is not necessary to Turn OFF the inverter, but it can be shut down manually if regulation setting or maintenance is required.

6.2 Shut-Down

Manual shutdown: Normally, it is not necessary to shutdown the inverter, but it can be shut down manually if regulation setting or maintenance is required.

Press **ESC** to the Main Menu and move the cursor the submenu “Power ON/OFF” Press **ENT** and Move the cursor to “OFF” and press **ENT**, and then the inverter will be shut down.

Automatic shutdown: The inverter will be shut down automatically when the output voltage and power of PV modules are lower than the set value, or AC power grid fails; or the ambient temperature exceeds the normal range.

6.3 Operation Mode

There are 4 operation modes. The following are corresponding indications for each mode.

(1) System check and Logo mode for start up, as shown in Figure 6-1:

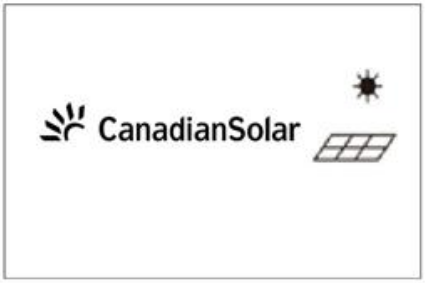


Figure 6-1 System Self Check Ongoing

This mode indicates that the inverter is checking whether it is ready for normal operation after the manual start-up of inverter.

(2) Normal operation mode: Default indication interface for normal operation is shown in Figure 6-2.

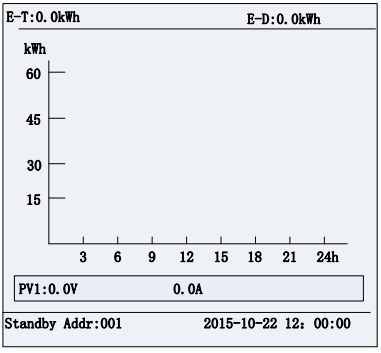


Figure 6-2 Default Indication Interface for Normal Operation

In Normal Operation mode, the inverter converts the power generated by PV modules to AC continuously and feeds into the power grid.

(3) Standby mode, as shown in Figure 6-3:

The inverter will enter standby mode when the output voltage and power of PV modules do not meet the startup conditions or PV voltage and input power are lower than the set value. The inverter will check automatically whether it meets the startup conditions in this mode until it turns back to normal mode. The inverter will switch from standby mode to fault mode if a malfunction occurs.

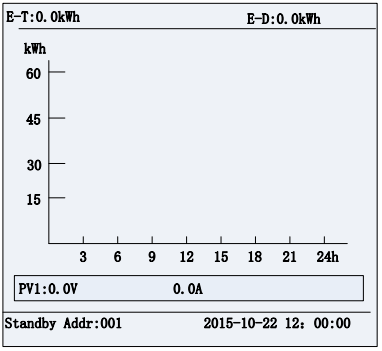


Figure 6-3 Inverter System in Standby Mode

(4) Fault mode, as shown in Figure 6-4:

The inverter will disconnect from the power grid and turn into fault mode when the inverter or power grid fails. Check the specific cause in “Troubleshooting table” (Table 7-2) according to the fault message displayed on the LCD and eliminate the fault referring to the instructions.

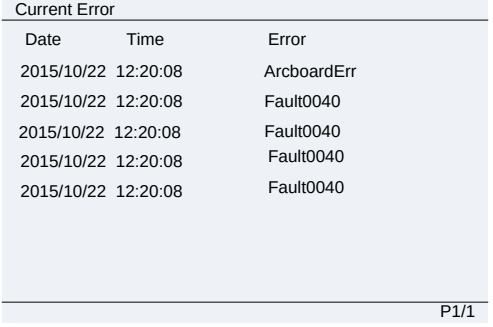


Figure 6-4 Fault Indication Interface

WARNING:

All the installation and wiring connections should be performed by qualified technical personnel. Disconnect the inverter from PV modules and the AC supply before undertaking maintenance.

Do not operate or maintain the inverter until at least 5 minutes after disconnecting all sources of DC and AC.

6.4 Grid-tied Power Generation

The CSI-50KTL-CT and CSI-60KTL-CT series inverters have an automatic grid-tied power generation process. It will check constantly whether AC power grid meets the conditions for grid-tied power generation, and also test whether the PV array has adequate energy. After all conditions are met, the inverter will enter grid-tied power generation mode. While in grid-tied power generation, the inverter can detect the power grid at all times, and also keep the photovoltaic array output in maximum power point tracking (MPPT) mode. In case of any abnormity, the inverter will enter the protection program immediately. In low light conditions when power generation is not enough to keep the inverter in operation, the inverter will enter standby mode. When the voltage of PV array changes and becomes stable and higher than the required start value, the inverter will attempt to start grid-tied power generation again.

Chapter 7 Maintenance and De-installation

7.1 Fault Shutdown and Troubleshooting

7.1.1 LED Fault and Troubleshooting

Please refer to the definition of LED lights in Table 5-1 and troubleshoot according to Table 7-1:

Table 7-1 Troubleshooting of LED Lights

LED fault status	Solutions
Neither the “Power” LED nor the LCD screen lights up.	1. Turn off the external AC breaker 2. Switch the DC switch to “OFF” position 3. Check the PV input voltage and polarity
The “GRID” LED is blinking.	1. Turn off the external AC breaker 2. Switch the DC switch to “OFF” position 3. Check whether the grid voltage is normal and whether the cable connection of AC side is correct and secure
The “RUN” LED lights off or “FAULT” LED lights up.	Refer to Table 7-2 for troubleshooting

7.1.2 LCD Fault and Troubleshooting

The inverter will be shut down automatically if the PV power generation system fails, such as output short circuit, grid overvoltage / undervoltage, grid overfrequency / underfrequency, high environmental temperature or internal malfunction of the machine. The fault information will be displayed on the LCD screen. Please refer to “5.4.2 Present fault” for detailed operation.

The causes of a fault can be identified based on the faults listed in Table 7-2. Proper analysis is recommended before contacting after-sales service. There are 3 types of fault: alarm, protection and hardware fault.

Table 7-2 LCD Troubleshooting

Alarm	1.TempSensorErr	Definition: Prompt detection of abnormal temperature
		Possible causes: 1.Temperature Sensor socket connecter has poor contact; 2.Temperature Sensor is damaged;
		Recommended solutions: 1.Observe temperature display; 2.Switch off 3-phase working power supply and then reboot the system; 3.Contact after-sales service personnel

Table 7-2 LCD Troubleshooting cont'd

Alarm	2.CommErr	Definition: Communication inside inverter fails
		Possible causes: Terminal block connecters of internal communication wires have poor contact
		Recommended solutions: 1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2.Switch off 3-phase working power supply and then reboot the system; 3.Contact after-sales service personnel
	3.ExtFanErr	Definition: Cooling fan failure by visual check
		Possible causes: 1.Fan is blocked; 2.Fan service life has expired; 3. Fan socket connecter has poor contact.
		Recommended solutions: 1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2.Check for foreign objects on fan blades; 3.Switch off 3-phase work power supply and then reboot the system; 4.Contact after-sales service personnel

Table 7-2 LCD Troubleshooting cont'd

Alarm	4.EepromErr	Definition: Internal alarm
		Possible causes: Internal memory has a problem
		Recommended solutions: 1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2.Contact after-sales service personnel
Protection	1.TempOver	Definition: Ambient or internal temperature is too high
		Possible causes: 1.Ambient temperature outside the inverter is too high; 2.Fan is blocked; 3. Convection airflow is insufficient due to improper installation.
		Recommended solutions: 1.Confirm that external ambient temperature is within the specified range of operating temperature; 2.Check whether air inlet is blocked; 3.Check whether fan is blocked; 4.Check whether the location of installation is appropriate or not; 5.Observe for 30 minutes and see whether the alarm will be eliminated automatically; 6.Contact after-sales service personnel

Table 7-2 LCD Troubleshooting cont'd

Protection	2.GridV.OutLim	Definition: Grid voltage exceeds the specified range,
		Possible causes: 1.Grid voltage is abnormal; Power grid breaks down 2.Cable connection between the inverter and the grid is poor;
		Recommended solutions: 1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Check whether the grid voltage is within the specified range; 3.Check whether the cable between the inverter and power grid is disconnected or has any fault; 4.Contact after-sales service personnel

Table 7-2 LCD Troubleshooting cont'd

Protection	3.GridF.OutLim	Definition: Grid voltage frequency is abnormal, or power grid is not detected
		Possible causes: 1.Grid frequency is abnormal; 2.Cable connection between the inverter and the grid is poor;
		Recommended solutions: 1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Check whether the grid frequency is within the specified range; 3.Check whether the cable between the inverter and power grid is disconnected or has any fault; 4.Contact after-sales service personnel
	4.PVVoltOver*	Definition: PV voltage exceeds the specified value
		Possible causes: PV over-voltage
		Recommended solutions: 1.Observe for 30 minutes and see whether the alarm will be eliminated automatically; 2.Check whether PV voltage exceeds the specified range; 3.Turn off the PV input switch, wait for 5 minutes, and then turn on the switch again; 4.Contact after-sales service personnel

Table 7-2 LCD Troubleshooting cont'd

Protection	5.PV1 (2) Reverse**	Definition: PV module is connected inversely
		Possible causes: PV positive pole and negative pole are connected inversely;
		Recommended solutions: 1.Check whether positive pole and negative pole are connected inversely; 2.Contact after-sales service personnel
	6.GFCI.Err	Definition: System leakage current is too high
		Possible causes: 1.Excessive parasitic capacitance on PV module due to environmental factor; 2.Grounding is abnormal; 3. Internal inverter fault
		Recommended solutions: 1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Detect whether the electrical connection is abnormal 3.Contact after-sales service personnel

Table 7-2 LCD Troubleshooting cont'd

Protection	7.IsolationErr	Definition: Insulation impedance of PV positive to ground or PV negative to ground exceeds the specified range
		Possible causes: Air humidity is high
		Recommended solutions: 1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Check insulation of PV system; 3.Contact after-sales service personnel
	8.ARC Protect	Definition: ARC fault
		Possible causes: Protection actions of ARC board
		Recommended solutions: 1. Use “ARCFaultClear” to clear the ARC fault. (Refer to section 5.4.4) 2. Check if there is an arc in PV input or the connection of PV cable is not good. 2. Contact after-sales service personnel

Table 7-2 LCD Troubleshooting cont'd

Protection	9.Arcboard Err	Definition: Arc board error
		Possible causes: Poor contact or damage of Arc board
		Recommended solutions: 1. Check whether the Arc board is in good condition 2. Use “ARCFaultClear” to clear the ARC fault. (Refer to section 5.4.4) 3. Contact after-sales service personnel
	10.IntProtect0010~0620	Definition: Internal protection of the inverter
		Possible causes: Protection procedure occurs inside the inverter
		Recommended solutions: 1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Contact after-sales service personnel

Table 7-2 LCD Troubleshooting cont'd

Fault	IntFault0010~0150	Definition: Internal fault of the inverter
		Possible causes: Fault occurs inside the inverter
		Recommended solutions: 1.The inverter can be forced to restart once if it is required by operation and if it is confirmed that there is no other problem; 2.Contact after-sales service personnel

INSTRUCTION:

The actual display of “PV.VoltOver” is “PV1VoltOver” or “PV2VoltOver”.

The actual display of “PV.Reverse” is “PV1Reverse” or “PV2Reverse”.

DANGER:

Please disconnect the inverter from AC grid and PV modules before opening the equipment. Make sure hazardous high voltage and energy inside the equipment has been discharged.

Do not operate or maintain the inverter until at least 5 minutes after disconnecting all sources of DC and AC.

7.2 Product Maintenance

7.2.1 Check Electrical Connections

Check all the cable connections as a regular maintenance inspection every 6 months or once a year.

1.) Check the cable connections. If loose, please tighten all the cables referring to “3.3 Electrical installation”.

2.) Check for cable damage, especially whether the cable surface is scratched or smooth. Repair or replace the cables if necessary.

7.2.2 Clean the Air Vent Filter

The inverter can become hot during normal operation. It uses built in cooling fans to provide sufficient air flow to help in heat dissipation.

Check the air vent regularly to make sure it is not blocked and clean the vent with soft brush or vacuum cleaner if necessary.

7.2.3 Replace the Cooling Fans

If the internal temperature of the inverter is too high or abnormal noise is heard assuming the air vent is not blocked and is clean, it may be necessary to replace the external fans. Please refer to Figure 7-1 for replacing the cooling fans.

1. Use a No.2 Phillips head screwdriver to take off the 10 screws on the fan tray (6 screws on the upper fan tray, and 4 screws on the lower fan tray).
2. Disconnect the waterproof cable connector from the cooling fan.
3. Use a No.2 Phillips head screwdriver to remove the screws.
4. Attached the new cooling fans on the fan tray, and fasten the cable on the fan tray with cable ties

Torque value: 0.8-1N.m (7.1-8.91in-lbs)

5. Install the assembled fans back to the inverter.

Torque value: 1.2N.m (10.6in-lbs)

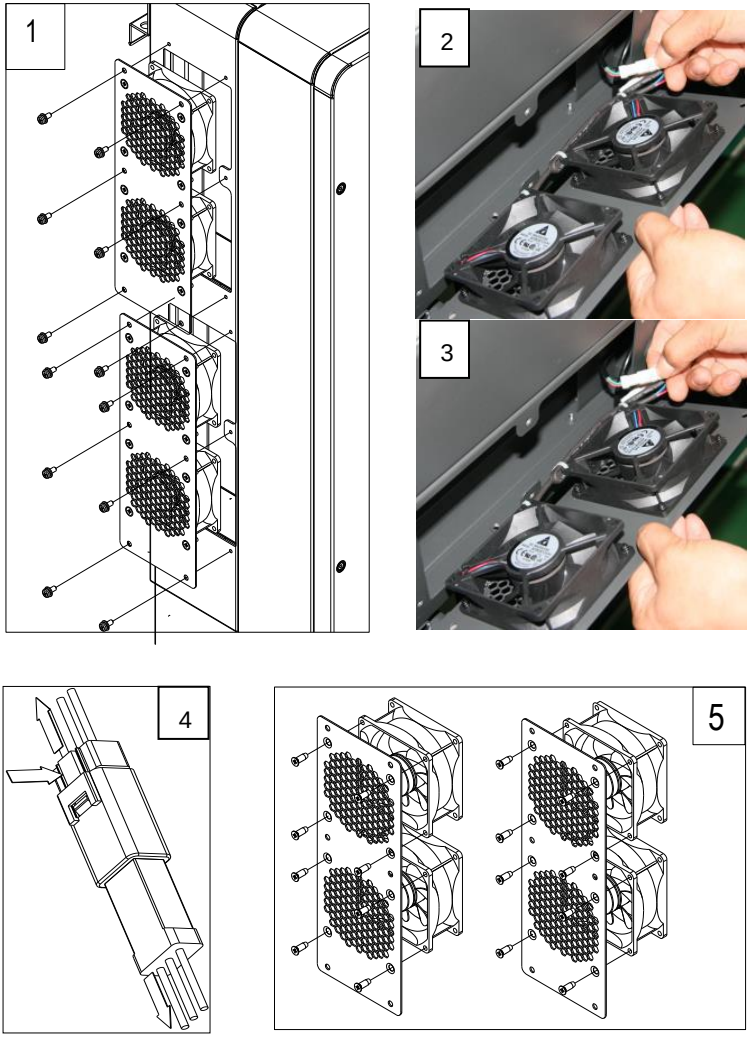


Figure 7-1 Replace cooling fans

7.2.4 Replace the Inverter

Please confirm the following things before replacing the inverter:

(1) The AC breaker of inverter is turned off.

(2) The DC switch of the inverter is turned off..

Then Replace the inverter according to the following steps:

a.) Unlock the padlock if it is installed on the inverter.

Figure 7-2 Unlock the padlock

b.) Use a No.3 Phillips head screwdriver to unscrew the 2 screws on both sides of the inverter.

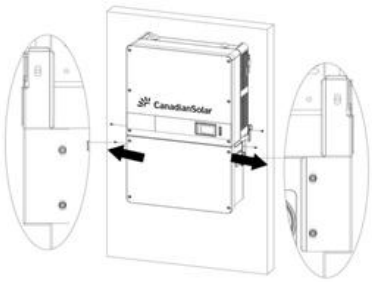


Figure 7-3 Remove the screws on both sides

c.) Use a No. 10 Hex wrench to remove the 4 screws between the main housing and the wiring box. Lift up the main inverter enclosure and disconnect from the wiring box.

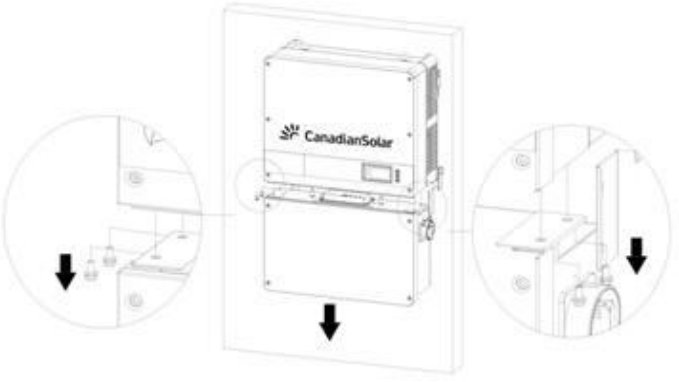


Figure 7-4 Disconnect the main housing from the wiring box

d.) Use a No.2 Phillips head screwdriver to remove the 2 screws on the left side of the wiring box, and take off the cover. Put the cover on the connector of wiring box. Torque value: 1.6N.m (14.2in-lbs)

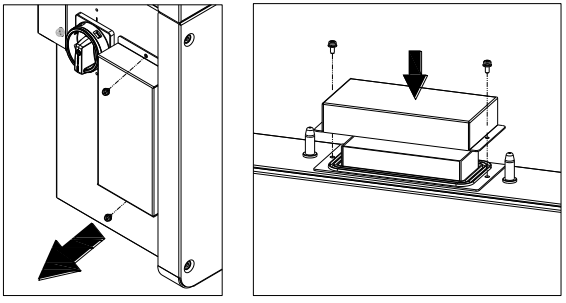


Figure 7-5 Install the cover on the connector of the wiring box

7.3 De-installing the Inverter

De-install the inverter according to the following steps when the service time is due or for other reasons:

DANGER:

Please disconnect the electrical connection in strict accordance with the following steps. Otherwise, the inverter will be damaged and the

service personnel's life will be endangered.

1.) Turn off the AC breaker, and use Padlocks if provided.

2.) Turn off the DC breaker, and use Padlocks if provided.
(Skip the two steps if there are no circuit breakers.)

3.) Switch the AC switch to "OFF" position.

4.) Switch the DC switch to "OFF" position.

5.) Wait for 10 minutes to ensure the internal capacitors have been completely discharged.

6.) Measure the AC output cable terminal voltage against the ground, and make sure the voltage is 0V.

7.) Disconnect the AC and PE cables referring to "3.3.2 AC and ground connection".

8.) Disconnect the DC cables referring to "3.3.1 DC connection".

9.) De-install the inverter using reverse of installation steps referring to "3.2 Mechanical installation"

Chapter 8 Technical Data

Model Name	CSI-50KTL-CT	CSI-60KTL-CT
DC Input		
Max. PV Power	75kW (25kW per MPPT)	90kW (30kW per MPPT)
Nominal DC Input Power	51.5kW	61.5
Max. DC Input Voltage	1000Vdc	
Operating DC Input Voltage Range	200-950Vdc	
Start-up DC Input Voltage / Power	330V / 80W	
Number of MPP Trackers	3	
MPPT Voltage Range	480-850Vdc	540-850Vdc
Operating Current (Imp)	108A (36A per MPPT)	114A (38A per MPPT)
Max.PV Short-Circuit Current (Isc x 1.25)	180A (60A per MPPT)	
Number of DC Inputs	15 inputs, 5 per MPPT	
DC Disconnection Type	Load rated DC switch	
AC Output		
Rated AC Output Power	50kW	60kW
Max. AC Output Power	50kVA	60kVA
Rated Output Voltage	480Vac	
Output Voltage Range[1]	422-528Vac	
Grid Connection Type	3Φ/PE/N	
Nominal AC Output Current @480Vac	62.2A	72.2A
Rated Output Frequency	60Hz	
Output Frequency Range[1]	57-63Hz	
Power Factor	>0.99 (±0.8 adjustable)	
Current THD	<3%	
AC Disconnection Type	Load rated AC switch	

1) The "Output Voltage Range" and "Output Frequency Range" may differ according to the specific grid standard.

System	
Topology	Transformerless
Max. Efficiency	98.8%
CEC Efficiency	98.5%
Stand-by / Night Consumption	<30W / <1W
Environment	
Enclosure Protection Degree	NEMA 4X
Cooling Method	Variable speed cooling fans
Operating Temperature Range	-22°F to +140°F / - 30°C to +60°C (derating from +113°F / +45°C)
Non-Operating Temperature Range[2]	No low temp minimum to +158°F / +70°C maximum
Operating Humidity	0-95%, non-condensing
Operating Altitude	13123.4ft / 4000m (derating from 9842.5ft / 3000m)
Audible Noise Emmision	<60dB @ 1m and 25°C
Display and Communication	
User Interface and Display	LCD + LED
Inverter Monitoring	Modbus RS485 and TCP / IP
Site Level Monitoring	CSI Flex Gateway (1 per 32 inverters)
Modbus Data Mapping	SunSpec / CSI
Remote Diagnostics / FW Upgrade Functions	Standard
Mechanical Data	
Dimensions (WxHxD)	600×1000×260mm
Weight	Inverter:123.5lbs/56kg; Wirebox:33lbs/15kg
Mounting / Installation Angle[3]	0 to 90 degrees from horizontal (vertical, angled, or lay flat)
AC Termination	M8 Stud Type Terminal Block (Wire range: #4 - 2/0AWG CU/AL)
DC Termination	Screw Clamp Fuse Holder (Wire range: #14 - #6AWG CU)
Fused String Inputs (5 per MPPT)	15A standard fuse value (20, 25, 30A acceptable)
Safety	
PV Arc-Fault Circuit Protection	Type 1
Safety and EMC Standard	UL1741-2010, UL1741SA-2016[4], UL1699B, CSA-C22.2 NO.107.1-01, IEEE1547; FCC PART15
Grid Standard and SRD	IEEE1547-2003, Rule 21[4] and HECO/Rule14[4]
Smart-Grid Features[4]	Voltage-RideThru, Frequency-RideThru, Soft-Start, Volt-Var, Frequency-Watt, Volt-Watt

2) See Chapter 3.1 for further requirements regarding non-operating conditions.
3) See Chapter 3.2 for Shade Cover accessory requirement for installation angles of 30 degrees or less.
4) Certification Pending.

Note 1: When the DC input voltage is lower than 480/540V or higher than 850V, the inverter output power (Pn) will begin to derate, as shown in Figure 8-1 and 8-2:

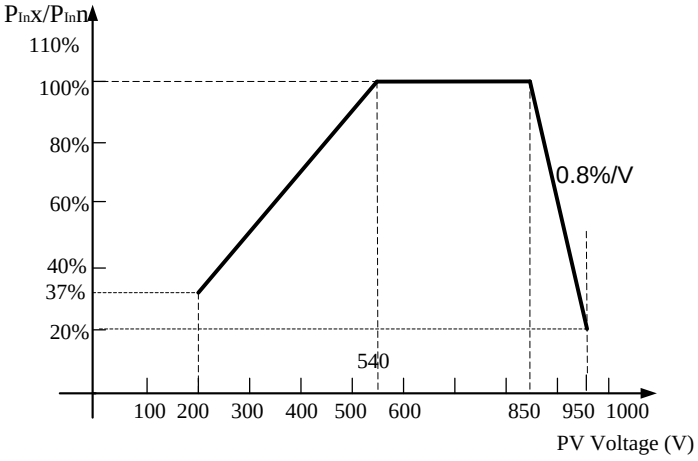


Figure 8-1 CSI-60KTL-CT derating curve of PV input voltage

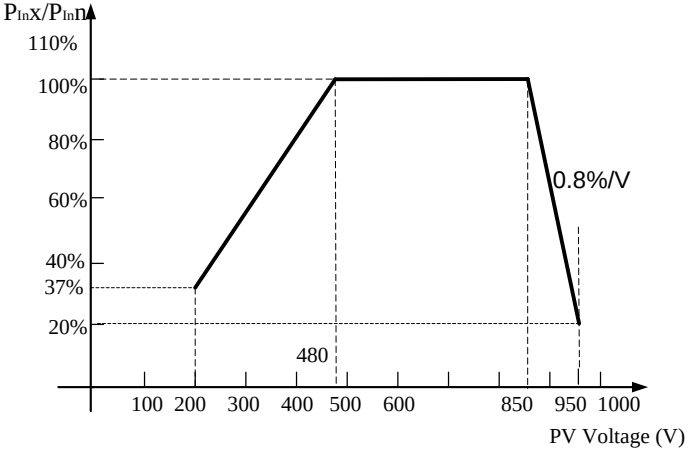


Figure 8-2 CSI-50KTL-CT derating curve of PV input voltage

Note 2: When the ambient temperature is higher than 113℉ (45℃), the inverter output power (Pn) will begin to derate, as shown in Figure 8-3:

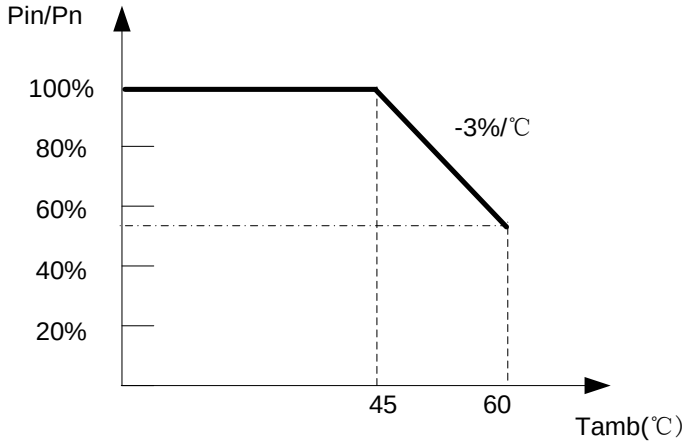


Figure 8-3 CSI-50/60KTL-CT Derating Curve with High Temperature

Note 3: When the altitude is higher than 9842.5ft (3000m), the rated output power (Pn) of the inverter will decrease, as shown in Figure 8-4:

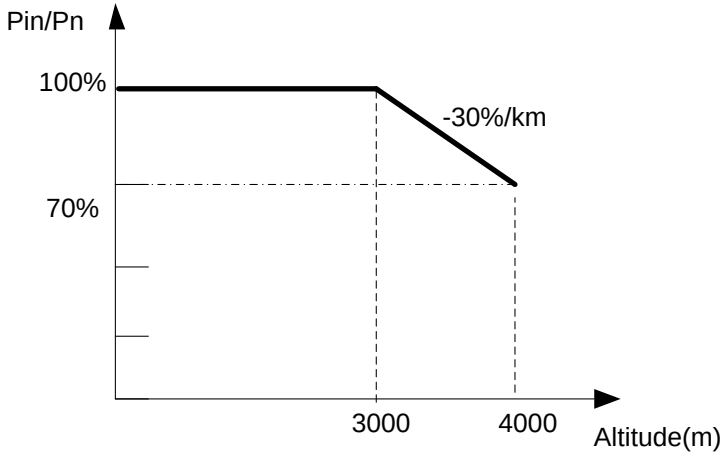


Figure 8-4 CSI-50/60KTL-CT Derating Curve with High Altitude

Note 4: When the grid voltage is within 100%~110% (Un ~ 1.1*Un) of the Rated Ouput Voltage, the inverter output power (Pn) may reach 100%. When the grid voltage is lower than the Rated Ouput Voltage, the inverter will limit the AC Output Current and the output power (Pn) will begin to derate, as shown in Figure 8-5.

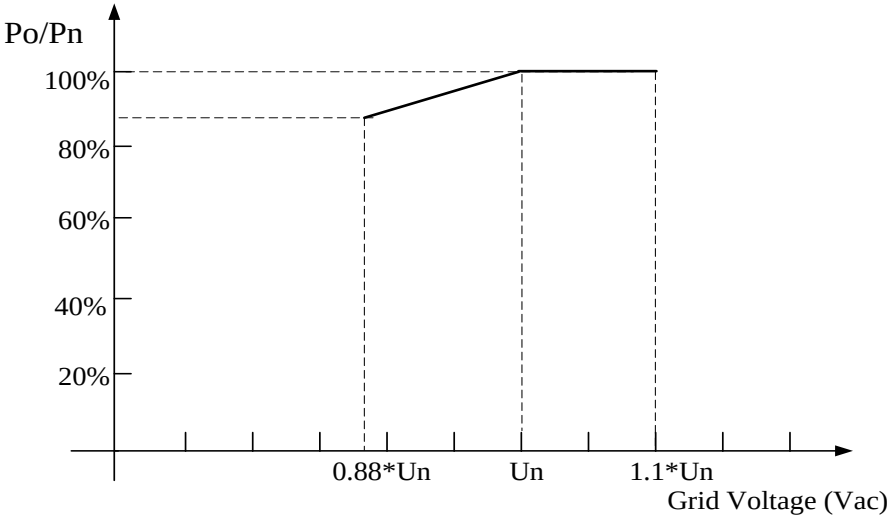


Figure 8-5 CSI-50/60KTL-CT Derating Curve of Grid Voltage

Chapter 9 Limited Warranty

The warranty policy of this product is specified in the contract; otherwise, the standard warranty is 10 years.

For service, Canadian Solar will provide local support. For Warranty terms, please refer to the CSI America standard warranty policy in place at time of purchase.

CANADIAN SOLAR INC.

Global Headquarters:

545 Speedvale Avenue, West Guelph, Ontario N1K 1E6, Canada

Tel: +1 519 837 1881

Sales Inquiries Email: sales.ca@canadiansolar.com

Technical Inquiries Email: service.ca@canadiansolar.com

CANADIAN SOLAR (USA), INC.

North America Headquarters:

2430 Camino Ramon, Ste 240, San Ramon, CA 94583

Tel: +1 888 998 7739

Sales Inquiries Email: sales.us@canadiansolar.com

Technical Inquiries Email: service.ca@canadiansolar.com

Part No: 9.0020.0334 A0

PROJECT NAME _____

LOCATION _____ NUMBER _____

CanadianSolar

INSTALLATION AND COMMISSIONING CHECKLIST
3 PHASE STRING INVERTERS (CSI-23/28/36KTL-CT & CSI-50/60KTL-CT)

Warning: This checklist is not a replacement to the manual.
Please Read User Manual prior to inverter site selection and installation.

Step	No.	Content	Details	Values / Notes	Conclusion
INSTALLATION	1	Installation environment	Ensure installation site meets environmental and physical constraints.		[ ] Good [ ] Poor
	2	Unpacking	Check inverter condition after unpacking.		[ ] Good [ ] Poor
	3	Mounting bracket installation	Install inverter mounting bracket according to installation instructions in user manual (tilt allowed: 15° to 90°).		[ ] Completed Record Tilt Angle in Notes
	4	Inverter installation	Carefully install the inverter to the mounting bracket and ensure it is firmly attached (Refer to Chapter 3 of the manual).		[ ] Completed
	5	Serial number	Record the product serial numbers located on the side label.		Serial Numbers; attached list
	6	Solar modules	Confirm PV module installation completion. Record the total power of the PV modules.		[ ] Completed Record kWp in Notes
	7	DC input and AC output connection	Switch off the DC and AC distribution unit, connect DC to PV terminals of inverter, and connect AC to AC terminals of inverter. Ensure proper polarity and cable size. Torque to specifications.		[ ] Completed Record Torque in Notes
	8	PV voltage	Measure and record DC voltage. Ensure voltage and polarity are correct.		[ ] Completed Record V_{DC} in Notes
	9	AC grid	Measure and record AC voltage and frequency.		[ ] Completed Record V_{AC} in Notes
	10	Grounding cable	Ensure ground cable is firmly attached to grounding lug.		[ ] Good [ ] Poor

PROJECT NAME _____

LOCATION _____ NUMBER _____

CanadianSolar

Step	No.	Content	Details	Values / Notes	Conclusion
COMMISSIONING	1	Communication cable (if the function is used)	Connect the RS485 cable to communication port.		[ ] Completed
	2	Supply DC power	Switch on the DC switch. The LCD and “Power” LED indicator will be green lighted, "Run" LED off, "Grid" LED flashing, "Fault" LED flashing and the inverter begins self-checking. Initially, "GridV.Outlimit" and "GridF.Outlimit" will be displayed, then the inverter will switch to "Standby" mode.		[ ] Completed
	3	Supply AC power	Switch on the AC switch. The Grid faults will clear automatically. In "Standby" mode "Power" LED is solid green, "Run" LED is off, "Grid" LED is solid green and "Fault" LED is off.		[ ] Completed Record LEDs status in notes
	4	Waiting time	A standard 5 minute delay is required before the inverter generates any power to the grid. In normal operation mode, "Power", "Run", "Grid" LEDs are solid green and "Fault" LED is off.		[ ] Completed Record LEDs status in notes
	5	Power generation	After grid connection, record power output of inverter.		[ ] Completed Record power in notes
	6	Date & Time setting	Set the current date and time using the front panel interface.		[ ] Completed Record current date/ time in notes
	7	Communication setting (if it’s available)	Set communication with a unique address for each inverter.		[ ] Completed Record communication address in notes
	8	Machine version	For maintenance and reference, please record the firmware revisions		Record with serial numbers
	9	Operating parameter	Record operating parameters of the inverter. Verify IEEE1547 setting is selected. De-rate inverter and attach de-rate sticker as required. (Refer to Chapter 4 & 5 of the manual)		[ ] Completed Record operating parameters in notes
	10	Testing	Open and close the DC breaker to confirm whether the inverter reboots and shuts down automatically.		[ ] Reboot sucessful [ ] Not rebooting
	11	Completion	Installation and commissioning is complete if no abnormality.		[ ] Good [ ] Issues detected

PROJECT NAME _____

LOCATION _____ NUMBER _____

CanadianSolar

System Owner: _____

Address / Location: _____ Note site typical arrangements and variances

Inverter model: _____ Inverter firmware revision: DSP: _____ LCD: _____

Number of inverters: _____ Inverter mounting tilt: _____

Output power*: _____ Input DC voltage: _____ Insulation limit (K): _____ PV start-up voltage: _____

Grid: V Max: _____ V Min: _____ Frequency Max: _____ Min: _____ Reactive compensation: _____ +/- PF

Configuration: MPPT Individual _____ MPPT Parallel _____

Monitoring: RS485: _____ Ethernet: _____ Monitoring equipment and supplier: _____

PV module manufacturer: _____ PV model: _____

DC cable size: _____ AC cable size: _____ Transformer ratings, supplier: _____

Number of series connected modules in PV strings: _____

Number of PV strings in parallel per MPPT: _____

Total System size (DC Watts): _____

GENERAL COMMENTS/OBSERVATIONS:

_____

_____

_____

*Specify de-rated power and add nameplate power in parenthesis

PROJECT NAME _____

LOCATION _____ NUMBER _____

CanadianSolar

Inverter serial numbers:

1 .....
2 .....
3 .....
4 .....
5 .....
6 .....
7 .....
8 .....
9 .....
10 .....
11 .....
12 .....
13 .....
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39 .....
40 .....
41 .....
42 .....

INSTALLER´S SIGNATURE _____

COMPANY _____

DATE _____

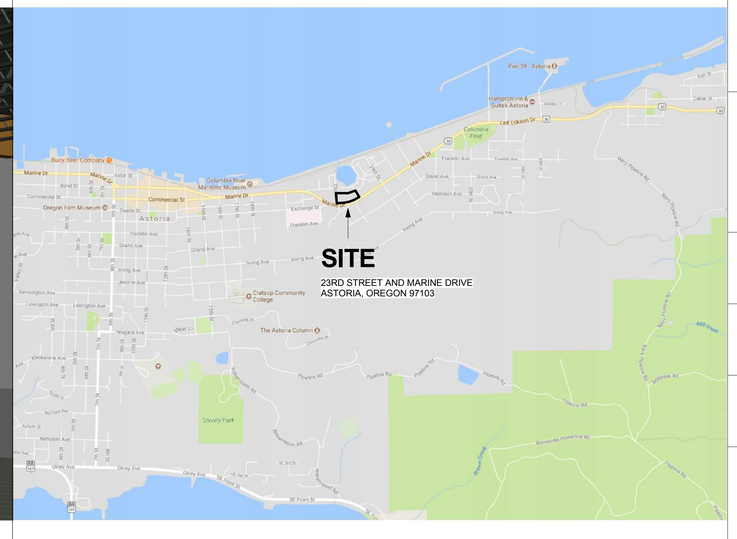
Please return completed form to inverter.register@canadiansolar.com

ASTORIA CO OP

EXTERIOR VIEW OF ENTRANCE

INTERIOR VIEW OF ENTRANCE

DRAWING INDEX



VICINITY MAP

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"

QU
AD

QUILICI ARCHITECTURE AND DESIGN
210 SW MORRISON ST. SUITE 600
PORTLAND, OR 97204
503.477.8922

STAMP

PROJECT

ASTORIA CO OP

ASTORIA, OREGON

CLIENT

PHASE

DESIGN REVIEW

REVISIONS

DATE

AUGUST 15, 2017

PROJECT NUMBER

17.01.01

SCALE

SHEET TITLE

COVER

A100

STEAM WHISTLE WAY

PROPOSED ELECTRICAL TRANSFORMER VAULT LOCATION

PROPOSED GRAVITY SANITARY SEWER TO 23RD ST

33'-0"

5'-0"

LOADING BAY

69'-0"

39'-6"

86'-0"

23RD STREET

PROPOSED WATER

PRELIMINARY BUILDING 11,580 SF 21.0 FF

128'-0"

8'-0"

12'-0"

17'-2"

OUTDOOR SEATING

PARKING LOT LIGHT, TYP.

CURB CUT FOR STORMWATER FLOW

PARKING LOT LIGHT, TYP.

CART CORRAL LOCATION

119'-0"

CART CORRAL LOCATION

CURB CUT FOR STORMWATER FLOW

PROPOSED SEWER FORCEMAIN

PARKING LOT LIGHT, TYP.

PROPOSED STORM LINE

PROPOSED CATCH BASIN

EX CATCH BASIN

20'-0"

PROPOSED STORMWATER DRAINAGE SWALE (PRELIMINARY)

15.0' EXISTING UTILITY EASEMENT

10.9' EXISTING ODOT SLOPE EASEMENT

MARINE DRIVE

PRELIMINARY SITE EXHIBIT

SCALE: 1" = 20'

SOIL CAP AREA AS DETERMINED BY D.E.Q. AND RECORDED IN THE PPA ON FEB. 12, 1998, BOOK 1000 PAGES 700-726

NO EXCAVATION AREA AS DETERMINED BY D.E.Q. AND RECORDED IN THE PPA ON FEB. 12, 1998, BOOK 1000 PAGES 700-726

SITE SUMMARY

ZONING: ATTACHED HOUSING (MILL POND) AH-MP
NO YARD SETBACK REQUIREMENTS

SITE AREA:	76,959 SF
BUILDING FOOTPRINT: (15% OF SITE)	11,580 SF
TOTAL LANDSCAPE AREA: (10% REQUIRED -- 50% SHOWN)	38,396 SF
HARD SURFACE AREA: (35% OF SITE)	26,983 SF

PARKING CALCULATIONS

TOTAL VEHICLE PARKING REQUIRED (INCLUDED 1 ADA STALLS W/1 VAN & LOADING)	24 STALLS
11,580 SF \ 500 SF	
TOTAL VEHICLE PARKING PROVIDED (INCLUDED 3 ADA STALLS W/1 VAN & LOADING) FULL 9.5 X 20 (% OF STALLS) COMPACT 8.5 X 16 (% OF STALLS)	51 STALLS
BIKE PARKING REQUIRED 24 VEHICLE STALLS / 10 50% SHORT TERM 50% LONG TERM	3 BIKE STALLS

20 0 10 20 40

SCALE: 1" = 20'

NO.	DATE	BY	REVISION COMMENTS

Design — Drawn — Checked — Initial Issue Date: ADD FEBRUARY 16, 2017

ASTORIA CO-OP

PRELIMINARY SITE EXHIBIT

ASTORIA, OR

PRELIMINARY

otak Incorporated
4253-A HWY 101 N.
GEARHART, OREGON 97138
Phone: (503) 738-3425
FAX: (503) 738-7455
Internet: WWW.OTAK.COM

68072 C68072T001.DWG
Project No. Drawing No.

EX1
Sheet No.

N:\Project\68000\68072\CAD\ACAD\C68072T001.dwg Plotted: Aug 14, 2017 - 1:57pm By: sarahmc

plant material schedule

trees

symbol	common name	botanical name	size	spacing	quantity
	city sprite zelkova	zelkova serrata 'jfs-kw1'	2" cal.	as shown	12
	little leaf linden	tilia cordata	2" cal.	as shown	4
	honey locust	gleditsia triacantho	2" cal.	as shown	5
	kousa dogwood	cornus kousa	2" cal.	as shown	4
	western hemlock	tsuga heterophylla	6'-8' hgt.	as shown	3
	incense cedar	calocedrus decurrens	6'-8' hgt.	as shown	3
	sitka spruce	picea sitchensis	6'-8' hgt.	as shown	3
	shore pine	pinus contorta var. contorta	6'-8' hgt.	as shown	3
	swedish columnar aspen	populus tremula 'erecta'	2" cal.	as shown	27

shrubs

	vine maple	acer circinatum	6' hgt. multistem	as shown	8
	oregon vibunum	viburnum ellipticum	5 gal.	as shown	5
	red osier dogwood	cornus sericea	5 gal.	as shown	54
	inkberry	ilex glabra 'shamrock'	3 gal.	as shown	48
	dwarf korean lilac	syringa meyeri 'palibin'	5 gal.	as shown	52
	evergreen huckleberry	vaccinium ovatum	5 gal.	as shown	28
	dwarf mountain laurel	kalmia latifolia 'elf'	3 gal.	as shown	46
	unique rhododendron	rhododendron 'unique'	3 gal.	as shown	18
	rock rose	cistus (various species)	3 gal.	as shown	14
	mock orange	philadelphus lewisii	3 gal.	as shown	17

groundcover

	st. johns wort	carex testacea	1 gal.	18" o.c. tri.	162 (560 sf)
	blue oat grass	helictotrichon sempervirens	1 gal.	18" o.c. tri.	171 (615 sf)
	dwarf fountain grass	pennisetum alopecuroides 'hameln'	1 gal.	18" o.c. tri.	315 (1,113 sf)
	autumn moor grass	hymenoxys scaposa	1 gal.	18" o.c. tri.	273 (974 sf)
	varigated sedge	carex morrowii 'ice dance'	1 gal.	18" o.c. tri.	348 (1,442 sf)

granular material

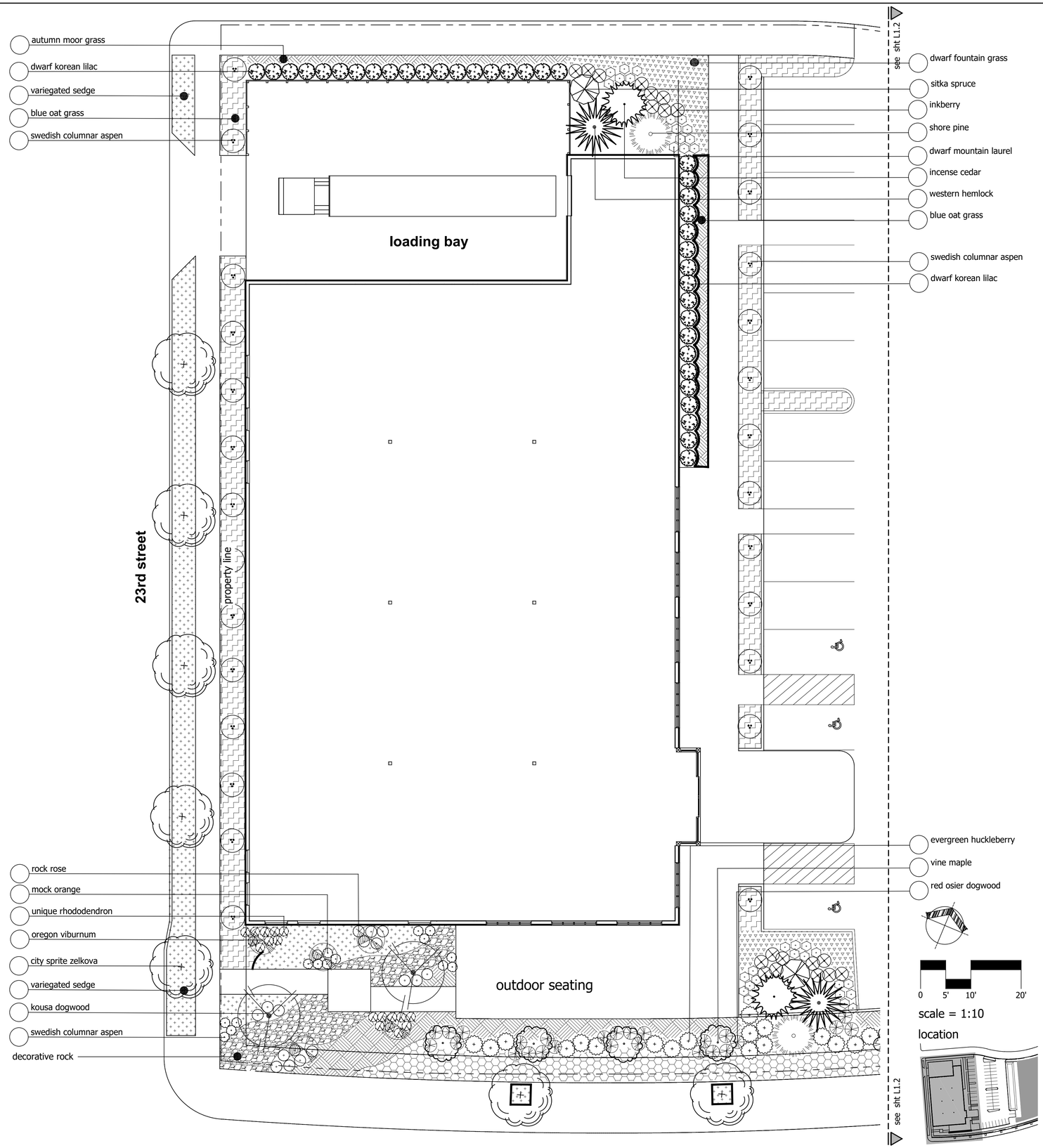
	river rock	size: 2"-6". mfg: locally sourced	307 sf

stormwater treatment area

qty/10sf — vegetated swale schedule (2,500 sf)

1	subalpine spirea	spiraea densiflora	2 gal.	30" o.c.		250
3	mahonia nervosa	dwarf oregon grape	1 gal.	24" o.c. triangular spacing	group	750
4	bay blue rush	juncus effusus 'bay blue'	4" pots	16" o.c. triangular spacing	group	1000
4	ovate spiked rush	eleocharis ovata	1-1/2" plugs	16" o.c. triangular spacing	group	1000
3	berkley sedge	carex tumulicola	1-1/2" plugs	16" o.c. triangular spacing	group	750
3	rossi sedge	carex rossi	1-1/2" plugs	16" o.c. triangular spacing	group	750
3	elks blue rush	juncus patens	1-1/2" plugs	16" o.c. triangular spacing	group	750

note: "group" can include up to 12 plants. contractors discretion.



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REGISTERED
349
JEFFREY K. SIMPSON
OREGON
03/31/18
LANDSCAPE ARCHITECT

astoria coop
landscape improvements
23rd street & marine drive

project no.
VCA0217
sheet title
landscape plan

date	07.25.17
designed	trh
drawn	trh
checked	jks

rev.	date	by

sheet
L1.1

notes: landscape plan

general

1. all local, municipal, state and federal laws regarding uses, regulations, governing or relating to any portion of the work depicted on these plans are hereby incorporated into and made part of these specifications and their provision shall be carried out by the contractor. the contractor shall at times protect the public throughout the construction process.
2. contractor shall carefully correlate construction activities with that of the earhtwork contractor and other site development.
3. contractor shall verify drawing dimensions with actual field conditions and inspect related work and adjacent surfaces. contractor shall verify the accuracy of all finished grades within the work area. contractor shall report to the landscape architect (la) or designated representative (odr) all conditions which prevent proper execution of this work.
4. exact location of all existing utility structures and underground utilities, which may not be indicated on the drawings, shall be determiined by the contractor. the contractor shall protect existing structures and utility services and is responsible for their replacement if damaged.
5. disturbance and impacts to native trees/shrubs shall be minimized to the greatest extent practicable.
6. contractor shall keep the premises free from rubbish and debris at al times and shall arrange material storage to not not to interfere with the operation of the project. all unused materials, rubbish and debris shall be removed from the site.
7. all plant material and planting supplies shall be warranted for a period of not less of one year from the completion date of the installation. all replacement stock shall be subject to the same warranty requirements as the original stock. any damage due to replacement operations shall be repaired by the contractor. at the end of the warranty period, inspections shall be made by the la, odr, tenant and contractor. all plant and lawn areas not in a healthy growing condition shall be removed and replaced with plants and turf cover of a like kind and size before the close of the next planting season.

grading / erosion control

8. design and placement of the buildings on the site lends itself to minimal slope conditions with positive drainage being maintained around the entire building. in this case, standard landscaping procedures of topsoil, lawn and a two inch layer of bark mulch on all planting beds will be sufficient to control erosion. in the event site conditions change or there are slopes/ bioswales/ detention ponds on the projects with slopes greater than 30%. thight wave Poly Jute netting shall be installed with anchoring pins as per manufacturers recommentdations prior to planting. recommend DeWitt PJN4216 erosion control poly jutt netting and Dewitt anchor pins or approved equal.
9. work limits shown on this plan shall clearly be marked in the field prior to construction. no disturbance beyond the work limits shall be permitted
10. grading shall be performed during optimal weather conditions.
11. erosion control measures shall be consturcted in conjunction with all clearing and grading activities and in such a manner as to ensure that sediment and sediment laden water does not enter the drainage system or violate applicable water standars.
12. prior to comencement of constuction activities, contractor shall place orange construction fencing around perimeters of of constuction impact areas, and sediment fencing at downhill portions of the site. contractor is responsible for proper instillation, maintenance, replacement and upgrading of all erosion and sediment control measures in accordance with local, state and federal regulations.

plant material

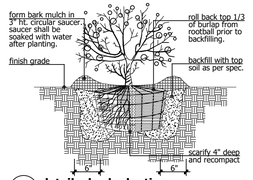
13. contractor shall verfiy all plant and tree quantities with LA or odr prior to construction. quantities shown are intended to assist contractor in evaluating their own take-offs and are not guaranteed as accurate representations of required materials. the contractor shall be responsible for his bid quantities as required by the plans and specifications. if there is a discrepancy between the number labeled on the plant tag and the quantity of graphic symbols shown, the graphic symbol quantity shall govern.
14. plant material shall be first quality stock and shall conform to the code of standards set forth in the current edition of the "American Standard of Nursery Stock" sponsored by the American Association of Nurserymen, Inc. (AAN).
15. species and variety as specified on the drawings and delivered to the site shall be certified true to their genus, species and variety and as defined within the current edition International Code of Nomenclature for Cultivated Plants.
16. obtain freshly dug, healthy, vigorous plants nursury grown under climatic conditions similar to those in the locality for the project for a minimum of two years. plants shall have been lined out in rows, annually cultivated, sprayed, pruned, and fertilized in accordance with good horticultural practice. all container plants shall have been transplanted or root pruned at least once in the past three years. ball and burlapped (B&B) plants must come from the soil which will hold a firm root ball. heeled in plants and plants from cold storage are not acceptable.
17. Plant stock shall be well-branched and well-formed, sound, vigorous, healthy, free from disease, sun-scaled, windburn, abrasion, and harmful insects and insect eggs; and shall have healthy, normal and unbroken root systems. deciduous trees and shrubs shall be symmetrically developed, uniform habitat in growth, with straight trunks and stems, and free form objectionable disfigurements. evergreen trees and shrubs shall have well developed symmetrical tops with typical spread of branches for each particular species or variety. only vines and groundcover plants well established shall be used. plants budding into leaf or having soft growth shall be sprayed with an anti-desiccant at the nursery before digging.
18. if required landscape material is not obtainable,contractor shall obtain written approval for all plant material substitutions from the landscape architect prior to installation. when authorized, adjustments of contract amount (if any) will be made by change order. plant substitutions without prior written approval that do not comply with the drawings and specifications may be rejected by the landscape architect at no cost to the owner. these items may be required to be replaced with plant materials that are in compliance with the drawings. submit proof of non-availabilty.
7. all plant material shall be installed at the size and quantity specified. the landscape architect is not responsible for sub-standard results caused by reduction in size and/or quantity of plant material.
8. landscape maintenance period begins immediately after the completion of all planting operations and written notification to the odr. maintain trees, shrubs, lawns and other plants until final acceptance or 90 days after notification and acceptance, whichever is longer.

planting

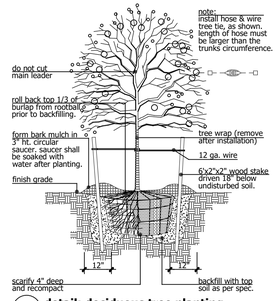
9. planting shall be installed between March 15 and May 1 or between October 15. if planting is installed outside these time frames, additional measures may be needed to ensure survival and shall be approved by the odr.
10. plant material shall be transported to the site in a timely manner to minimize on-site storage. where storage is required, all plants shall be kept moisted and shaded.
11. plant stock shall be handled in a manner that will break, scrape, or twist any portion of the plant. protect plants at all times from conditions that can damage the plant (eg. sund, wind, freezing conditions).
12. provide the following clearance for planting of trees where applicable
    maintain 35 feet vision triangle at all intersections, measure back from the point of interesting curbs or curb lines
    5 feet from all driveways
    10 feet from any fire hydrant
    15 feet from any street light measured from its base
13. no trees or shrubs shall be planted on existing or proposed utility lines. where proposed tree locations occur under existing overhead utilities or crowd existing trees, notify odr to adjust tree locations.
14. all shrub beds shall receive a minimum 2inch layer of bark mulch evenly applied immediately after planting is completed. all plant beds shall drain away from buildings.
15. excavate plant pits for shrubs and trees as follows:
    container stock; width = 2 times the container diameter, depth = container depth
    bare root stock; 2 times widest diameter of root, depth = of root sytem
    B&B; width = 2 times ball diameter, depth = ball depth
    scarify sides and bottom of plant
16. place plants plumb to the pit, backfill with native soil or top soil mixture to the original plant soil line and tap solidly around the ball and roots. water plants immediately after planting if soil is not saturated to the surface.

top soil mixture

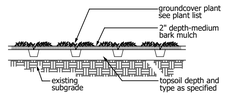
17. apply caseron as a weed control agent after planting as per manufacturers specified recommendations or approved equal.
18. all non-native, invasive plants species shall be removed from the site prior to the addition of organic amendments and fertilizer.



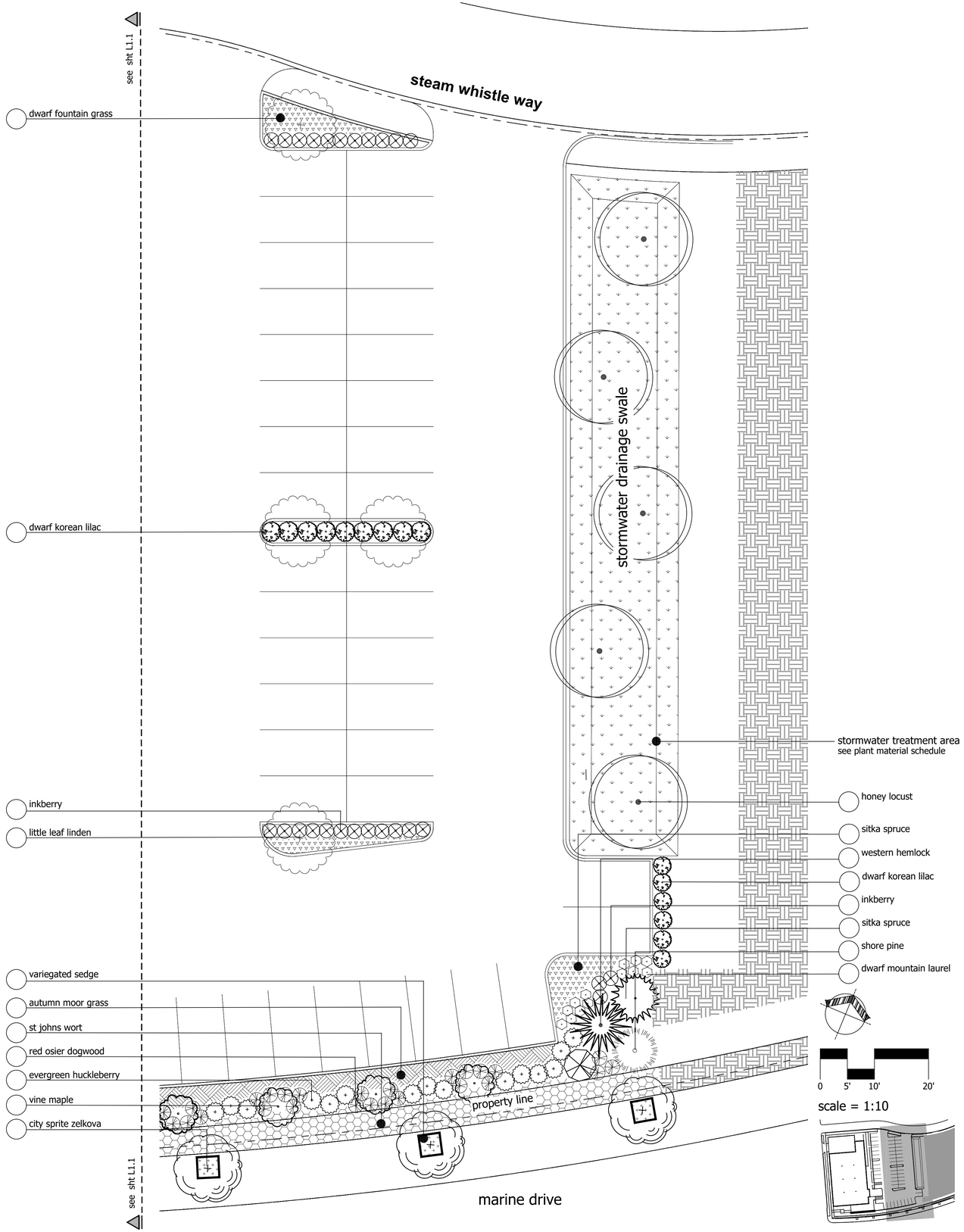
2 detail: shrub planting
nts



3 detail: deciduous tree planting
nts



4 detail: groundcover
nts



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349
JEFFREY K. SIMPSON
OREGON
03/31/18
LANDSCAPE ARCHITECT

astoria coop
landscape improvements
23rd street & marine drive

project no.
VCA0217
sheet title
landscape plan

date	07.25.17
designed	trh
drawn	trh
checked	jks

rev.	date	by

sheet
L1.1

A101
1 BUILDING AXONOMETRIC
SCALE:

QU
AD
QUILICI **A**RCHITECTURE AND **D**ESIGN
210 SW MORRISON ST. SUITE 600
PORTLAND, OR 97204
503.477.8922

STAMP

PROJECT
ASTORIA CO OP
ASTORIA, OREGON

CLIENT

PHASE
DESIGN REVIEW

REVISIONS

DATE
AUGUST 15, 2017

PROJECT NUMBER
17.01.01

SCALE

SHEET TITLE
AXONOMETRIC

A101

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"

A102
1 VIEW FROM SE CORNER
SCALE:

A102
2 VIEW FROM NE CORNER
SCALE:

A102
3 VIEW FROM NW CORNER
SCALE:

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"

QU
AD
QUILICI **A**RCHITECTURE AND **D**ESIGN
210 SW MORRISON ST. SUITE 600
PORTLAND, OR 97204
503.477.8922

STAMP

PROJECT
ASTORIA CO OP
ASTORIA, OREGON

CLIENT

PHASE
DESIGN REVIEW

REVISIONS

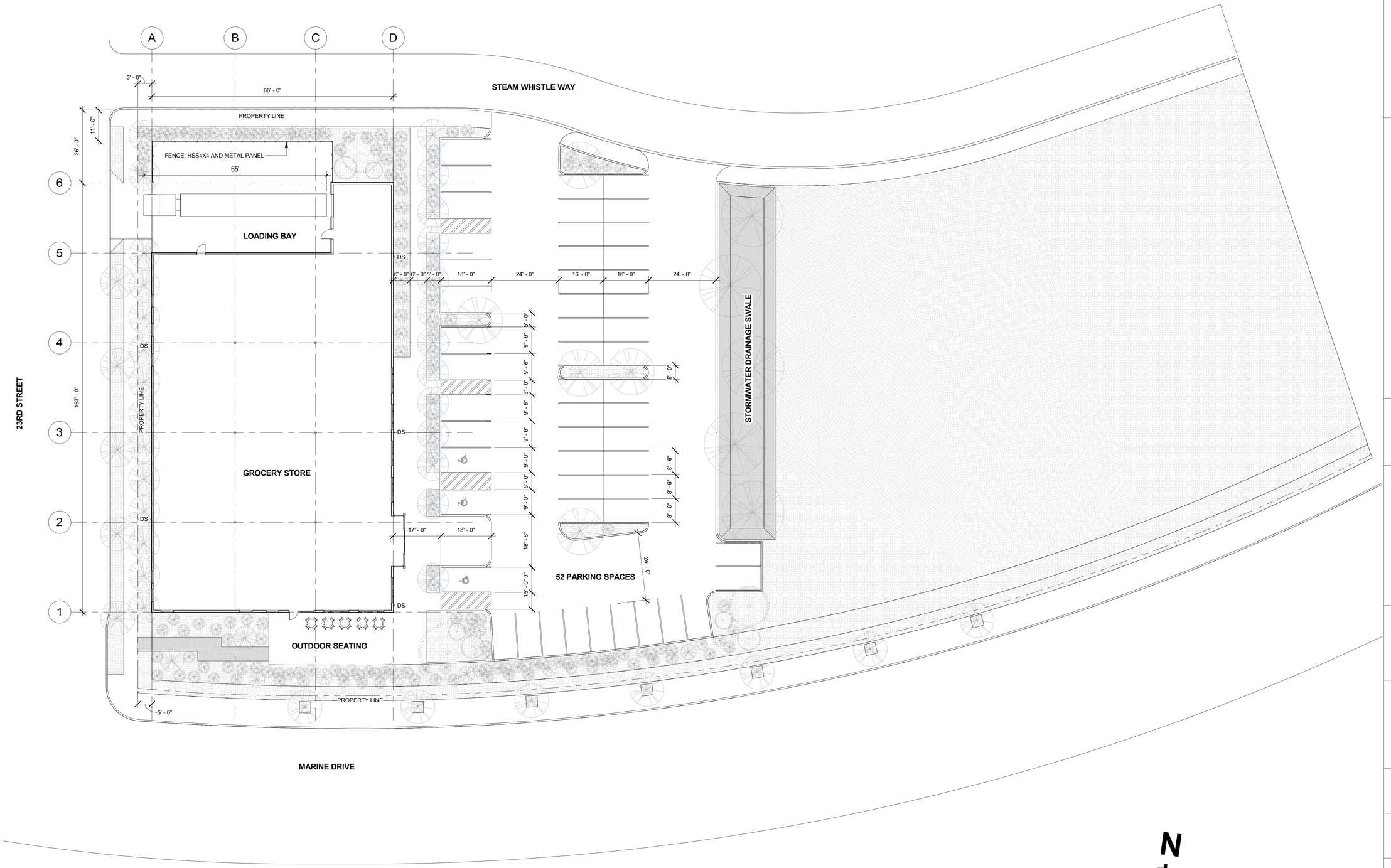
DATE
AUGUST 15, 2017

PROJECT NUMBER
17.01.01

SCALE

SHEET TITLE
VIEWS

A102



A201
1 SITE PLAN
SCALE: 1/16" = 1'-0"

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"

QU
AD
QUILICI ARCHITECTURE AND DESIGN
210 SW MORRISON ST. SUITE 600
PORTLAND, OR 97204
503.477.8922

STAMP

PROJECT
ASTORIA CO OP
ASTORIA, OREGON

CLIENT

PHASE
SCHEMATIC DESIGN

REVISIONS

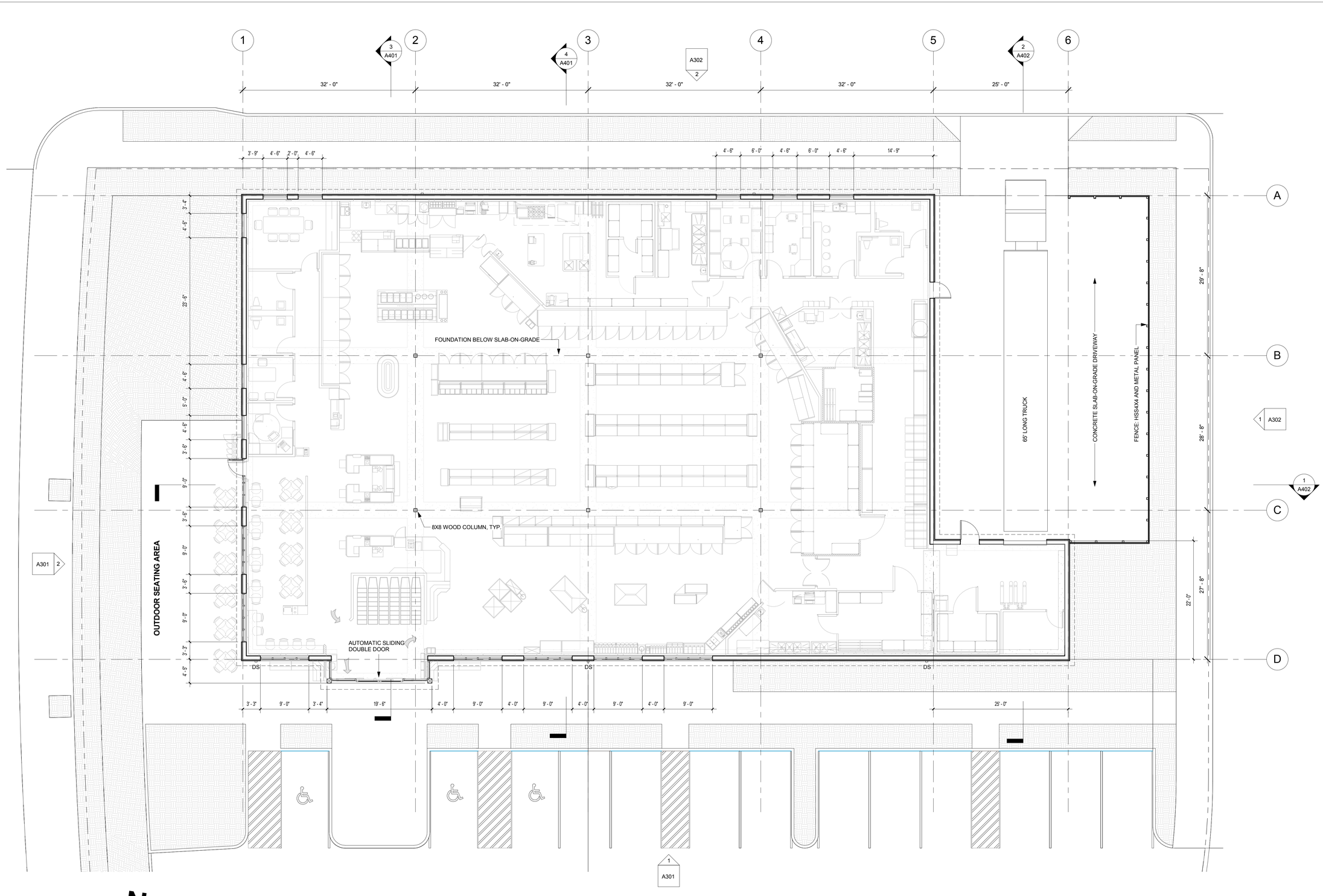
DATE
AUGUST 8, 2017

PROJECT NUMBER
17.01.01

SCALE
1/16" = 1'-0"

SHEET TITLE
SITE PLAN

A201



N

A202 1 GROUND FLOOR
SCALE: 1/8" = 1'-0"

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"

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QUILICI ARCHITECTURE AND DESIGN
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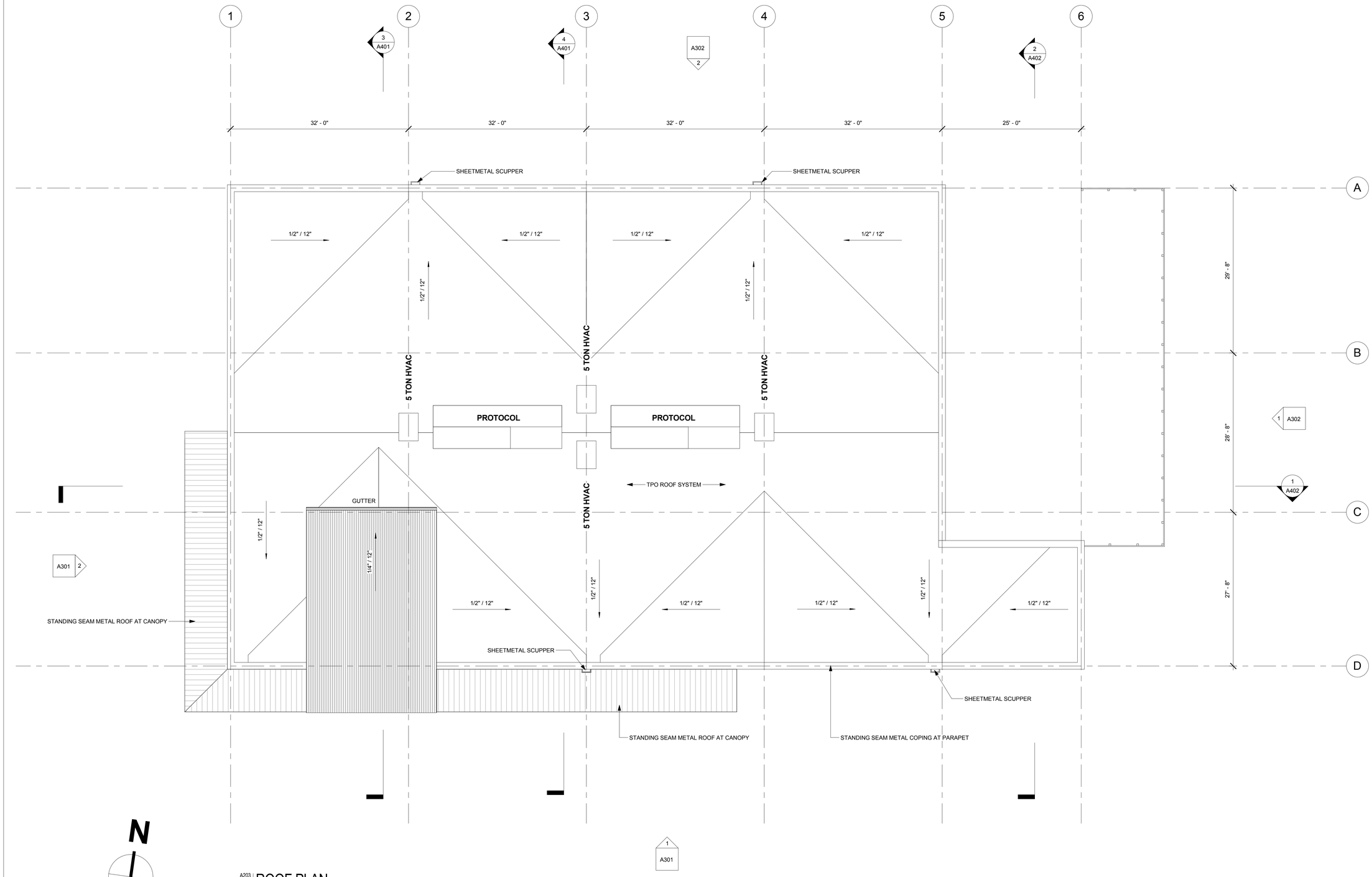
SCALE
1/8" = 1'-0"

SHEET TITLE
FLOOR PLAN

A202



A203 1 ROOF PLAN
SCALE: 1/8" = 1'-0"

QU AD
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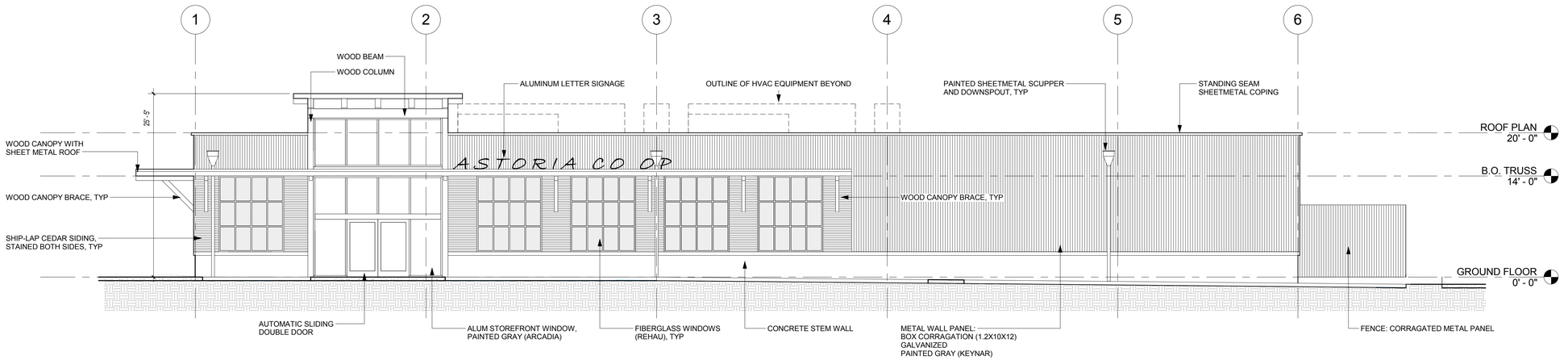
SCALE
1/8" = 1'-0"

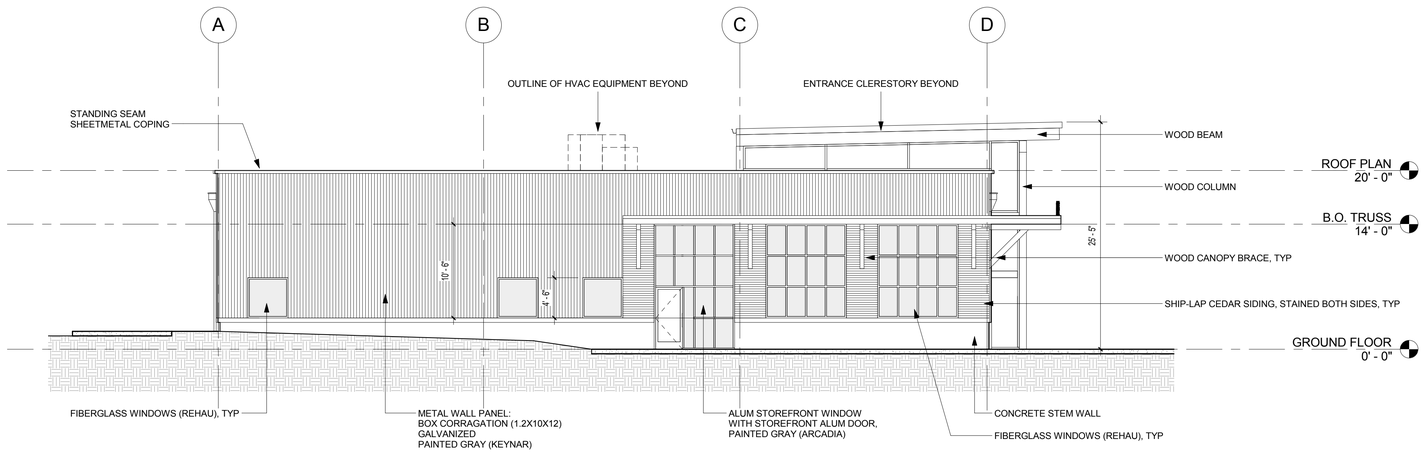
SHEET TITLE
ROOF PLAN

A203

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"



A301
1 EAST ELEVATION
SCALE: 1/8" = 1'-0"



A301
2 SOUTH ELEVATION
SCALE: 1/8" = 1'-0"

QU
AD
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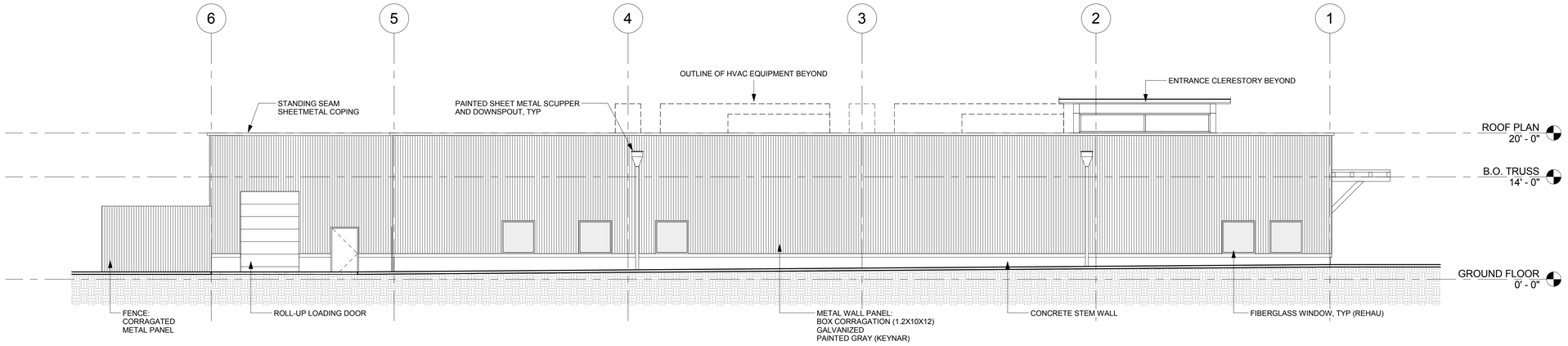
SCALE
1/8" = 1'-0"

SHEET TITLE
ELEVATIONS

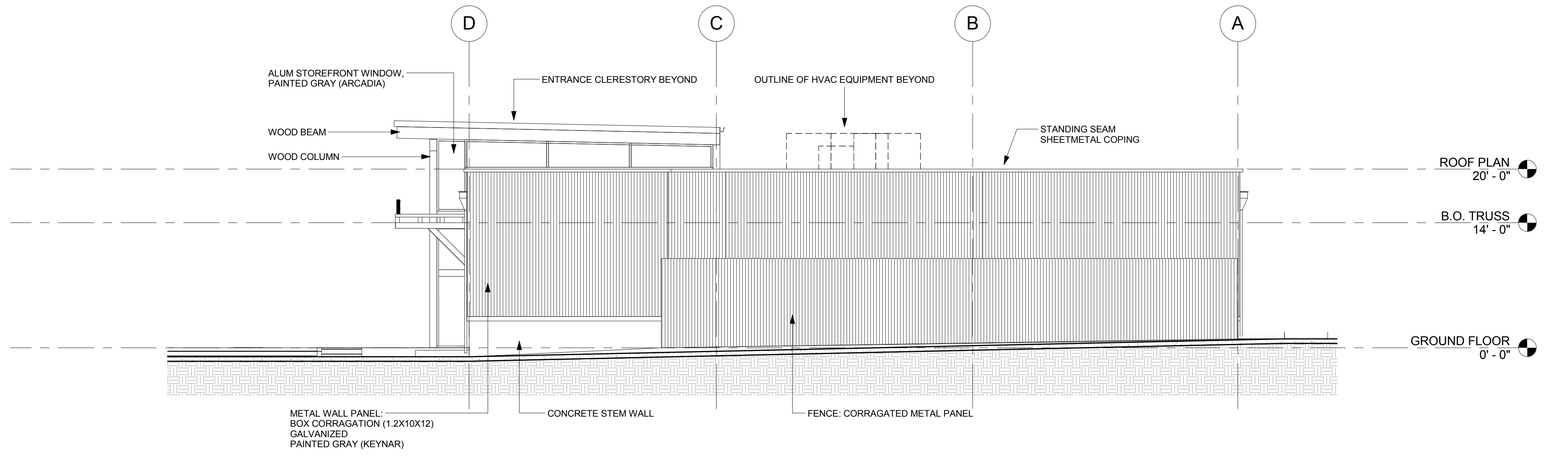
A301

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"



A302 **2** WEST ELEVATION

SCALE: 1/8" = 1'-0"



A302 **1** NORTH ELEVATION

SCALE: 1/8" = 1'-0"

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"

QU
AD

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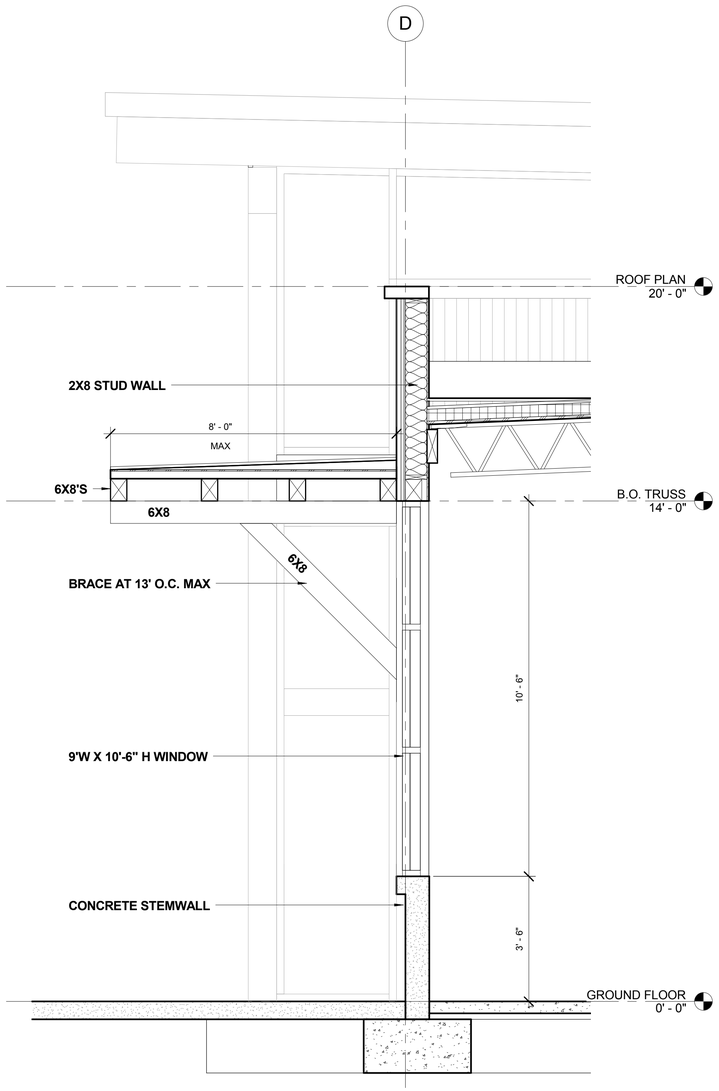
SCALE

1/8" = 1'-0"

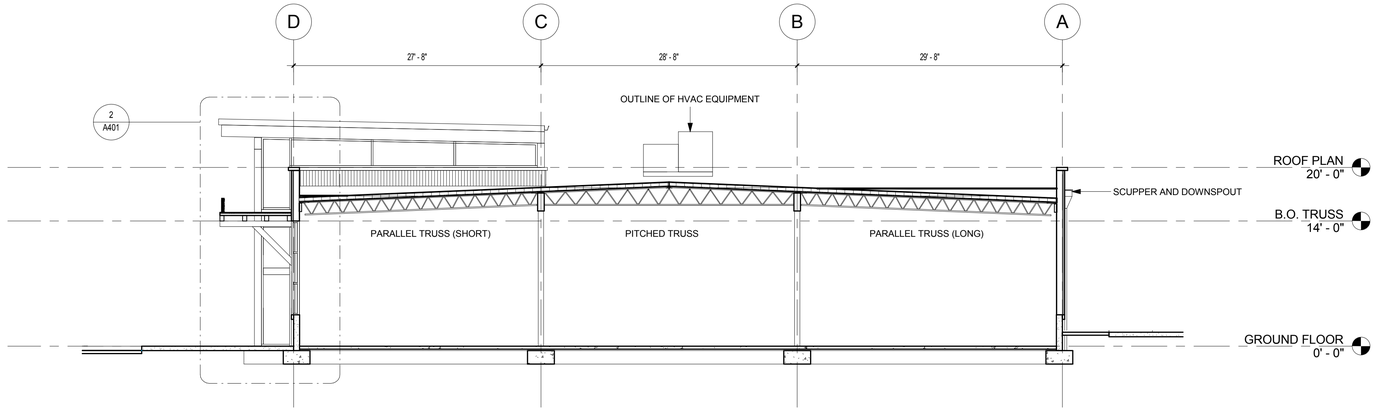
SHEET TITLE

ELEVATIONS

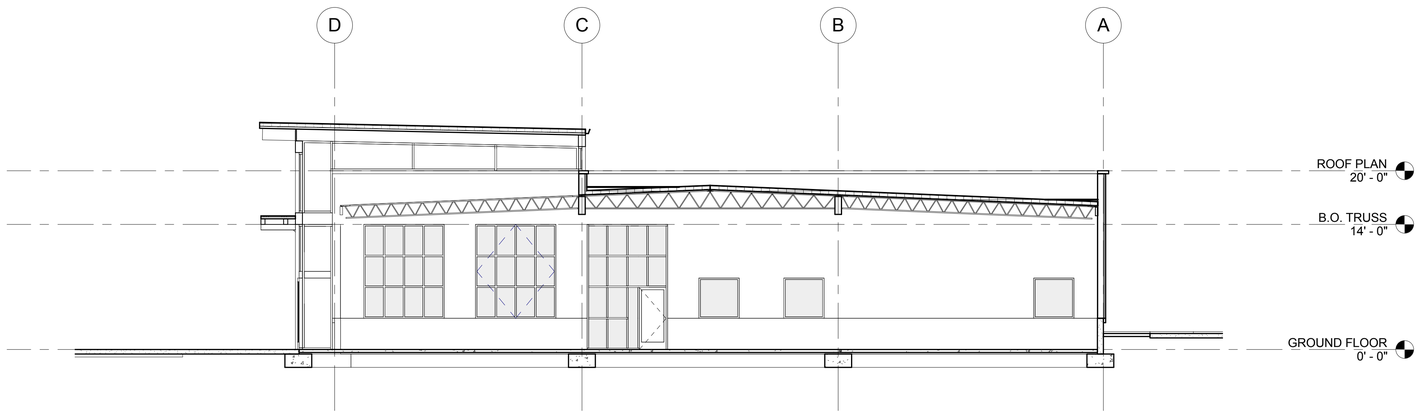
A302



A401 2 WALL SECTION - TYP
SCALE: 1/2" = 1'-0"



A401 4 WEST/EAST BUILDING SECTION AT ENTRY
SCALE: 1/8" = 1'-0"



A401 3 WEST/EAST BUILDING SECTION, TYP
SCALE: 1/8" = 1'-0"

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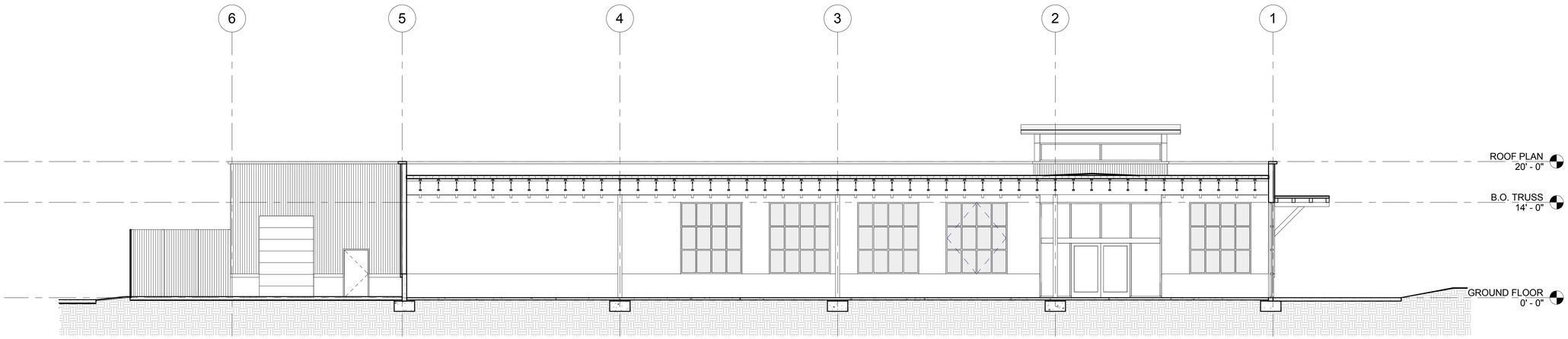
SCALE
As indicated

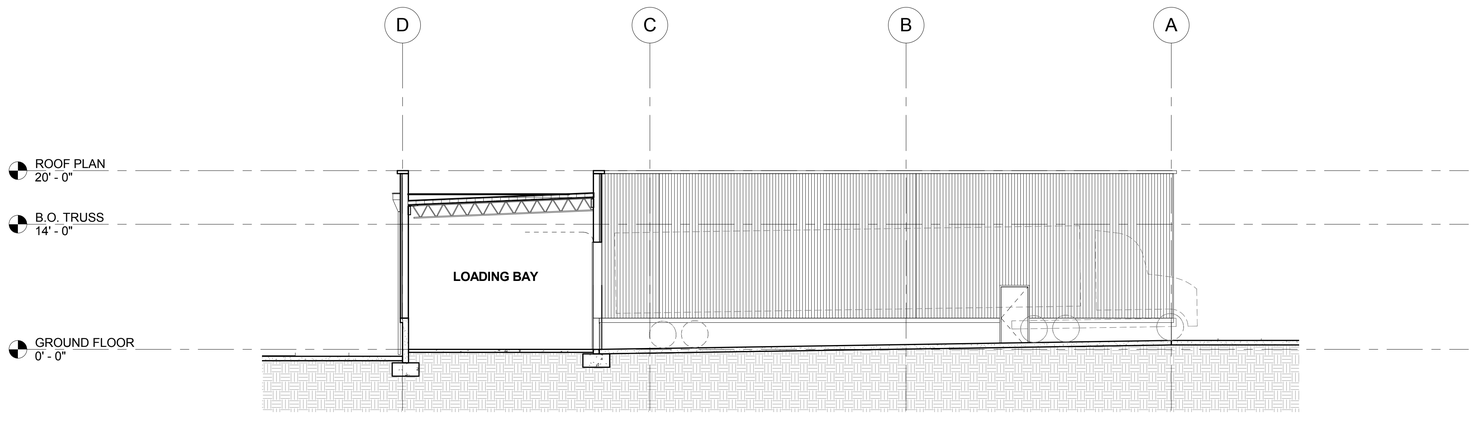
SHEET TITLE
BUILDING SECTIONS

A401

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"



A402
1 NORTH/SOUTH WALL SECTION
SCALE: 1/8" = 1'-0"



A402
2 WEST/EAST BUILDING SECTION AT LOADING DOCK
SCALE: 1/8" = 1'-0"

QU
AD
QUILICI ARCHITECTURE AND DESIGN
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AUGUST 8, 2017

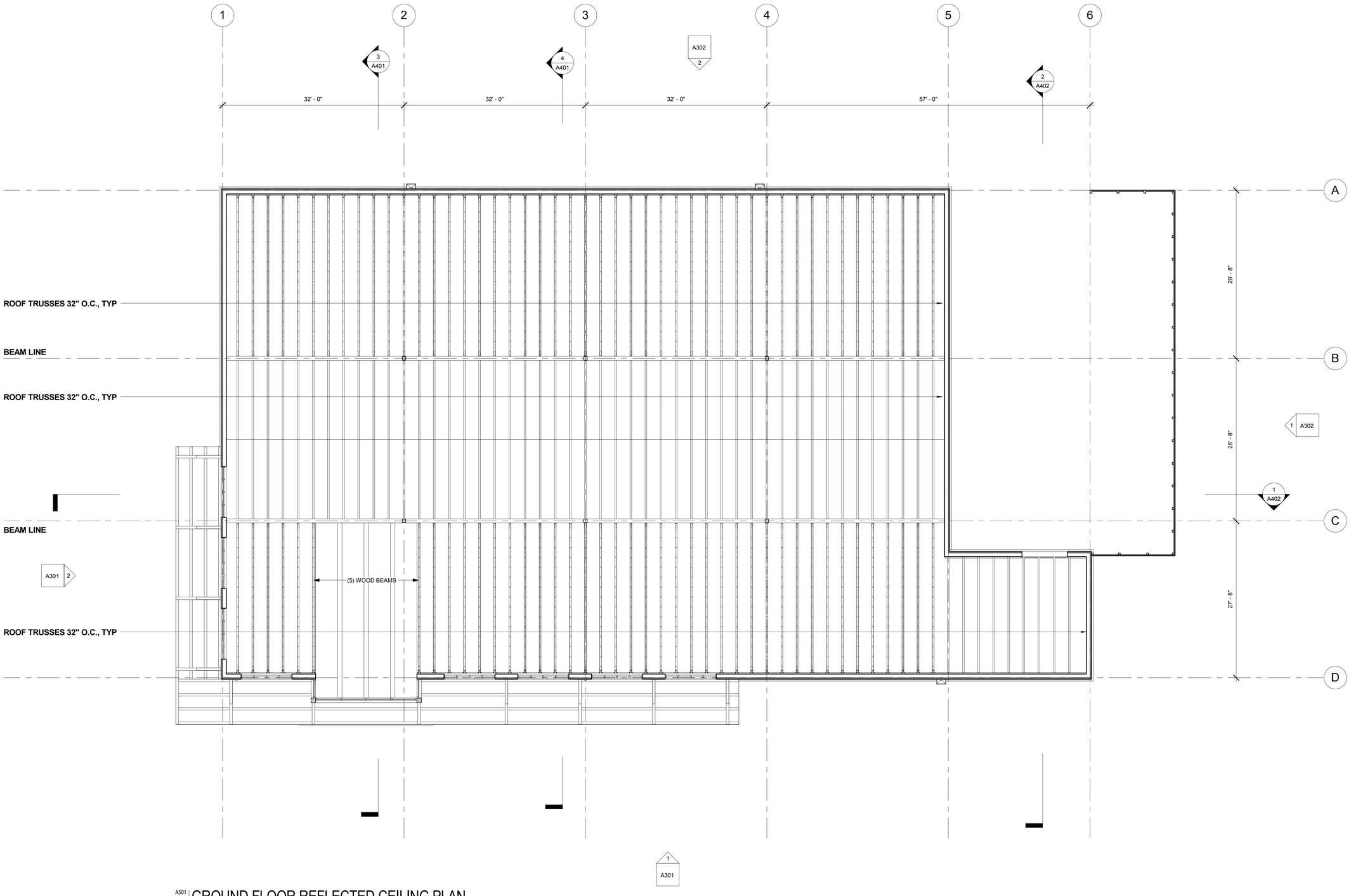
PROJECT NUMBER
17.01.01

SCALE
1/8" = 1'-0"

SHEET TITLE
BUILDING SECTIONS

A402

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"



A501 **1** GROUND FLOOR REFLECTED CEILING PLAN

SCALE: 1/8" = 1'-0"

QU AD

QUILICI **A**RCHITECTURE AND **D**ESIGN
210 SW MORRISON ST. SUITE 600
PORTLAND, OR 97204
503.477.8922

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PROJECT

ASTORIA CO OP

ASTORIA, OREGON

CLIENT

PHASE

SCHEMATIC DESIGN

REVISIONS

DATE

AUGUST 8, 2017

PROJECT NUMBER

17.01.01

SCALE

1/8" = 1'-0"

SHEET TITLE

REFLECTED CEILING PLAN

A501

FULL-SIZE: 24"X36" HALF-SIZE: 12"X18"

PROJECT NOTES:

1. 57.420 KW DC, 50.000 KW AC SOLAR PHOTOVOLTAIC SYSTEM
2. 2 STORY ---- ROOF AT 0° PITCH.
3. CONSTRUCTION FOREMAN TO CONFIRM FINAL CONDUIT RUN PLACEMENT WITH CUSTOMER.
4. CONTACT: LUCAS MILLER PHONE: 503-967-5786
5. DESIGN CRITERIA:
   - 5.1. SYSTEM WEIGHT: 3LBS/SQFT.
   - 5.2. EFFECTIVE WIND SPEED: ---- MPH 3-SEC GUST.
   - 5.3. WIND EXPOSURE CATEGORY:----
   - 5.4. SNOWLOAD: 30 PSF

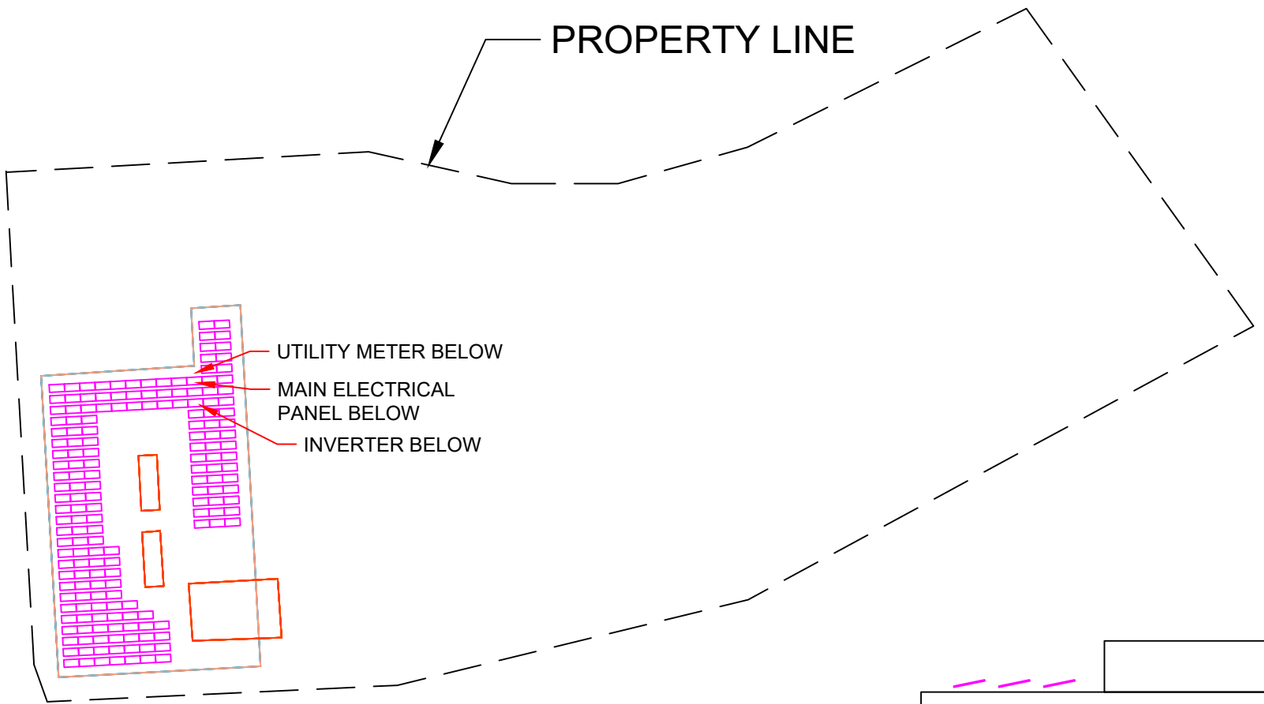
OSSC 3111

TOTAL PV ARRAY AREA: 174 FT²
ROOF SLOPE: 0°
ROOF AREA MEASURED IN PLAN VIEW: 11580FT²
PV ARRAY/ROOF AREA: 28.89 %

TABLE OF CONTENTS

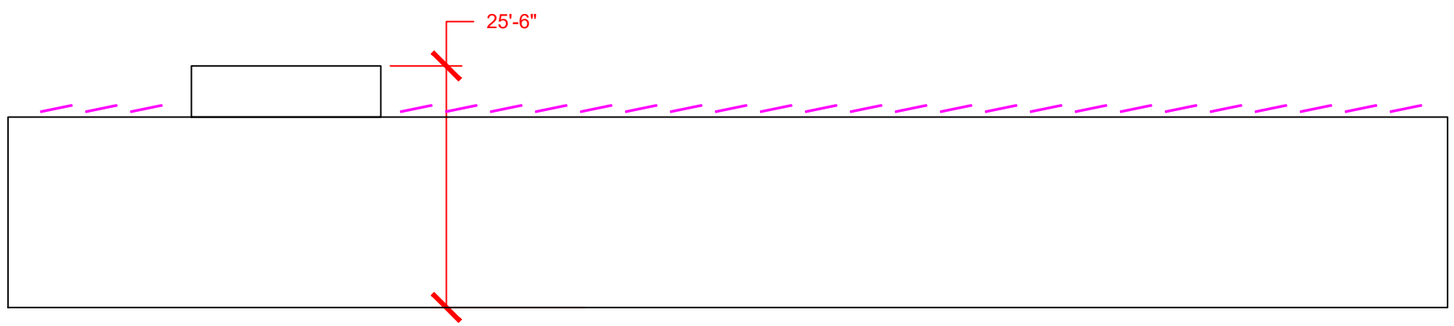
Plan view from above
Scale:1/64" = 1'-0"

SITEPLAN



NOTE:
TSRF PERCENTAGE TO BE 91% CONSISTENTLY ACROSS ROOF AS MODELED IN HELIOSCOPE

SECTION



WEST - Facing Section
Scale:1/16" = 1'-0"

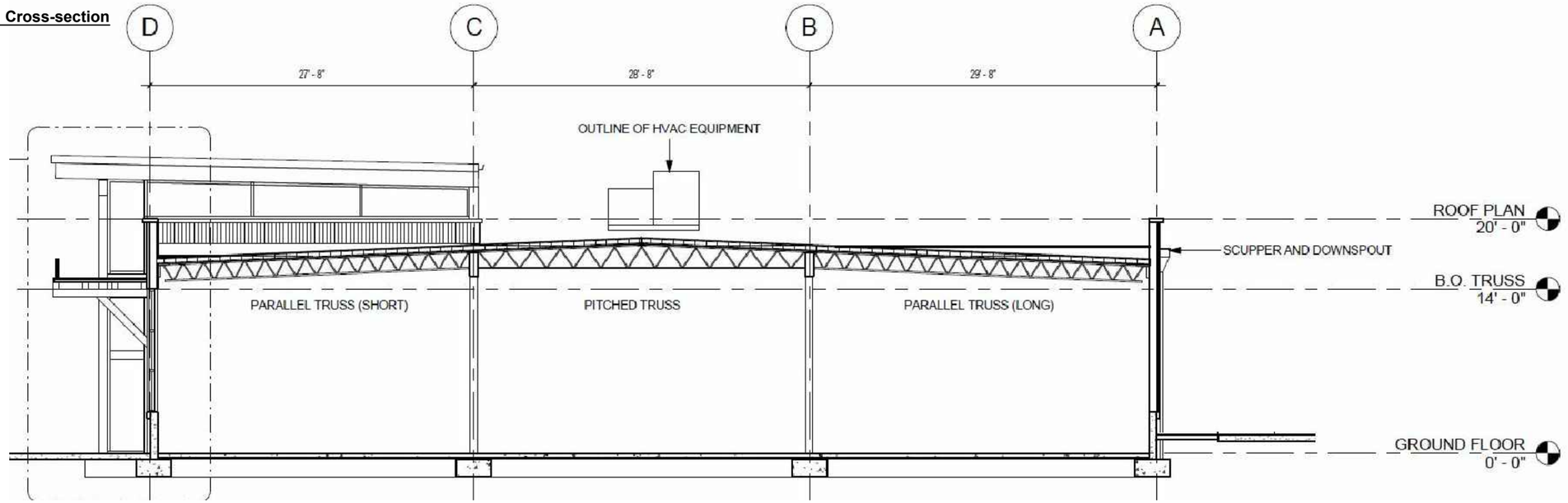
ELECTRICAL EQUIPMENT LOCATIONS NTS

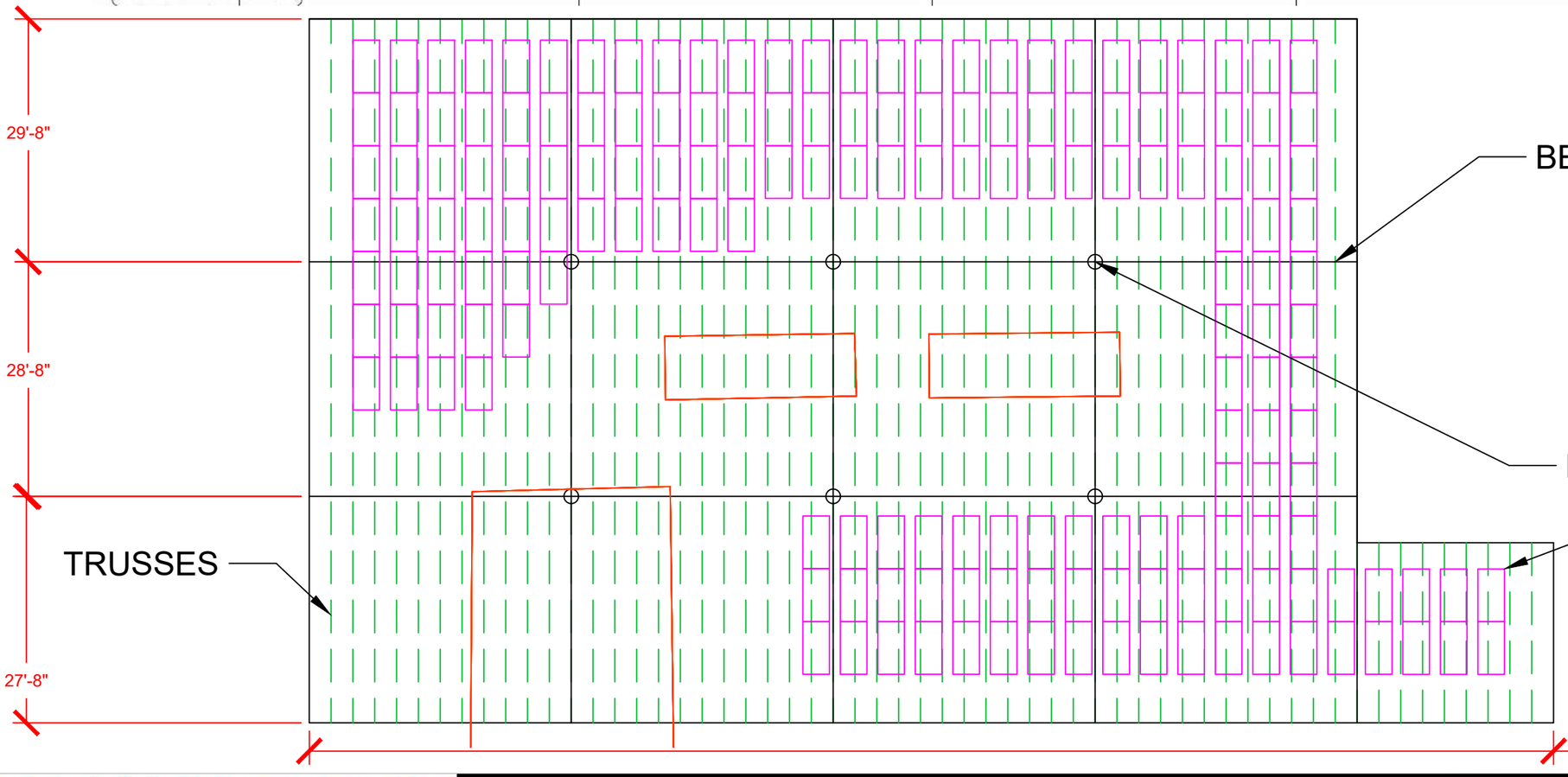
ELEMENTAL ENERGY

DESIGNED BY: N. VAN ALMELO CHECKED BY: G KAMPS	ELEMENTAL ENERGY CB 195151	MATTHEW STANLEY 23RD AND MARINE DRIVE, ASTORIA, OR 97103	SITE PLAN	PV-01	REV: PRE 8/17/2018

STRUCTURAL LAYOUT

EAST - Facing Structural Cross-section
Scale:3/32" = 1'-0"

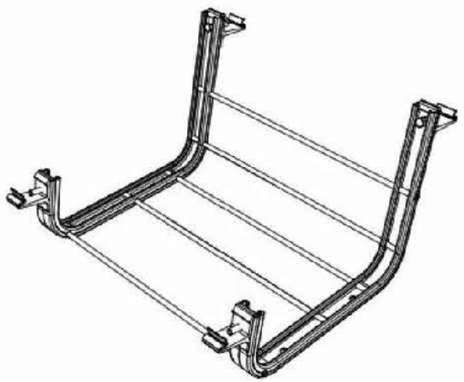




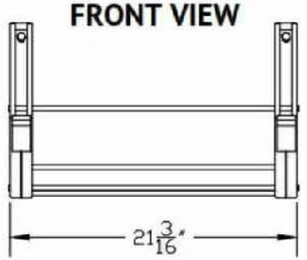
PLAN VIEW
MODULE LAYOUT

ELEMENTAL ENERGY	DESIGNED BY: N. VAN ALMELO CHECKED BY: G KAMPS	ELEMENTAL ENERGY CB 195151	MATTHEW STANLEY 23RD AND MARINE DRIVE, ASTORIA, OR 97103	RACKING LAYOUT	PV-02	REV: PRE 8/17/2018

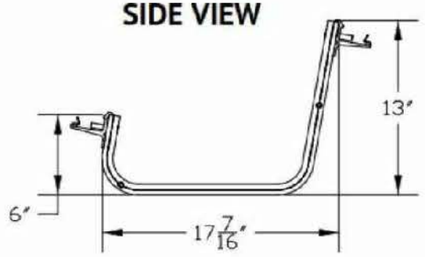
RACKING DETAILS



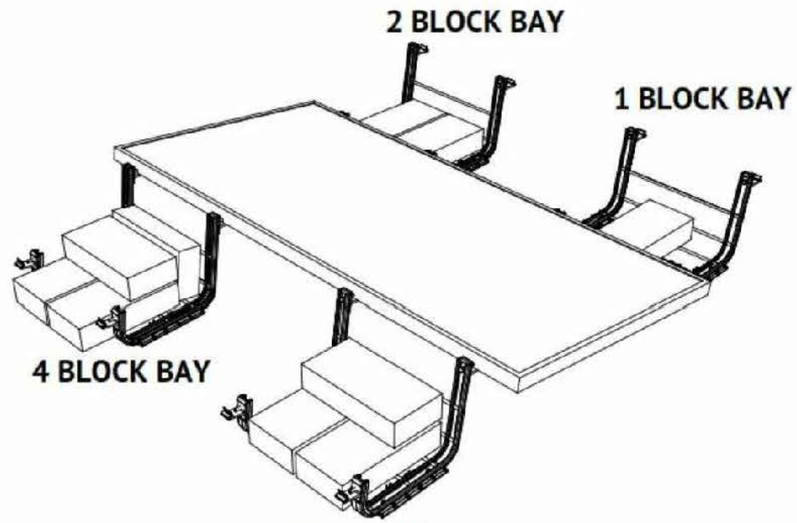
FRONT VIEW



SIDE VIEW



UNIRAC 1411 BROADWAY BLVD NE ALBUQUERQUE, NM 87102 USA WWW.UNIRAC.COM	PRODUCT LINE: RM DRAWING TYPE: COMPONENT ASSEMBLY DESCRIPTION: BAY & MODULE CLIPS REVISION DATE: APRIL - 2016	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL PRODUCT PROTECTED BY ONE OR MORE US PATENTS LEGAL NOTICE	RM-A01 SHEET



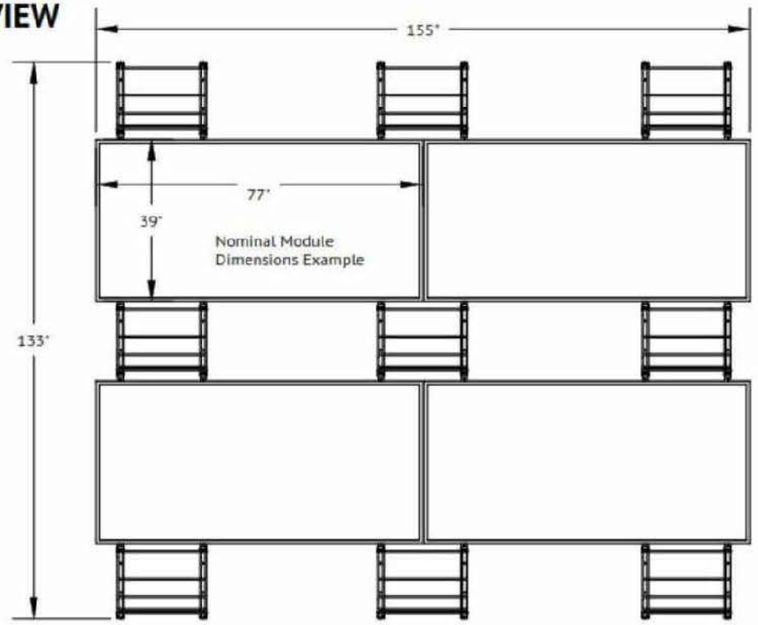
UNIRAC 1411 BROADWAY BLVD NE ALBUQUERQUE, NM 87102 USA WWW.UNIRAC.COM	PRODUCT LINE: RM DRAWING TYPE: ASSEMBLY DESCRIPTION: 1-2-3-4 BLOCK RM BAYS REVISION DATE: APRIL - 2016	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL PRODUCT PROTECTED BY ONE OR MORE US PATENTS LEGAL NOTICE	RM-A02 SHEET

ELEMENTAL ENERGY	DESIGNED BY: N. VAN ALMELO CHECKED BY: G KAMPS	ELEMENTAL ENERGY CB 195151	MATTHEW STANLEY 23RD AND MARINE DRIVE, ASTORIA, OR 97103	RACKING DETAILS	PV-03.1	REV: PRE 8/17/2018

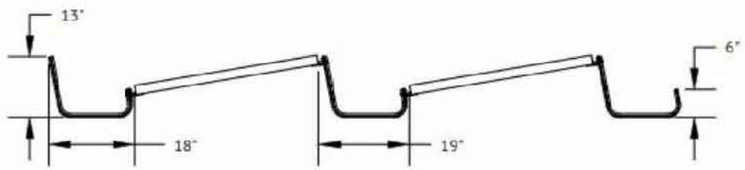
RACKING DETAILS

NOTE: ARRAY DIMENSIONS WILL VARY BASED ON MODULE WIDTH, LENGTH AND RETURN FLANGE

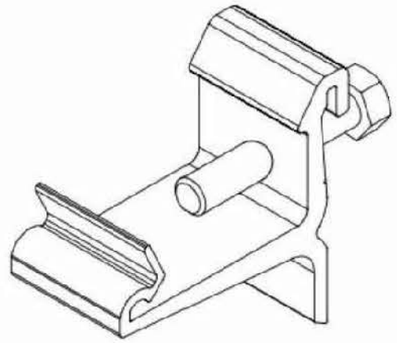
TOP VIEW



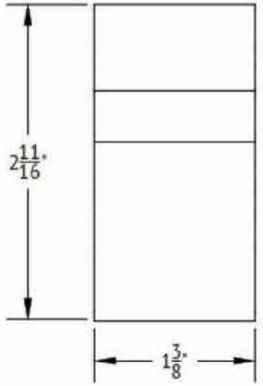
SIDE VIEW



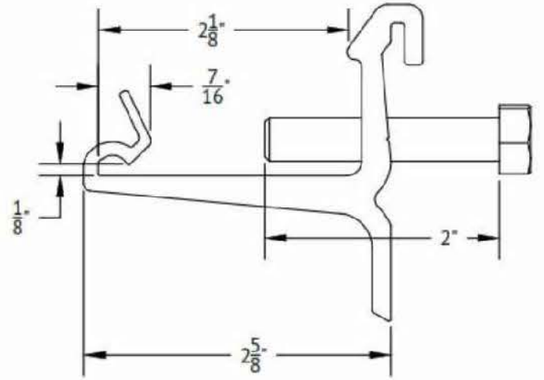
UNIRAC	
1411 BROADWAY BLVD NE ALBUQUERQUE, NM 87102 USA	
WWW.UNIRAC.COM	
PRODUCT LINE:	RM
DRAWING TYPE:	ASSEMBLY
DESCRIPTION:	4 MODULE RM LAYOUT
REVISION DATE:	APRIL - 2016
DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL	
PRODUCT PROTECTED BY ONE OR MORE US PATENTS	
LEGAL NOTICE	
RM-A03	
SHEET	



FRONT VIEW



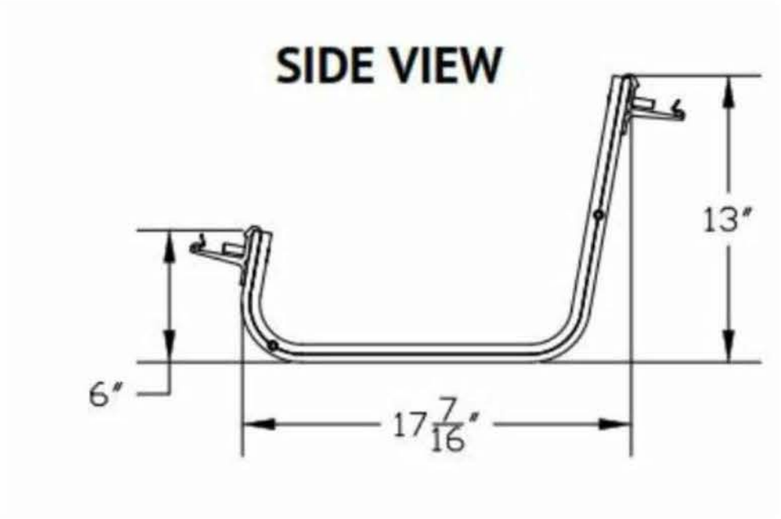
SIDE VIEW



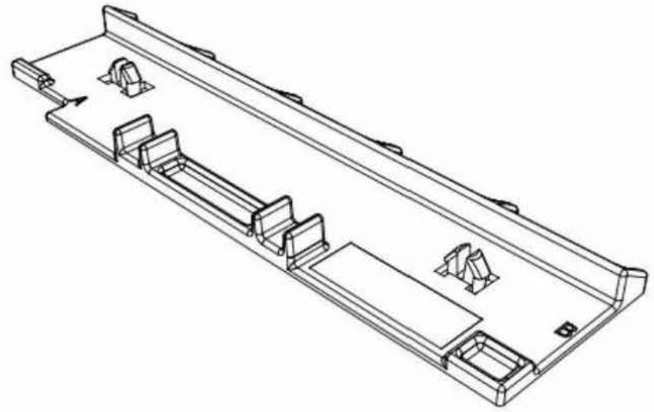
UNIRAC	
1411 BROADWAY BLVD NE ALBUQUERQUE, NM 87102 USA	
WWW.UNIRAC.COM	
PRODUCT LINE:	RM
DRAWING TYPE:	PART
DESCRIPTION:	RM CLIP & BOLT
REVISION DATE:	APRIL - 2016
DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL	
PRODUCT PROTECTED BY ONE OR MORE US PATENTS	
LEGAL NOTICE	
RM-P01	
SHEET	

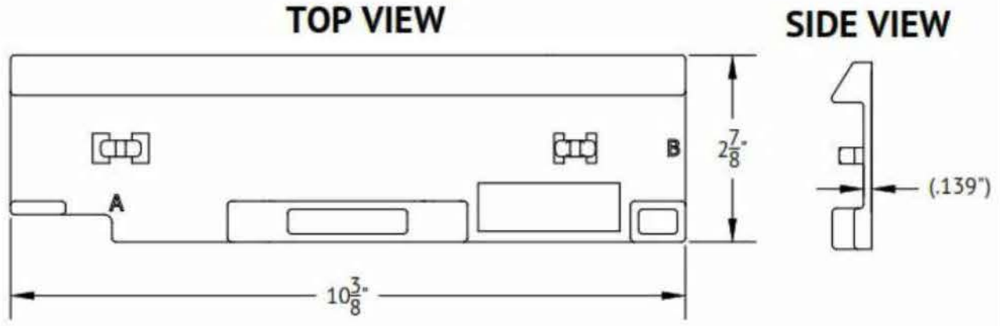
ELEMENTAL ENERGY	DESIGNED BY: N. VAN ALMELO CHECKED BY: G KAMPS	ELEMENTAL ENERGY CB 195151	MATTHEW STANLEY 23RD AND MARINE DRIVE, ASTORIA, OR 97103	RACKING DETAILS	PV-03.2	REV: PRE 8/17/2018

RACKING DETAILS



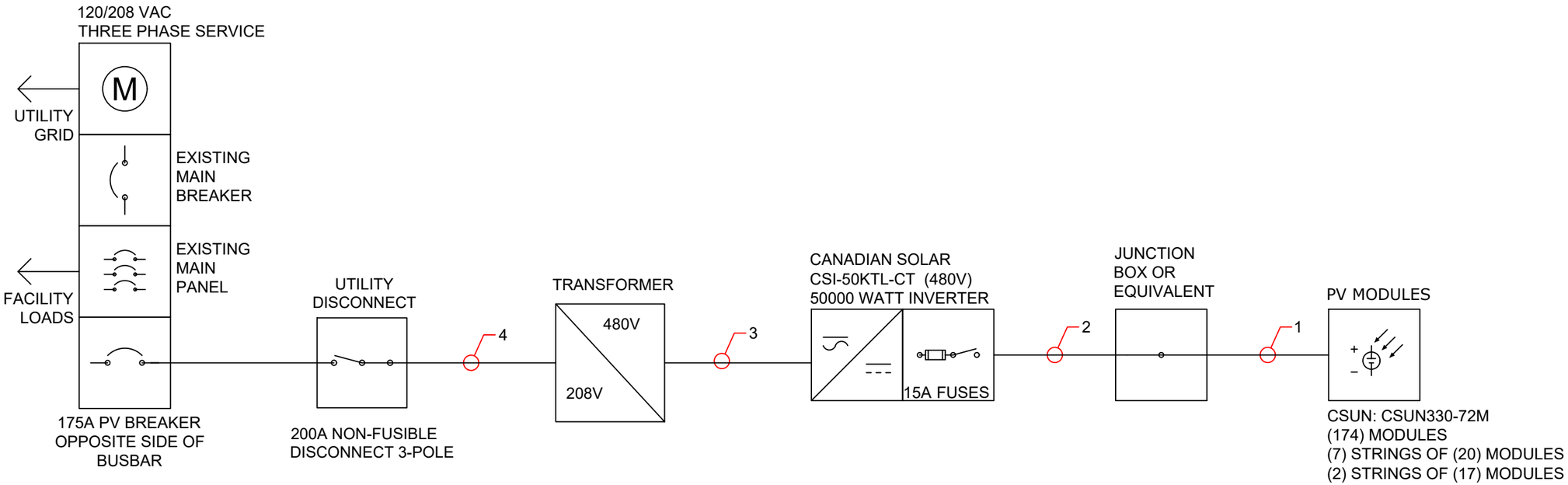
Material: TPE 70 Shore A: Santoprene 201-73,
Elastocon 2870 or Unisoft TPE ST-70A BK-2-01.
Color: Black





UNIRAC 1411 BROADWAY BLVD NE ALBUQUERQUE, NM 87102 USA WWW.UNIRAC.COM	PRODUCT LINE:	RM	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL	RM-P02
	DRAWING TYPE:	PART		
	DESCRIPTION:	RM FOOT PAD	PRODUCT PROTECTED BY ONE OR MORE US PATENTS	
	REVISION DATE:	APRIL - 2016	LEGAL NOTICE	SHEET

ELEMENTAL ENERGY	DESIGNED BY: N. VAN ALMELO CHECKED BY: G KAMPS	ELEMENTAL ENERGY CB 195151	MATTHEW STANLEY 23RD AND MARINE DRIVE, ASTORIA, OR 97103	RACKING DETAILS	PV-03.3	REV: PRE 8/17/2018



CONDUIT SCHEDULE

#	CONDUIT	CONDUCTOR	NEUTRAL	EGC
1	NONE	(2) 10 AWG PV WIRE	NONE	N/A
2	(9) 3/4" EMT OR EQUIV.	(2) 10 AWG THWN	NONE	#6 AWG BARE
3	1-1/4" EMT OR EQUIV.	(2) #4 AWG: THHN/THWN-2	(1) #6 AWG: THHN/THWN-2	(1) #6 GND
4	2" EMT OR EQUIV.	(2) #2/0 AWG: THHN/THWN-2	(1) #2/0 AWG: THHN/THWN-2	(1) #6 GND

POINT OF INTERCONNECTION:
BACKFED BREAKER ON MAIN PANEL
1. ADD175 AMP PV BREAKER TO MAIN PANEL

ELECTRICAL NOTES:
1. PHOTOVOLTAIC SYSTEM WILL COMPLY WITH 2017 NEC.
2. ELECTRICAL SYSTEM GROUNDING WILL COMPLY WITH 2017 NEC.
3. MODULES CONFORM TO AND ARE LISTED UNDER UL 1703.
4. INVERTER CONFORMS TO AND IS LISTED UNDER UL 1741.
5. ARRAY DC CONDUCTORS ARE SIZED FOR DERATED CURRENT.
   9.2 AMPS MODULE SHORT CIRCUIT CURRENT.
   14.35 AMPS DERATED SHORT CIRCUIT CIRCUIT (690.8 (a) & 690.8 (b)).

MODULE CHARACTERISTICS		
CSUN: CSUN330-72M	330	W
OPEN CIRCUIT VOLTAGE	46.1	V
MAX POWER VOLTAGE	37.7	V
SHORT CIRCUIT CURRENT	9.2	A
SHORT CIRCUIT CURRENT (690.8(A)(1))	11.50	A

SYSTEM CHARACTERISTICS		
INVERTER OPERATING AC VOLTAGE	480	V
UTILITY VOLTAGE	208	V
NOMINAL OPERATING AC FREQUENCY	60	HZ
MAXIMUM AC POWER	50000	W
MAXIMUM AC CURRENT	138	A
MAXIMUM OVERCURRENT DEVICE RATING FOR AC MODULE PROTECTION	175	A
MAX DC VOLTAGE	962	V
VOLTAGE MAX POWER	630	V

VOLTAGE DROP CALCULATIONS

MODULES TO INVERTER: (80FT. MAX)
%VD = (2 x 80 ft x 9.2 A x .99Ω/1000 ft.)/630 V = .73%

INVERTER TO TRANSFORMER: (30 FT. MAX)
%VD = (2 x 30 ft x 60.2 A x .25 Ω/1000 ft.480 V = .40%

TRANSFORMER TO INTERCONNECTION: (15 FT MAX)
%VD = (2 x 10 ft x 138 A x .078 Ω/1000 ft.)/208 V = .17

TOTAL DC V.D. = .73%
TOTAL AC V.D. = .40% + .17% = .57%

ELEMENTAL ENERGY

DESIGNED BY: N. VAN ALMELO CHECKED BY: G KAMPS	ELEMENTAL ENERGY CB 195151	MATTHEW STANLEY 23RD AND MARINE DRIVE, ASTORIA, OR 97103	SINGLE LINE DIAGRAM	PV-04	REV: PRE 8/17/2018

SOLAR PORTFOLIO

80.6kW Grid-Tied Solar PV System

The Doctors Luce Pediatrics | Beaverton, Oregon

SOLAR PORTFOLIO

55.2kW Grid-Tied Solar PV System

Metroeast Community Media | Gresham, Oregon

SOLAR PORTFOLIO

39.6kW Grid-Tied Solar PV System

Mazama Mountaineering Center | Portland, Oregon

SOLAR PORTFOLIO

31kW Ground-mount Solar PV System

Log Homes Store + Vineyard | Sheridan, Oregon

SOLAR PORTFOLIO

26kW Off-grid Solar PV System + Battery Storage

Stephen Mazujian Middle School | Siem Reap, Cambodia

In partnership with Twende Solar (a non-profit founded by Elemental Energy), EE volunteers designed and installed a 26kW off-grid PV system***—empowering a generation of Cambodian Students.***

SOLAR PORTFOLIO

6kW Off-Grid Solar PV System + Battery Storage

Oaxaca, México

A future-proof design for eventual grid connection, this 6kW off-grid system includes satellite internet and a custom battery storage room for safe keeping.

SOLAR PORTFOLIO

18.7kW Grid-Tied Solar PV System

Street of Dreams | Happy Valley, Oregon

Quote: 07312018ZKH Date: 7-31-18

Matt
Astoria Co-op

Dear Matt,

Thank you for opportunity to quote your solar needs.

1. Scope of Work for 57.4kW Solar Array
    a. Submittal Design, Preparation and Shop Drawings of 57.4kW PV System
    b. Turn-key installation, inclusive of interconnection
    c. All equipment & Installation manuals
2. Price for 57.4kW PV System, Less Permitting & Engineering: $138,242.67

Regards,

Elemental Energy
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