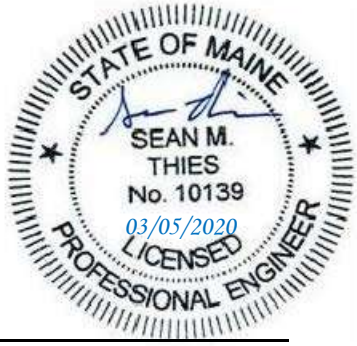
MEMO



To: Megan Norwood, City Planner II, City of Auburn

From: Sean Thies, P.E., Senior Project Manager, CES, Inc. (CES)

Re: BD Solar Auburn, LLC | Development Review Application

Date: March 5, 2020

CES has prepared this Memo in response to requests from the City of Auburn Planning Department for BD Solar Auburn, LLC's Development Review Application. The requirements are written in italics, followed by CES' response.

Special Exception Standards

Although the project is not required to meet the City of Auburn Draft Solar Ordinance as it has not yet been approved, CES is confident the project complies with the new regulations. The City has requested additional information to show the project meets the Zoning Ordinance Special Exception criteria below, as these criteria align with the proposed Solar Ordinance.

Glare: Requires that solar panels be placed to minimize glare from impacting neighboring properties or roadways. For parcels within 2 nautical miles of the Auburn Lewiston Municipal Airport, a Solar Glare Hazard Analysis Tool Report is required to be submitted.

The Applicant is currently working with the Auburn Lewiston Municipal Airport to meet this requirement. Correspondence will be forwarded to the City upon completion.

Site Plan (#1): Protection of adjacent areas against detrimental or offensive uses on the site by provision of adequate surface water drainage, buffers against artificial and reflected light, sight, sound, dust and vibration; and preservation of light and air.

CES has performed stormwater calculations using HydroCAD to show that stormwater runoff will not increase at Summation Point 2. The location of Summation Point 2 is identified on Sheet C702. Results of revised calculations are provided below.

Sensible Solutions | www.cesincusa.com
465 South Main Street
PO Box 639
Brewer, Maine 04412
T 207.989.4824
F 207.989.4881

Vegetative buffers are being proposed to treat new impervious areas. New impervious areas include piling which support the solar panels, the new roadway and equipment pads. The pilings will be self-treating by the surrounded meadow area. The road and equipment pads will be treated using roadside meadow buffers. These buffers will be maintained to the standards of the Maine Department of Environmental Protection, as described in **Appendix 10** of the **City of Auburn Development Review Application.**

A majority of the site perimeter is wooded, buffering adjacent properties from any potential reflected light. Please see the attached Glint and Glare from Solar PV Panels report, describing that glare from solar panels is limited. Visual buffering will be accomplished by maintaining existing woodland along property boundaries.

The project is not expected to create adverse impacts due to noise, dust, vibration, light pollution, or air emissions.

Special Exception (#2): *That the special exception sought will neither create nor aggravate a traffic hazard, a fire hazard or any other safety hazard.*

As discussed in the **Site Plan Review Narrative** on Page 3, the project is not expected to impact adjacent street traffic or create traffic hazards. A Knox Box will be installed at the access gate to allow emergency vehicle access, if necessary. The Applicant will coordinate use of the Knox Box with the local fire department upon construction completion.

Special Exception (#4): That the exception sought will not alter the essential characteristics of the neighborhood and will not tend to depreciate the value of property adjoining and neighboring the property under application.

The project site is in the Industrial Zone, and in the vicinity of similar land uses. For example, the property is surrounded by the railroad on all project boundaries. There are several nearby commercial properties including the Lewiston Auburn Municipal Airport which is just south of Lewiston Junction Road.

City of Auburn Review Comments

The following italicized comments were provided by the City of Auburn Planning Department.

1. *We are showing a couple of structures/impervious area on the two parcels adjacent to the detention pond. Have those already been demolished? In the application materials you state there isn't any impervious area currently, so I just want to make sure they've already been demolished/removed.*

   This appears to be correct according to Google Earth imagery from 2018. Stormwater calculations have been revised to include an estimated 14,389 SF of impervious area from existing structures. These structures will be removed prior to installation of the solar array.

2. *Do you have the redesign of the width of the access road and addition of turnarounds? The Engineering Department is waiting for that information before issuing their signoff on the project because they say it will completely change the stormwater calculations.*
    a. *On the same note, could you highlight where the access drives are located on the site? Based on the plan, it appears you have one proposed where the underground utilities are located. Are there any other small access roads to access the panels in an emergency or how would that work? It also isn't clear to us where the access road itself will be accessed from. Will access be through another parcel off of Lewiston Junction Road?*

Please refer to the attached Site Plan, revised. The stormwater calculations were previously performed assuming a 24-foot wide road, which exceeds the design road width of 20-feet. The calculations have been revised, reducing impervious areas to reflect the 20-foot wide road and increasing areas for the three new turnarounds. Impervious areas decreased by 3,134 Sf, 2,390 SF and 2,130 SF for sub-catchments 1, 2 and 3, respectively. The existing impervious area not previously accounted for in sub-catchment 1 was also added to pre-development conditions. The following table summarizes the revised pre- and post-development stormwater runoff. The stormwater runoff results in the table below show that the estimated runoff has not changed from the original submission.

		2 Year (cfs)	10 Year (cfs)	25 Year (cfs)	25 Year Net Change	25 Year % Change
Summation Point 1 (Auburn)	Pre	24.92	53.05	79.76	**-3.28**	**-4.1**
	Post	24.08	51.00	76.48		
Summation Point 2 (Poland)	Pre	0.41	5.48	13.87	**0.59**	**4.3**
	Post	0.21	5.01	14.46		

The site will be accessed from an existing gravel road off Lewiston Junction Road. Only one access road is being proposed.

3. *Do you have a plan for decommissioning the facility at the end of its useful life?*

   Please refer to the enclosed Decommissioning Plan.

4. *I obviously assume this is the case, but I have to ask just to make sure. You won't exceed 30 feet with any of the proposed structures, correct? If you do, it is okay because the Industrial District allows up to 75 feet in height, however, the new ordinance created by the Planning Board would cap solar projects at 30 feet and it would be good for the PB if we could demonstrate that the project meets that standard (which they assume is easily attainable with solar projects).*

   The solar panels will be approximately 9.8' to 11.5' high at the tallest point of the solar panels and will therefore not exceed 30-feet in height. Please see the attached Terraglide Fixed-Tilt Ground Mount technical data sheet.

5. *The Industrial District has specific landscaping standards between nonresidential uses (Evergreen tree line planted in staggered rows having the base of the trees not more than 10 feet apart. The width of the screened buffer line shall not be less than 15 feet). It appears some of the panels are located in close proximity to the property line. A buffer such as this may be prohibitive to the solar project due to shading, etc. Could you provide a response to those landscaping standards that we could provide to the Planning Board? The Planning Board will likely ask for a waiver request to be submitted and justification for the waiver. For reference the Ordinance section is: Sec. 60-579(3)(g)(4).*

   The proposed tree-line has been revised in the southeast property corner to maintain existing woodland within 15-feet of the property line.

6. *Address Items in bold:*

(2) A narrative describing the proposed Solar Energy Generating System, including an overview of the project; the project location; ***the total rated capacity of the solar energy system; dimensions of all components and respective manufacturers****; and a description of associated facilities and how the system and associated facilities comply with the standards of this ordinance.*

The total rated capacity of the solar energy system is 9.98 MW (AC). The dimensions of all components and respective manufacturers are:

- Inverters: Each inverter is attached to a transformer skidlet. Together they have the footprint of a 20 foot container. Please see datasheet of the inverter and drawing of transformer skidlet attached.

- Modules: There will be 2 modules used in the projects Risen (2034x1000 mm) and Talesun (2031x1011 mm). Please see datasheets attached.

(3) An accurate scaled site plan of the subject property showing the planned location of the proposed Solar Energy Generating System and all associated facilities; property lines, adjoining streets and access; topographic contour lines; existing and proposed buildings; fencing; structures; ***potential shade from nearby trees and structures****; vegetation; driveways, parking and curb cuts on the subject property;* ***specifications for all proposed electrical cabling/transmission lines****,* ***accessor equipment*** *and landscaping,* ***including the tallest finished height of the solar collectors and name****, address, phone number and signature of the project proponent, as well as co-proponents or property owners, if any, the names, contact information and signature of any agents representing the project proponent. The site plan shall show* ***any proposed off-site modifications to provide grid connections****, access the installation, or to maintain the proposed solar energy system.*

Please refer to the revised Site Plan showing the proposed tree-line. Although shading of the panel will be avoided along the majority of the project, some shading from vegetation may occur to meet City landscaping standards. The grid interconnection is also shown on **C-101 Site Plan**. Please refer to the attached technical data for information on accessory equipment.

(4) Information on any connections to the grid including evidence of meeting the ***local electric utility's transmission and distribution interconnection requirements (this may be a condition of approval if a copy of the application for interconnection with the electric utility provider is submitted)****.*

All the equipment meets the local utility requirements as the same equipment was approved in other projects. The interconnection application was submitted for the utility to review this specific project.

(5) ***Documentation that the solar generation equipment has been approved under the UL certification program and that the system complies with all applicable local, state and federal codes/regulations with the standards regarding signal interference. Electrical component and connection information shall be in sufficient detail to allow for a determination that it meets Maine electrical codes.***

This will be verified by the electrical utility in the interconnection application process. Approval of the application will be forwarded to the City upon receipt.

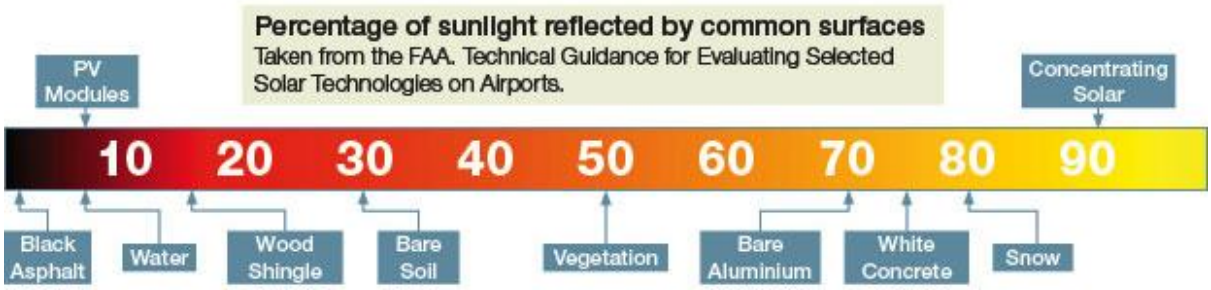
Final electrical design plans can be provided to the City during the building permit application process.

Glint and Glare from Solar PV Panels

Glint and glare from reflective surfaces, such as glass buildings, in close proximity to airports pose a challenge for pilots and air traffic control. Glint is the result of the direct reflection of the sun's light, while glare is the result of diffused light and is a continued source of brightness. However, glint and glare are dependent on several factors including time of day, angle of the reflective surface and the direction of ascent and descent of aircraft. In the case of PV arrays glint and glare are minimal. In the figure presented below, PV modules are found to reflect the same amount of sunlight similar or less than water bodies, which is less than other materials that make up the built environment, namely, aluminium (and other metals), white concrete and vegetation.

The misconception that PV panels reflect sunlight, likely stems from the understanding that in the case of thermal and CSP sunlight is used to generate heat with mirrors. However, PV panels do not generate heat rather they are designed to absorb heat and light to generate electricity. Efficiency of panels is tied to how well light is absorbed, therefore, by design they are intended to reflect little to no light. Moreover, as the technology for panels advances silicon panels are becoming more efficient. As panels are mounted and fixed at a specific angle and designed to absorb light that hits the panel directly at a 90^{o} degree angle, if the angle at which light hits panels is not 90^{o}, then there is some potential that glint and glare are generated. The greatest amount of glare being generated when the sun is low on the horizon. However, this is a challenge that would be faced by pilots and air traffic control at sunrise and sunset irrespective of the presence of solar PV arrays.

In spite of the concern over the risk of glint and glare, airport-solar partnerships have been immensely successful. According to the FAA there are over 30 solar projects operating in proximity of 15 airports in the US[1]. Many airports in Europe have installed solar PV arrays adjacent to runways and terminals such as Munich, Athens, Berlin and Gatwick international airports. Further, the installation of solar panels have yield immense benefits for airports in terms of increasing their energy efficiency, and aid in cooling the building and surrounding environment by absorbing light. Ultimately, solar PV panels pose little risk to the operations of airports as they generate minimum glint and glare.



Source: http://www.solarcentury.com/uk/media-centre/glint-and-glare-how-dazzling-is-pv/

[1] http://www.solarindustrymag.com/issues/SI1306/FEAT_02_Glare_Factor.html

DECOMMISSIONING PLAN

1. Project Description

BD Solar Auburn LLC is proposing to develop a solar energy farm in Auburn, Maine. A solar array consists of photovoltaic panels that transform sunlight into usable energy. The facility will have approximately 36,072 individual panels transforming sunlight each day into usable energy that is fed into the regional electric grid. Annually the project will generate enough electricity to power over 3,000 Maine homes. Estimated operational life of the project will be 40 years with option to extend.

The project consists of a 14.6 Megawatt ("MW") solar array to generate power that will be sold under a long-term contract to Central Maine Power under the Maine Community Renewables Program ("MCR"). The MCR program was established to promote the construction of small scale renewable energy projects in the State of Maine that would be owned by qualified Maine companies to maximize the value of renewables to local communities.

2. Construction

The solar energy farm will be located on a property that is currently primarily of wooded area, wetlands, and some open grassed and gravel surfaces. The ground-mounted solar panels will be located within a fenced area approximately 45 acres in size. A gravel road will be constructed to access the solar panels within the fenced area. Each solar panel will rest on a galvanized steel and aluminum frame and will be located on a metal pole that will be driven into the ground. Utility trenches will be excavated to install the underground electrical lines leading to each string of solar panels. Once the utilities are installed the utility trench will be filled and seeded to maintain a consistent grassed surface. Concrete slabs will be installed to hold the necessary inverters/transformers required to operate the solar array.

3. Decommissioning Process

This section sets out the details and different steps of decommissioning the solar farm.

a) Deconstruction: DC-Cabling

All inverter systems and electrical components of the PV-System will be switched off. In following all plug-in connectors and string cables will be disconnected. To remove the cables which are laid in the ground, all cable trenches will be opened. In the following all cables will be removed and separated. After the uninstalling of the wiring the materials will be deposed in accordance to the disposal regulations for metal waste which applies at the installation site at the time.

b) Deconstruction: PV-Modules

All PV-Modules would be removed and separated from mounting system and removed from the site. After removal the PV-Modules will be reused or recycled.

c) Deconstruction: Inverters / Transformers / Substation

After the uninstallation of the entire monitoring system (cabling + components) the inverter / transformer stations as well as the substation will be removed from the site. The concrete foundations will be removed and the wholes will be filled with soil. Than the transformer stations will be removed and disposed in accordance with the disposal regulations for metal and concrete waste which apply at the installation site at the time.

d) Deconstruction: Mounting System

The mounting system will be removed completely. The deconstruction shall proceed as follows: I. module carrier system, II. purlin profiles, III. posts The disposal of the materials will be done in accordance with the disposal regulations for metal waste which applies at the installation site at the time.

e) Deconstruction: AC- Cabling / Earthing

All AC-cables and combiner boxes will be disconnected and removed. To remove the cables which are laid in the ground, all cable trenches will be opened. In the following all cables and earth stripes will be removed and separated. The cable trenches will be back filled and paved again. After the uninstalling of the entire wiring the materials would be disposed in accordance to the disposal regulations for metal waste which applies at the installation site at the time.

f) Deconstruction: Fence and Alarm System

All parts of the fence as well as the alarm system will be removed. The disposal of the materials follows in accordance with the disposal regulations for metal waste which apply at the installation site at the time.

g) Ground Regulation

When the decommission works are completed the land will be returned to its original state.

All equipment and fixtures removed from the solar farm will either be reused, recycled, or disposed of at the time of decommissioning. Upon decommissioning of this solar farm, reuse of the solar panels will be the priority. If reuse is not feasible, the solar panels will be recycled in accordance with the PV CYCLE USA waste management scheme, or similar. Items that are not able to be reused or recycled will be disposed of in accordance with local rules and regulations.

4. Cost

Based on the value of recyclable materials that make up the solar farm, it is expected that the salvage cost will outweigh the labor cost to remove the materials and restore the site. We have researched the current price estimates for the disassembly & disposal of the solar equipment, site restoration, and value of salvageable materials and have made the following assumptions:

- Current labor costs have been approximated to be $20 per hour for the state of Maine, according to the Bureau of Labor Statistics. We have assumed 2% inflation per annum over lifetime of the projects (40 years).
- Salvage values have been estimated using data from http://www.scrapmonster.com

- PV modules have been assumed to have salvageable value that is 15% of the original cost.
- A 95% salvageable rate was assumed for PV modules.

Projected Cost of Decommissioning		
Labour Costs		
Item	Tasks	Estimated Current Labor Cost
1	Remove PV Modules	$127,660.90
2	Remove Inverters	$4,320.83
3	Remove Transformer	$785.61
4	Dismantle and Remove Racking Frames	$9,034.46
5	Dismantle and remove Racking Posts	$11,587.68
6	Remove LV Wiring	$17,283.32
7	Remove MV Wiring and equipment	$5,106.44
8	Remove Fence	$13,551.70
9	Remove Concrete	$785.61
10	Remove Gravel	$25,139.38
11	Re-seed	$4,910.03
12	Transportation costs	$4,910.03
Total Cost		**$225,075.99**
Salvageable Parts and Materials		
Item	Parts / Materials	Estimated Current Salvageable Cost
1	PV Modules (95% of original amount)	$199,525.42
2	Inverters / Transformers	$1,452.50
3	Racking Frame	$73,172.86
4	Racking Posts	$27,626.73
5	LV Wiring (aluminum/copper)	$124,237.84
6	MV Wiring (aluminum)	$298.08
7	Chain Link Fence	$9,873.40
Total Salvage Value		**$436,186.83**
Net Decommissioning Cost		**-$211,110.84**

5. Force Majeure

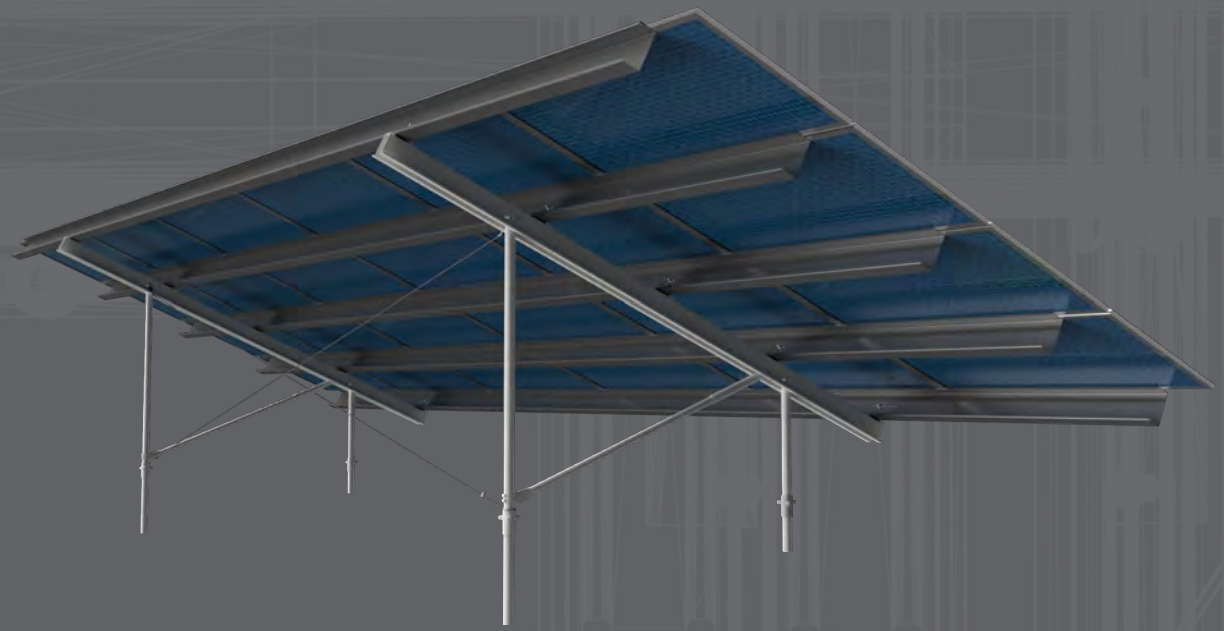
An exception to these requirements will be allowed for a force majeure event, which is defined as any event or circumstance that wholly or partly prevents or delays the performance of any material obligation arising under the Project permits, but only to the extent:

- Such event is not within the reasonable control, directly or indirectly, of BD Solar Auburn LLC (including without limitation event such as fire, earthquake, flood, tornado, hurricane, acts of God and natural disasters; war, civil strike or similar violence);
- BD Solar Auburn LLC has taken all responsible precautions and measures to prevent or avoid such event or mitigate the effect of such event on BD Solar Auburn LLC's ability to perform its obligations under the Project permits and which, by the exercise of due diligence, it has been unable to overcome; and

- Such event is not the direct or indirect result of the fault of negligence of BD Solar Auburn LLC.

In the event of force majeure event, which results in the absence of electrical generation by one or more solar panels for 12 months, BD Solar Auburn LLC will demonstrate to MDEP by the end of the 12 months of non-operation that the Project, or any single solar panel, will be substantially operational and producing electricity within 24 months of the force majeure event. If such a demonstration is not made to MDEP's satisfaction, the decommissioning of any single solar panel only (and no other part of the Project that is operational) or if the entire Project is not substantially operational and producing electricity, then decommissioning of the Project will be initiated 18 months after the force majeure event.

TERRASMART.



(239) 362-0211 | WWW.TERRASMART.COM

TERRAGLIDE - TGL

Fixed-Tilt Ground Mount

OVERVIEW

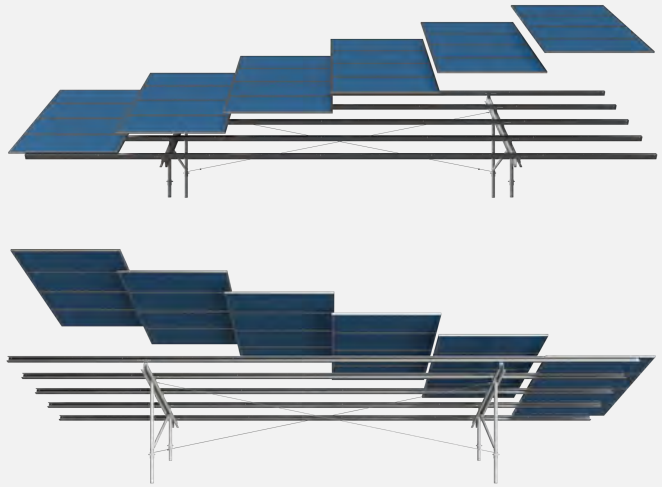
TerraGlide is TerraSmart's front line fixed-tilt ground mount racking solution that offers complete bifacial module compatibility. TGL is the culmination of nine years and over 2 gigawatts of installed-capacity experience in engineering, manufacturing and construction. As a result, TerraGlide is currently the most economical racking system in TerraSmart's fixed-tilt ground mount racking portfolio.

Leveraging the benefits of TerraSmart's widely deployed proprietary ground screw foundation, TGL is designed to work in any soil condition ultimately offering customers increased install efficiency, reduced labor hours and a significant savings in material costs.

START SMART. BUILD SMART.

SPECS

Structural Material Specifications	Cold Rolled Steel Galvanized to ASTM A653 (G90 min) ASTM A 500 Hollow Structural Steel, Hot Dip Galvanized to ASTM A123 (3.0 mils min)
Hardware Material	316 Stainless Steel for Module Mounting Hardware Carbon Steel Alloy, Magni Coated to ASTM F2833 for all Structural Hardware
Foundation Options	Ground Screws
Module Orientation	Landscape
Module Mounting	Bottom Mount Bifacial Compatibility (Shadow Free Backside) Integrated Electrical Bonding
Tilt Angle	5 to 40 degrees
Wire Management	Incorporated in Structure – NEC Compliant
Configuration	Landscape Module Orientation up to 4 high x 6 wide
Slopes	East or West facing, up to 30%, north or south facing, up to 36%
Load Capacities	Project Specific; Up to 170 MPH wind speed and 100 PSF Ground Snow Load
Certifications	UL 2703, Edition 1; CPP Wind Tunnel Tested
Warranty	20 - year limited warranty



FAST
- Exponentially Less Hardware
- Integrated Electrical Bonding
- Included Wire Managment

COMPLIANT
- UL 2703, Edition 1 Listed
- NEC Compliant
- Wind Tunnel Tested

VERSATILE
- Numerous Configurations
- Adapts to Steep Slopes
- Accommodates Arduous Soils

LIGHT
- Lighter / Stiffer Components
- Less Freight Costs

(239) 362-0211 | WWW.TERRASMART.COM

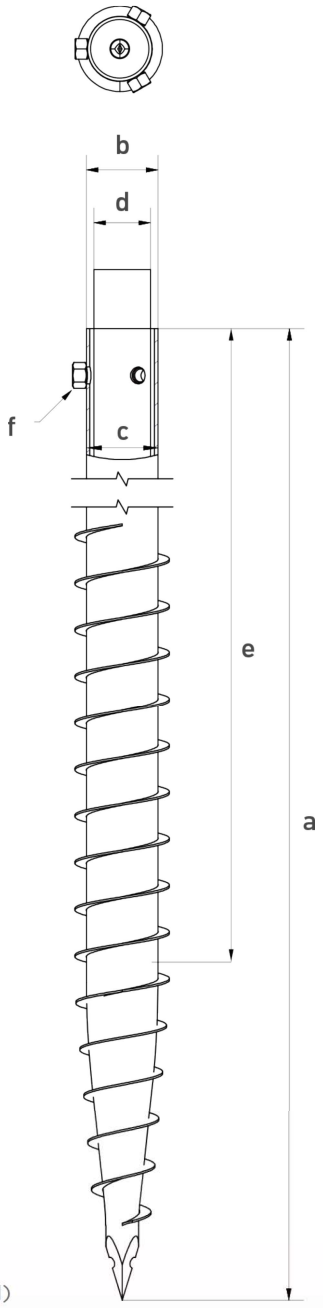
GROUND SCREW SPECIFICATION SHEET

KSF G 76x2400-3xM16

TERRASMART

SIDE VIEW (Fig 1)

a.	Length	94.0”
b.	Outside Diameter	3.0”
c.	Inside Diameter	2.7”
d.	Internal Adjustment	2.3”
e.	Depth	76.0”
f.	Adjustment Nuts	3 x M16



(Fig 1)

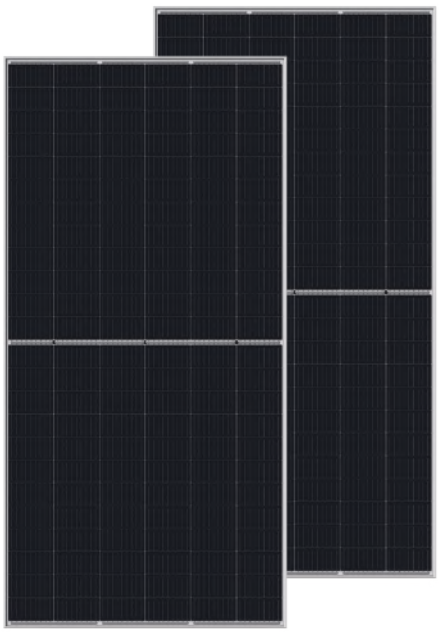
TALESUN

BIPRO

TD6G72M 144-cell

385 ~ 410W

bifacial dual glass
9BB half-cut mono perc



KEY FEATURES

9BB half-cut cell technology

New circuit design,lower internal current,lower Rs loss

Industry leading high yield

Bifacial PERC cell technology,
5%-25% more yield depends on different conditions

Excellent Anti-PID performance

2 times of industry standard Anti-PID test by TUV SUD

Wider application

No water-permeability and high wear-resistance,
can be widely used in high-humid, windy and dusty area

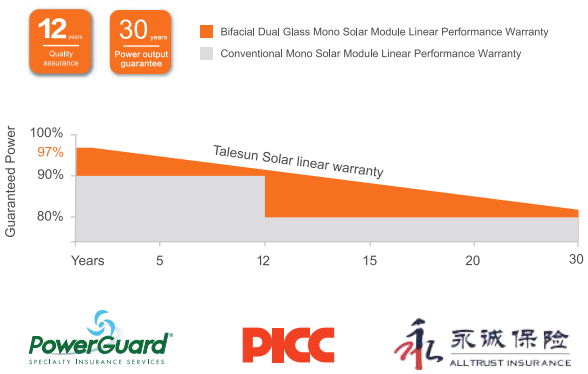
IP68 junction box

High waterproof level

SYSTEM & PRODUCT CERTIFICATES

- IEC 61215 / IEC 61730 / UL 1703
- ISO 9001 : 2015 Quality Management System
- ISO 14001 : 2015 Environment Management System
- ISO 45001 : 2018 Occupational Health and Safety Management Systems

PERFORMANCE WARRANTY



PowerGuard SPECIALTY INSURANCE SERVICES PICC 永诚保险 ALLTRUST INSURANCE

marketing.hq@talesun.com

Annual Module Capacity Globally : 8 GW
China : 7 GW
Thailand : 1 GW

Talesun Solar is one of the world's largest integrated clean energy providers, who develops, manufactures and delivers highly reliable and cost-effective solar modules and integrated PV energy solutions for every application and market, for homes, businesses and utility power plants. It was ranked as one of the top 10 module suppliers in 2018, and was also listed as global TIER1 module supplier by BNEF since 2015.

ELECTRICAL PARAMETERS

Performance at STC (Power Tolerance 0 - +3%)

Maximum Power(Pmax/W)	390	395	400	405	410
Operating Voltage(Vmpp/V)	40.2	40.5	40.8	41.1	41.4
Operating Current(Impp/A)	9.71	9.76	9.81	9.86	9.91
Open-Circuit Voltage(Voc/V)	48.5	48.7	48.9	49.1	49.3
Short-Circuit Current(Isc/A)	10.25	10.29	10.33	10.37	10.41
Module Efficiency ηm(%)	19.0	19.2	19.5	19.7	20.0

Performance at NMOT

Maximum Power(Pmax/W)	295	299	302	306	310
Operating Voltage(Vmpp/V)	37.7	38.0	38.3	38.6	38.9
Operating Current(Impp/A)	7.82	7.86	7.90	7.93	7.97
Open-Circuit Voltage(Voc/V)	45.7	45.9	46.1	46.3	46.5
Short-Circuit Current(Isc/A)	8.26	8.29	8.33	8.36	8.39

STC: Irradiance 1000W/m², Cell Temperature 25°C, Air Mass AM1.5 NMOT: Irradiance at 800W/m², Ambient Temperature 20°C, Air Mass AM1.5, Wind Speed 1m/s

Electrical characteristics with different rear side power gain (reference to 400W front)

Pmax gain	Pmax/W	Vmpp/V	Impp/A	Voc/V	Isc/A
5%	420	40.8	10.30	48.9	10.84
10%	440	40.8	10.79	48.9	11.36
15%	460	40.8	11.28	48.9	11.87
20%	480	40.8	11.77	48.9	12.39
25%	500	40.8	12.26	48.9	12.91

MECHANICAL SPECIFICATION

Cell Type	Half-cell 9 busbar
Cell Dimensions	158.75*158.75mm(6inches)
Cell Arrangement	144 (6*24)
Weight	26.8kg
Module Dimensions	2031*1011*30mm
Cable Length	500/500mm(19.69/19.69inches)
Cable Cross Section Size	4mm²(0.006inches²)
Front Glass	2.0mm (0.08inches) AR Coated Heat Strengthened Glass
Back Glass	2.0mm (0.08inches)Heat Strengthened Glass (White Grid Glass)
No.of Bypass Diodes	3/6
Packing Configuration	A: 32pcs/Pallet, 704 pcs/40hq
Frame	30 mm (1.18 inches) Anodized Aluminium Alloy
Junction Box	IP68

OPERATING CONDITIONS

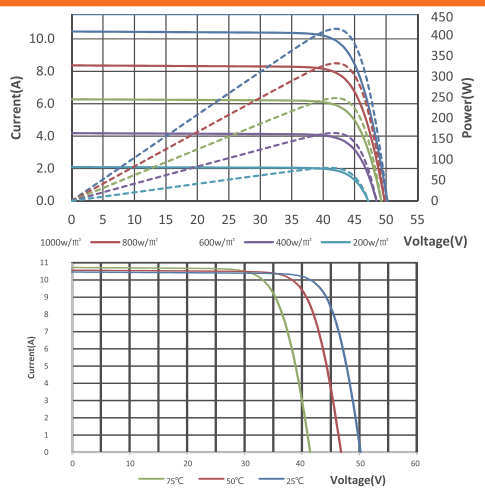
Maximum System Voltage	1500V/DC(IEC)
Operating Temp	-40°C-+85°C
Maximum Series Fuse	20A
Static Loading	5400pa
Conductivity at Ground	≤ 0.1Ω
Safety Class	II
Resistance	≥100MΩ
Connector	MC4 Compatible
Backside Output Ratio*	>75%

*Under STC: Backside Output Ratio = $P_{max(rear)}$ /$P_{max(front)}$

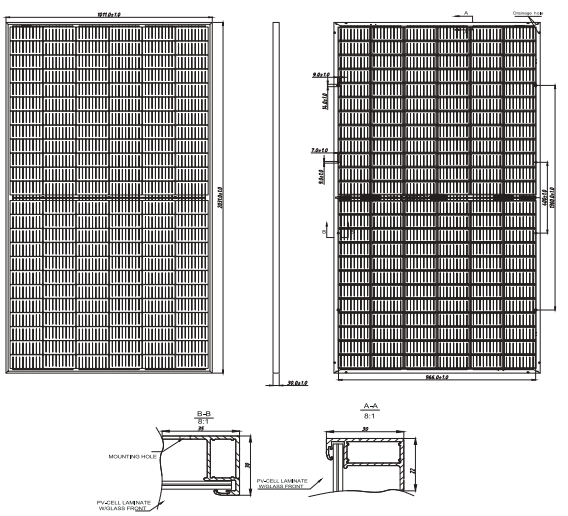
TEMPERATURE COEFFICIENT

Temperature Coefficient Pmax	-0.35%/°C
Temperature Coefficient Voc	-0.25%/°C
Temperature Coefficient Isc	+0.04%/°C
NMOT	41±3°C

I-V CURVE



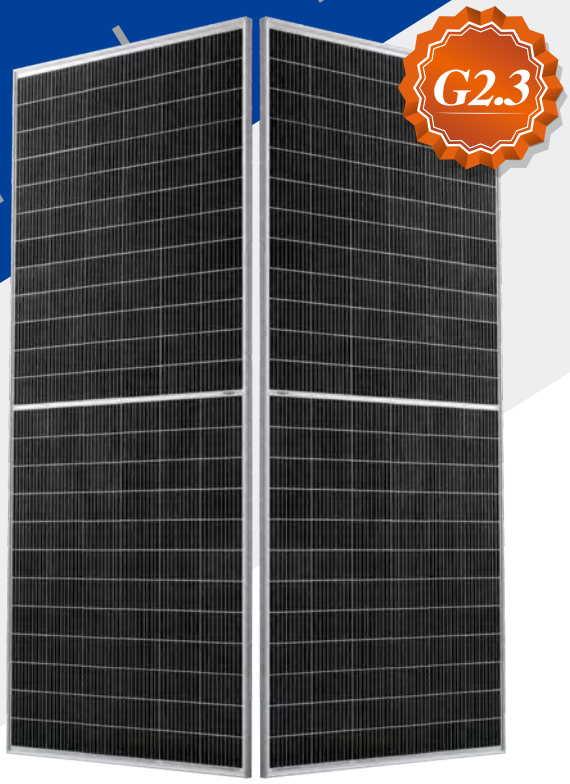
TECHNICAL DRAWINGS



TALESUN
www.talesun.com

Jäger Plus

HIGH PERFORMANCE
BIFACIAL PERC MONOCRYSTALLINE MODULE



RSM144-6-390BMDG-410BMDG

144 CELL
Mono PERC Module

390-410Wp
Power Output Range

1500VDC
Maximum System Voltage

20.2%
Maximum Efficiency

KEY SALIENT FEATURES

- Global, Tier 1 bankable brand, with independently certified state-of-the-art automated manufacturing
- Bifacial technology enables additional energy harvesting from rear side (up to 25%)
- Industry leading lowest thermal co-efficient of power
- Industry leading 12 years product warranty
- Excellent low irradiance performance
- Excellent PID resistance
- Positive tight power tolerance
- Dual stage 100% EL Inspection warranting defect-free product
- Module Imp binning radically reduces string mismatch losses
- Warranted reliability and stringent quality assurances well beyond certified requirements
- Certified to withstand severe environmental conditions
  - Anti-reflective & anti-soiling surface minimise power loss from dirt and dust
  - Severe salt mist, ammonia & blown sand resistance, for seaside, farm and desert environments
  - Excellent mechanical load 2400Pa & snow load 5400Pa resistance

ISO9001
ISO14001
OHSAS18001
IEC TS 62941

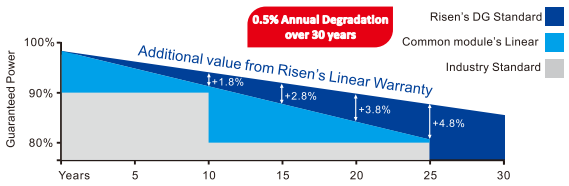
RISEN ENERGY CO., LTD.

Risen Energy is a leading, global tier 1 manufacturer of high-performance solar photovoltaic products and provider of total business solutions for residential, commercial and utility-scale power generation. The company, founded in 1986, and publicly listed in 2010, compels value generation for its chosen global customers. Techno-commercial innovation, underpinned by consummate quality and support, encircle Risen Energy's total Solar PV business solutions which are among the most powerful and cost-effective in the industry. With local market presence and strong financial bankability status, we are committed, and able, to building strategic, mutually beneficial collaborations with our partners, as together we capitalise on the rising value of green energy.

Tashan Industry Zone, Meilin, Ninghai 315609,Ningbo | PRC
Tel: +86-574-59953239 Fax: +86-574-59953599
E-mail: marketing@risenenergy.com Website: www.risenenergy.com

LINEAR PERFORMANCE WARRANTY

12 year Product Warranty / 30 year Linear Power Warranty

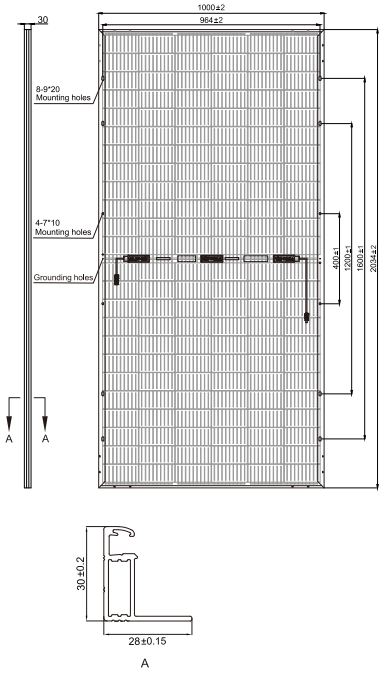


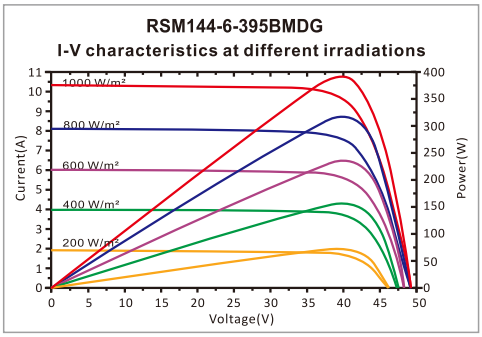
risen solar technology

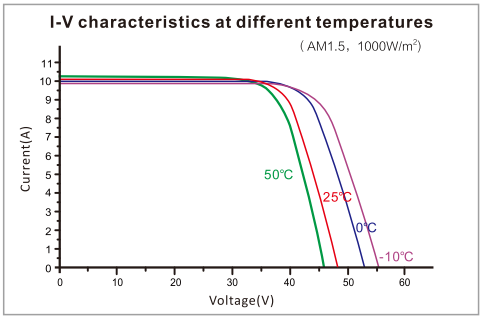
THE POWER OF RISING VALUE

Dimensions of PV Module

Unit: mm







Our Partners:

ELECTRICAL DATA (STC)

Model Number	RSM144-6-390BMDG	RSM144-6-395BMDG	RSM144-6-400BMDG	RSM144-6-405BMDG	RSM144-6-410BMDG
Rated Power in Watts-Pmax(Wp)	390	395	400	405	410
Open Circuit Voltage-Voc(V)	48.30	48.45	48.60	48.75	48.90
Short Circuit Current-Isc(A)	10.30	10.40	10.50	10.60	10.70
Maximum Power Voltage-Vmpp(V)	40.25	40.35	40.45	40.55	40.65
Maximum Power Current-Impp(A)	9.70	9.80	9.90	10.00	10.10
Module Efficiency (%)	19.2	19.4	19.7	19.9	20.2

STC: Irradiance 1000 W/m², Cell Temperature 25°C, Air Mass AM1.5 according to EN 60904-3.
Bifacial factor: 75%±5%

ELECTRICAL DATA (NMOT)

Model Number	RSM144-6-390BMDG	RSM144-6-395BMDG	RSM144-6-400BMDG	RSM144-6-405BMDG	RSM144-6-410BMDG
Maximum Power-Pmax (Wp)	291.8	295.6	299.3	303.1	306.9
Open Circuit Voltage-Voc (V)	44.40	44.60	44.70	44.90	44.99
Short Circuit Current-Isc (A)	8.45	8.53	8.61	8.69	8.77
Maximum Power Voltage-Vmpp (V)	36.90	37.00	37.05	37.14	37.24
Maximum Power Current-Impp (A)	7.92	8.00	8.08	8.16	8.24

NMOT: Irradiance at 800 W/m², Ambient Temperature 20°C, Wind Speed 1 m/s.

MECHANICAL DATA

Solar cells	Monocrystalline, 9BB
Cell configuration	144 cells (6×12+6×12)
Module dimensions	2034×1000×30mm
Weight	27kg
Superstrate	2.0 mm, High Transmission, Low Iron, Tempered ARC Glass
Substrate	2.0 mm, Tempered Glass
Frame	Anodized Aluminium Alloy type 6063T5, Silver Color
J-Box	Potted, IP68, 1500VDC, 3 Schottky bypass diodes
Cables	4.0mm² (12AWG), Positive(+) 270mm, Negative(-) 100mm
Connector	Risen Twinsel PV-SY02, IP68

TEMPERATURE & MAXIMUM RATINGS

Nominal Module Operating Temperature (NMOT)	45°C±2°C
Temperature Coefficient of Voc	-0.28%/°C
Temperature Coefficient of Isc	0.05%/°C
Temperature Coefficient of Pmax	-0.36%/°C
Operational Temperature	-40°C~+85°C
Maximum System Voltage	1500VDC
Max Series Fuse Rating	20A
Limiting Reverse Current	20A

PACKAGING CONFIGURATION

	40ft
Number of modules per container	770
Number of modules per pallet	35
Number of pallets per container	22
Packaging box dimensions (LxWxH) in mm	2100×1130×1135
Box gross weight[kg]	1000

CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

SUNGROW

SG2500U

Turnkey Station for North America 1500 Vdc System

High Yield

- Advanced three-level technology, max. efficiency 98.8%, CEC efficiency 98.5 %
- Effective cooling, 1.1 overload capacity, no derating up to 122 °F
- Max. DC/AC ratio more than 1.5

Easy O&M

- Integrated current and voltage monitoring function for online analysis and fast trouble shooting
- Modular design, easy for maintenance
- Convenient external LCD

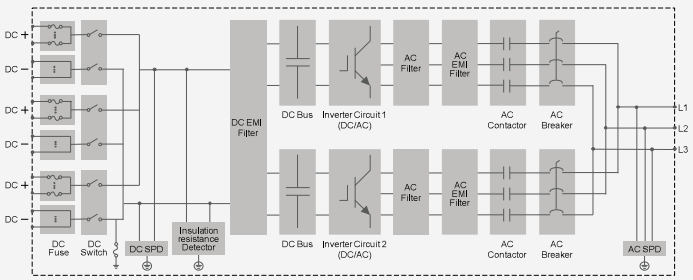
Saved Investment

- Low transportation and installation cost due to 10-foot container design
- 1500V DC system, low system cost
- Integrated LV auxiliary power supply

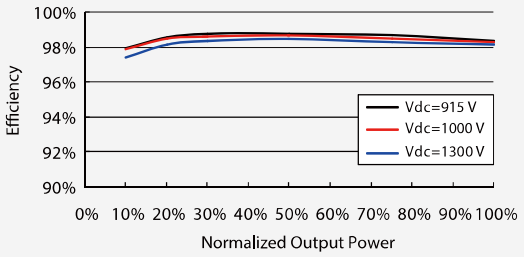
Grid Support

- Complies with UL 1741, UL 1741 SA, IEEE 1547, Rule 21 and NEC 2014/2017
- Grid support including L/HVRT, L/HFRT, power ramp rate control, active andreactive power support

Circuit Diagram



Efficiency Curve



Input (DC)	SG2500U
Max. PV input voltage	1500V
Min. PV input voltage / Startup input voltage	800 V / 840 V
MPP voltage range for nominal power	800 – 1300 V
No. of independent MPP inputs	1
No. of DC inputs	18 – 21
Max. PV input current	3508 A
Max. DC short-circuit current	4800 A
PV array configuration	Negative grounding

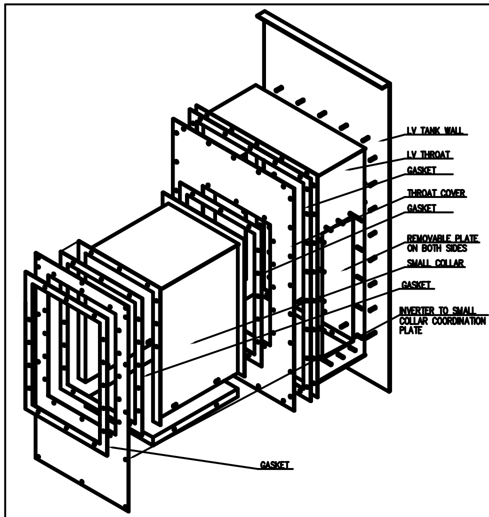
Output (AC)	
AC output power	2750 kVA @ 45 ℃ (113 ℉) / 2500 kVA @ 50 ℃ (122 ℉)
Max. AC output current	2886 A
Nominal AC voltage	550 V
AC voltage range	484 - 605 V
Nominal grid frequency / Grid frequency range	60 Hz / 55 – 65 Hz
THD	< 3 % (at nominal power)
DC current injection	< 0.5 % In
Power factor at nominal power / Adjustable power factor	> 0.99 / 0.8 leading – 0.8 lagging
Feed-in phases / Connection phases	3 / 3

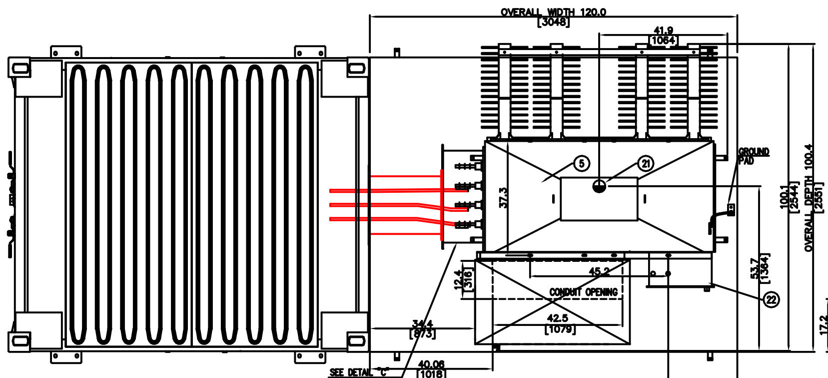
Efficiency	
Max. efficiency / CEC efficiency	98.8 % / 98.5 %

Protection	
DC input protection	Load break switch + fuse
AC output protection	Circuit breaker
Overvoltage protection	DC Type II / AC Type II
Grid monitoring / Ground fault monitoring	Yes / Yes
Insulation monitoring	Optional
Night SVG function	Optional
Overheat protection	Yes

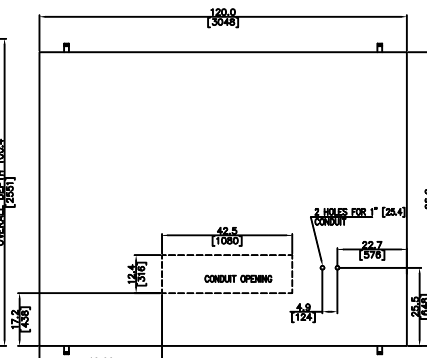
General Data	
Dimensions (W*H*D)	2991*2896*2438 mm **117.8"*114.0"*96.0"**
Weight	6.9 T **15211.9 lb**
Isolation method	Transformerless
Degree of protection	NEMA 3R
Auxiliary power supply	120 Vac, 5 kVA / Optional: 480 Vac, 30 kVA
Operating ambient temperature range	-30 to 60 ℃ (> 50 ℃ derating) **-22 to 140** ℉ **(> 122** ℉ **derating)**
Allowable relative humidity range (non-condensing)	0 – 95 %
Cooling method	Temperature controlled forced air cooling
Max. operating altitude	4000 m (> 2000 m derating) **13123 ft (> 6561 ft derating)**
Display	Touch screen
Communication	Standard: RS485, Ethernet; Optional: optical fiber
Compliance	UL 1741, IEEE 1547, UL1741 SA, NEC 2014/2017
Grid support	Night SVG function (optional), L/HVRT, L/HFRT, active & reactive power control and power ramp rate control, Volt-var, Frequency-watt

FUSES	CAT No.	MANUFACTURER
EXP. (2 PER PHASE)	592B581G09	ABB
CLF (2 PER PHASE)	9F59CBD150	MERSEN

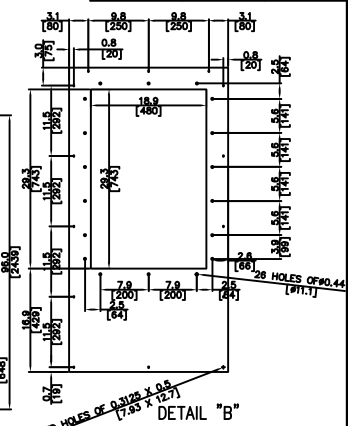




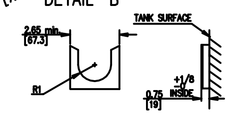
TOP VIEW



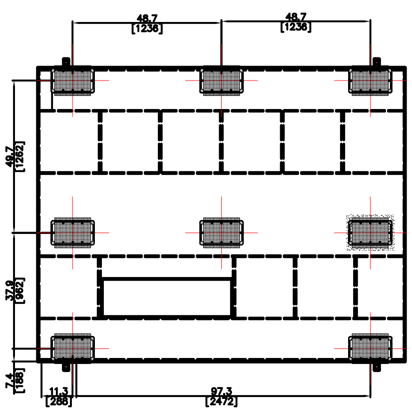
SKID TOP VIEW



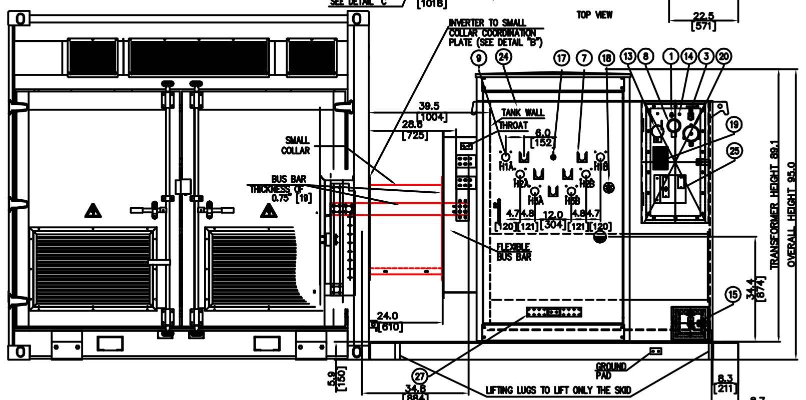
DETAIL "B"



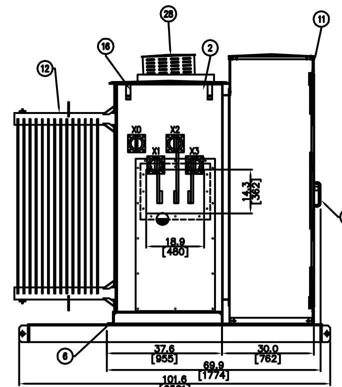
PARKING STAND DETAIL



FOUNDATION RECOMENDATION
TOP VIEW



FRONT VIEW



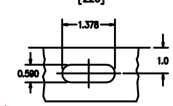
SIDE VIEW

1	PRESSURE RELIEF VALVE, QUALITROL 202-032-01 50 SCFM
2	TANK (MILD STEEL)
3	FILTER PRESS VALVE
4	GROUND PADS
5	TANK COVER
6	BASE (MILD STEEL)
7	PARKING STAND
8	LIQUID LEVEL GAUGE WITH ALARM CONTACTS (SET AT LOW LEVEL)
9	HV INTEGRATED BUSHING 25kV CLASS, 125kV BIL, 600A
10	LV BUSHING 6 HOLE BLADE SUPPORTED 30KVBIL 4515A
11	CABINET (MILD STEEL)
12	RADIATORS (MILD STEEL)
13	PRESSURE VACUUM GAUGE WITH ALARM CONTACTS SET AT -7 PSIG TO 7.5 PSIG
14	SHRADDER VALVE
15	1" DRAIN VALVE WITH 3/8" SAMPLER HJ DV1000-001-FB
16	LIFTING LUGS
17	(1) 2 POSITION RADIAL SWITCH 300 AMP
18	TAP CHANGER
19	ANODIZED ALUMINUM NAMEPLATE
20	THERMOMETER WITH ALARM CONTACTS (SET AT 85 C AND 105 C)
21	HAND HOLE 14"X25"
22	ACCESORIES BOX
23	DOOR HANDLE WITH PROVISION FOR PADLOCK
24	HV DOOR W/PENTA HEAD BOLT
25	TERMINAL BLOCK
* 26	SMALL COLLAR
27	GROUND BUS
28	MECHANICAL PRESSURE RELIEF DEVICE SET AT 10PSI (QUALITROL 208-60E)
* 29	LV FLEXIBLE BUS BARS
30	LV THROAT (DETACHABLE IN 2 PIECES)

TRANSFORMER WEIGHTS

CORE & COIL	7 008 LBS
TANK AND FITTINGS	4 458 LBS
588 GALLONS OF VG 100	4 425 LBS
TOTAL WEIGHT	15 891 LBS
SKID WEIGHT	2337 LBS

NOTE: ITEMS MARKED IN RED AND WITH * WILL BE SHIPPED SEPARATELY



ANCHORING DETAIL

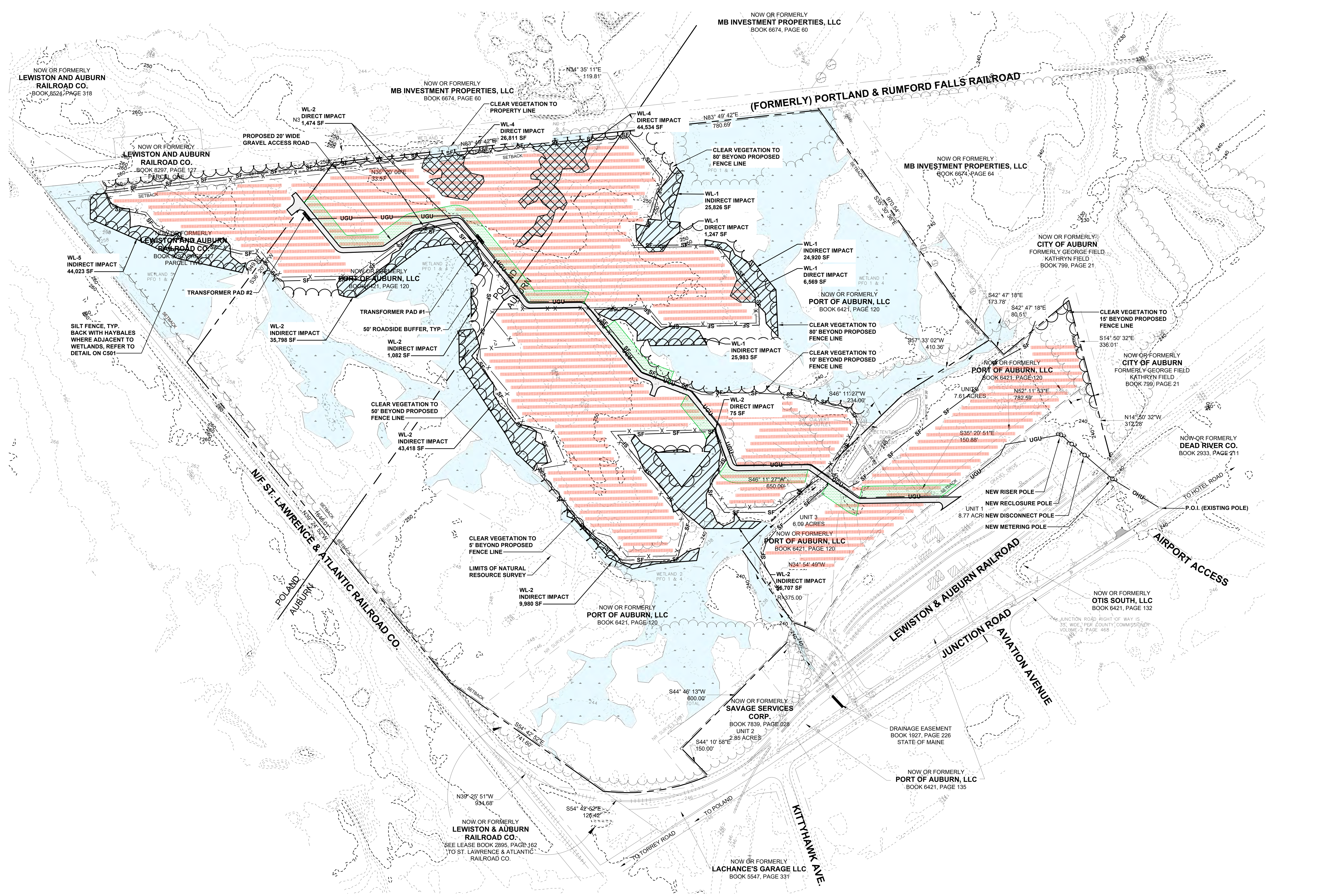
Note: Overall Dimensions are nominal with tolerance of +/- 0.5 all other dimensions have a tolerance of +/- 0.1

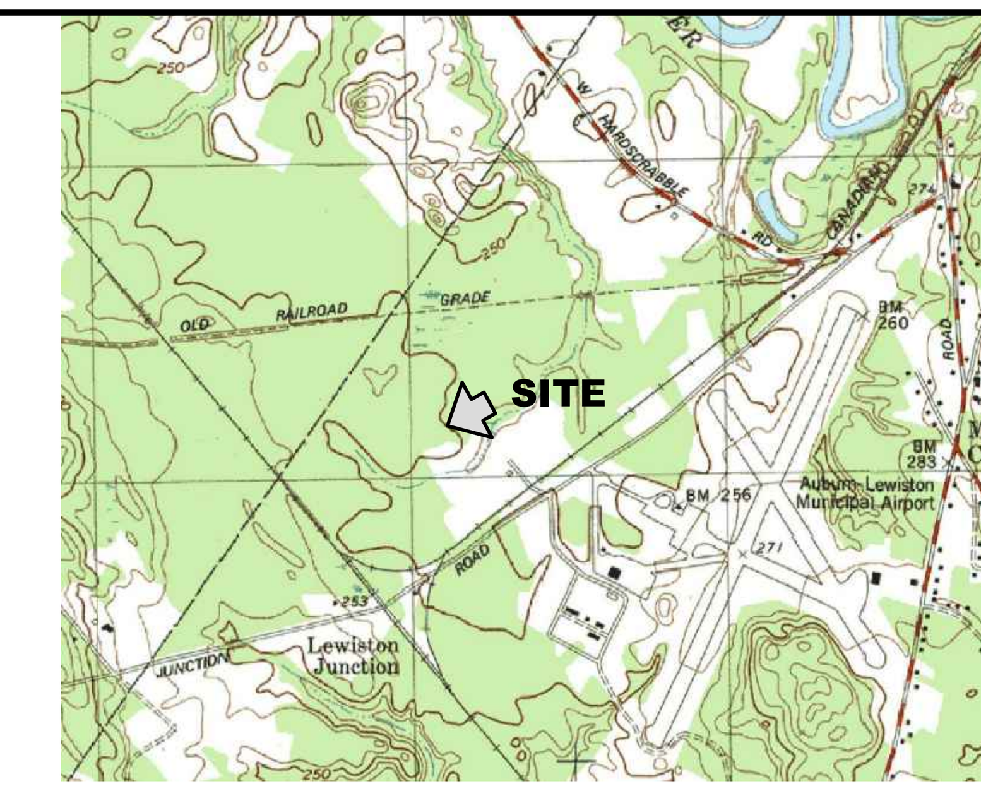
http://www.prolecge.com

COLOR: RAL7035
CENTER OF GRAVITY
DESIGNED TO OPERATE BELOW 3300.0 FEET ABOVE SEA LEVEL

Rev.1: DETAIL "C" GASKET WAS ADDED 05/10/2019 RB

Draftman AUDI	Customer: SUNGROW	REQ. NO. :
REV: JRBG		
App: JRBG	Title: OUTLINE DRAWING 2750 kVA, 3 PHASE, 60 HERTZ, 13200-550Y/317 VOLT 65 °C, DELTA - WYE COOLING KNAN	
Scale: 1:34		
Dimensions in inch [mm]		
Date: 04/30/2019	PROLEC GE	Drawing No. RHZ815B802
Rev: 1		





LOCATION MAP: USGS QUADRANGLE: MINOT
SCALE: 1"=2000'
MAPTECH® USGS TOPOGRAPHIC SERIES™,
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WWW.MAPTECH.COM/TOPO

LEGEND:

- PROPERTY LINE
- WETLAND BOUNDARY
- STREAM
- MAJOR FOOT CONTOUR
- MINOR FOOT CONTOUR
- TREELINE
- CHAINLINK FENCE
- EDGE OF PAVEMENT
- EDGE OF GRAVEL
- LIMITS OF NATURAL RESOURCE SURVEY
- DIRECT WETLAND IMPACTS
- INDIRECT WETLAND IMPACTS

SOURCE:

1. CAD FILE FOR PORT OF AUBURN, LLC. PREPARED BY PLANIT MAPPING IN JULY OF 2009, NAMED 09-14 BND V2004 EMAIL, COMPLIMENTED WITH LIDAR TOPOGRAPHY COURTESY OF THE MAINE OFFICE OF GIS.

RESOURCE NOTES:

1. NATURAL RESOURCE FIELD SURVEY WAS COMPLETED BY CES INC. IN NOVEMBER 2018, MAY AND AUGUST 2019 ON A PORTION OF THE PROPERTY, AS SHOWN ON THIS PLAN. REFER TO THE ACCOMPANYING SITE CONDITIONS REPORT PREPARED FOR THE SITE, DATED DECEMBER 2019.
2. WETLANDS WERE IDENTIFIED AND DELINEATED IN ACCORDANCE WITH 1987 CORPS OF ENGINEERS WETLAND DELINEATION MANUAL AND THE 2012 NORTHCENTRAL AND NORTHEAST REGIONAL SUPPLEMENT (VERSION 2.0).
3. APPROPRIATELY TIMED VERNAL POOL FIELD SURVEY WAS COMPLETED IN ACCORDANCE WITH STATE AND FEDERAL REGULATIONS AND DEFINITIONS, AND THE MAWS VERNAL POOL SURVEY PROTOCOL. ADDITIONAL INFORMATION IS PROVIDED IN THE ACCOMPANYING SITE CONDITIONS REPORT, DATED DECEMBER 2019.
4. NATURAL RESOURCE SITE FEATURES WERE LOCATED USING A SUB-METER CAPABLE TRIMBLE GEO XH (6000 SERIES). DATA WAS POST-PROCESSED ACCORDING TO MANUFACTURER'S RECOMMENDED POST-PROCESSING SETTINGS USING CORS REFERENCE STATIONS. UNDER CERTAIN CONDITIONS, THE POSITIONAL ERROR OF THE GPS DATA MAY EXCEED SUB-METER.

RESOURCE IMPACT SUMMARY:

INDIRECT WETLAND IMPACT:	313,310 SF / 7.19 AC
DIRECT WETLAND IMPACT:	80,710 SF / 1.85 AC

ZONING: INDUSTRIAL

CES INC
Engineers • Environmental Scientists • Surveyors

Brewer
465 South Main Street
PO Box 639
Brewer, ME
T.207-989-4824
F.207-989-4881

Bar Harbor
1366 State Hwy 102
Bar Harbor, ME
T.207-288-0587
F.207-288-0588

Lewiston
640 Main Street
Lewiston, ME
T.207-795-6009
F.207-795-6128

Machias
61 Dublin Street
PO Box 587
Machias, ME
T.207-255-3270
F.207-255-8367

Presque Isle
549 Main Street
PO Box 827
Presque Isle, ME
T.207-764-8412
F.207-764-8414

Waterville
44 Main Street
Suite 204
Waterville, ME
T.207-680-2202
F.207-680-2204

Saco
146 Main Street
Suite 300
Saco, ME
T.207-283-9151
F.207-283-9136

BWLK, a division of CES, Inc.
13041 McGregor Blvd
Fort Myers, FL 33919
T.239-481-1331
F.239-481-1073

PROJECT TITLE
BD SOLAR AUBURN, LLC
AUBURN, MAINE

SHEET TITLE
PROPOSED SITE PLAN

REV.	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
R1	PER CITY REVIEW COMMENTS	2020-03-04	BLQ	SMT
R2				
R3				
R4				
R5				
R6				
R7				

ISSUE STATUS
NOT FOR CONSTRUCTION

STATE OF MAINE
SEAN M. THIES
No. 10139
03/05/2020
LICENSED PROFESSIONAL ENGINEER

PROPOSED SITE PLAN
FOR
BD SOLAR AUBURN, LLC
AUBURN, MAINE

GRAPHIC SCALE
200 0 100 200 400 800
(IN FEET)
1 inch = 200 ft.

OWNER:
PORT OF AUBURN, LLC
415 AUBURN ROAD
AUBURN, ME 04210

APPLICANT:
BD SOLAR AUBURN, LLC
ATTN: NICHOLAS MAZUROSKI
PO BOX 9729
PORTLAND, ME 04104

ENGINEER:
CES, INC.
ATTN: SEAN THIES
PO BOX 639
BREWER, ME 04412

SCALE	1"=200'		
DATE	2019-12-18		
DRAWN BY	WAB/BLQ	CHECKED BY	JED/JES
DESIGNED BY	JED	APPROVED BY	SMT
JOB NUMBER	12186.008		
DRAWING NUMBER	C101		