DropNGo

Planning and Installation Guide

PRE-CAST CONCRETE BASE
For All
PowerSeries Mounts

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Throughout this manual, the terms WARNING, CAUTION, and NOTE are used to highlight hazards or unsafe practices or significant points worthy of emphasis, defined as:

WARNING
Hazards or unsafe practices that could cause damage, serious injury or death.

CAUTION
Hazards or unsafe actions or conditions that could cause personal injury or damage to the equipment and or PV components.

NOTE
Notes that will make assembly or operation easier and less prone to error or may avoid poor performance due to improper installation or adjustment.

READ THIS ENTIRE DOCUMENT CAREFULLY BEFORE INSTALLING

PV PANEL MANUFACTURER'S MOUNTING INSTRUCTIONS SUPERCEDE THOSE OF THE MOUNT ITSELF

ALL REFERENCES TO PV PANELS, ELECTRICAL AND GROUNDING INSTRUCTIONS CONTAINED IN THIS MANUAL ARE FOR INFORMATION ONLY CONSULT THE MANUFACTURER FOR INSTALLATION INSTRUCTIONS

THIRD PARTY DESIGN, ANCHORING AND INSTALLATION OF THE POST IT MOUNTS ON IS ALSO FOR INFORMATION ONLY - ALWAYS CONSULT A PROFESSIONAL CIVIL ENGINEER

DISCLAIMERS - GENERAL SOLAR PV PEDESTAL AND PANEL MOUNTING INFORMATION

1. Introduction

This document provides recommendations for the installation of a mounting system for virtually any photovoltaic panel and identifies the hazards associated with the handling and installation of these products. *Please read this document in its entirety before installing.*

1.1. Disclaimer of Liability

All True North Power NG products are designed and manufactured to comply with relevant international standards (refer to the product label for details). However, as the conditions or methods of installation, operation and maintenance are beyond True North's control, True North Power NG Inc. does not assume responsibility and expressly disclaims liability for loss, damage or expense arising out of, or in any way connected with, such installation, operation, use or maintenance. DropNGo ballast is designed for easy installation and long life. However, the warranty can be invalidated, in the event of a claim, if there is evidence that ballast or connected equipment have been improperly installed or damaged prior to or during installation. Refer to the Warranty Certificate, provided separately, for full details regarding the Limited Warranty. DropNo ballasts are intended to operate under normal climate conditions between -40 and +50degC.

2.2. Handling Safety

Use appropriate protective safety equipment as recommended by local safety codes and practices (e.g. Hard hat, scaffolding, steel toed shoes, gloves and restraining harness) and exercise caution particularly when installing modules at height. ALWAYS keep sharp edges of rails or other hardware away from the module surface when handling. DropNGo Ballasts are heavy and should always be handled by heavy lift devices with 2 or more people.

CAUTION
Exercise CAUTION around the SunpointGPS unit whenever the power is ON. The slew drive moves very slowly but with extreme force. Watch out for pinch points and fingers, tools or clothing becoming caught or wedged between the slew drive and post or strongback. ALWAYS turn the unit OFF (ie UNPLUG THE POSITIVE BATTERY TERMINAL) before performing any servicing.

2.3. Installation precautions

DO NOT attempt any installation in adverse weather conditions (when high winds, rain, ice or snow is present). Remove any jewelry or other loose clothing, and stay clear of ropes or cables. Stay clear of lifting areas and ballast pieces while they are being removed from transport or in the process of being placed. Ensure that people operating heavy equipment or handling these large concrete ballast are properly trained and equipped before beginning operations.

6. Useful References

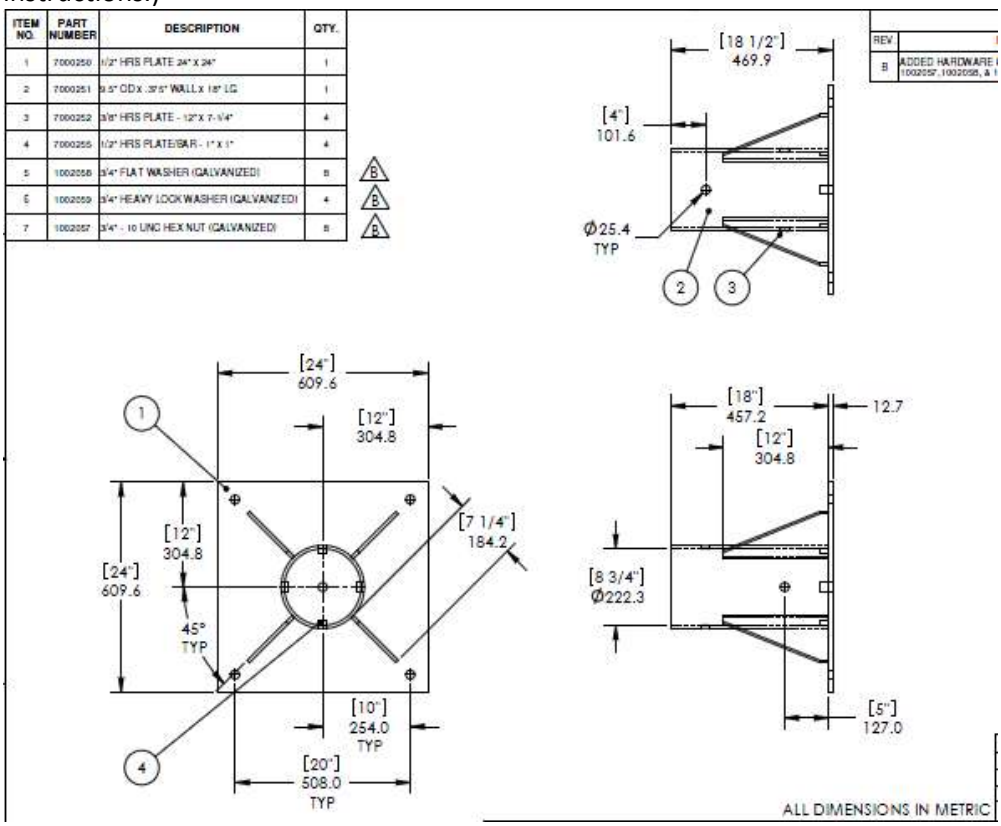
- A5/ANZ 5033:2005 Installation of photovoltaic (PV) arrays
- 1EC61140 Protection against electric shock - Common aspects for installation and equipment
- IEC 60364-4-41: 1992, Electrical installations of buildings. Part 4: Protection for safety.
- IEC61 730-1 Photovoltaic (PV) module safety qualification-
-CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1
- NFPA 70 US National Electrical Code (NEC)

Tools Required for Placing DropNGo Ballasted Systems

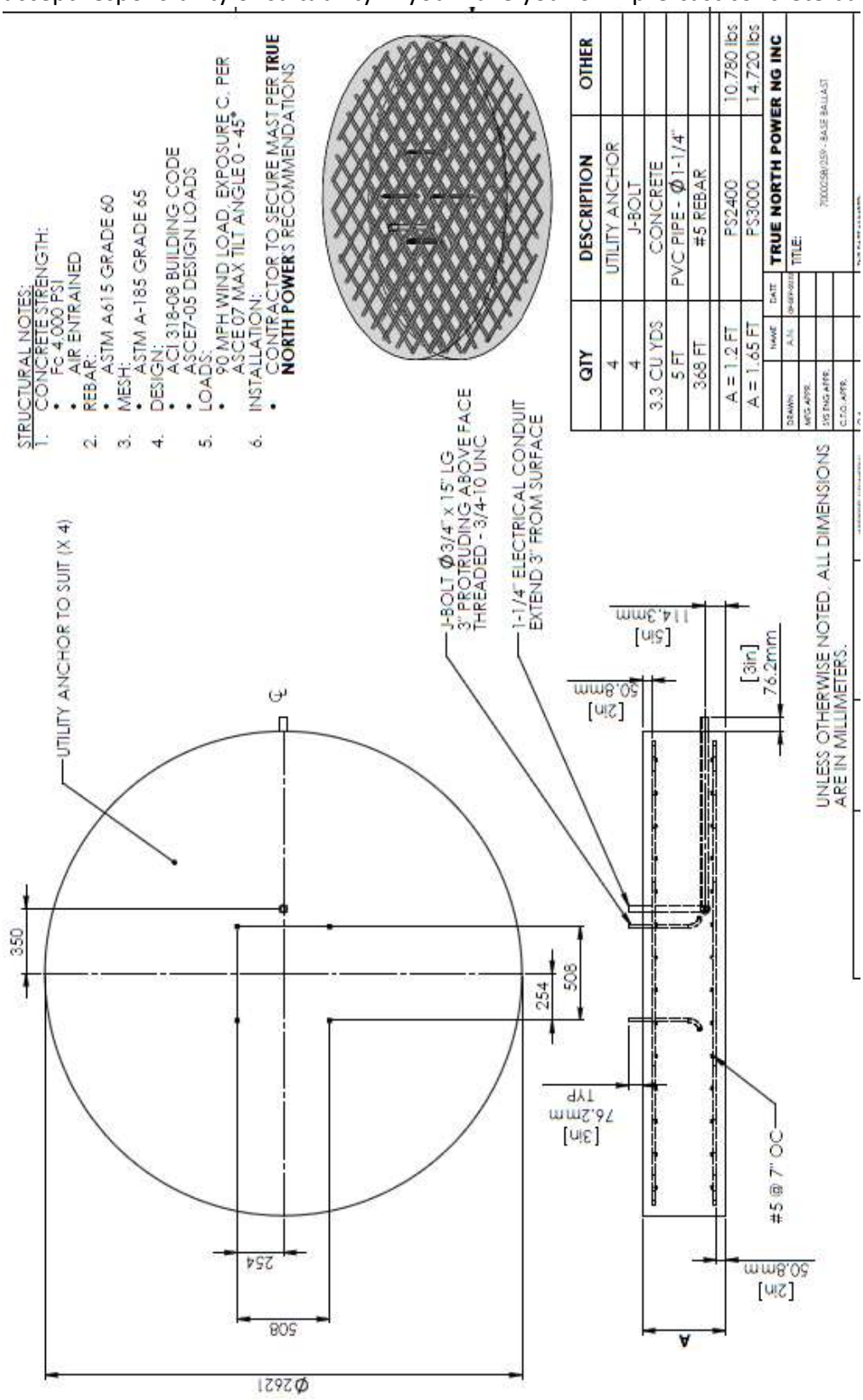
1) Backhoe or small lifting device capable of up to 15,000lbs,
2) Trenching equipment for 2ft deep trenching
3) A set of standard Metric Open End or Adjustable Wrenches
4) T-Square or framing square
5) Torque Wrench and a set of standard Metric sockets

DropNGo Site Preparation and Placement

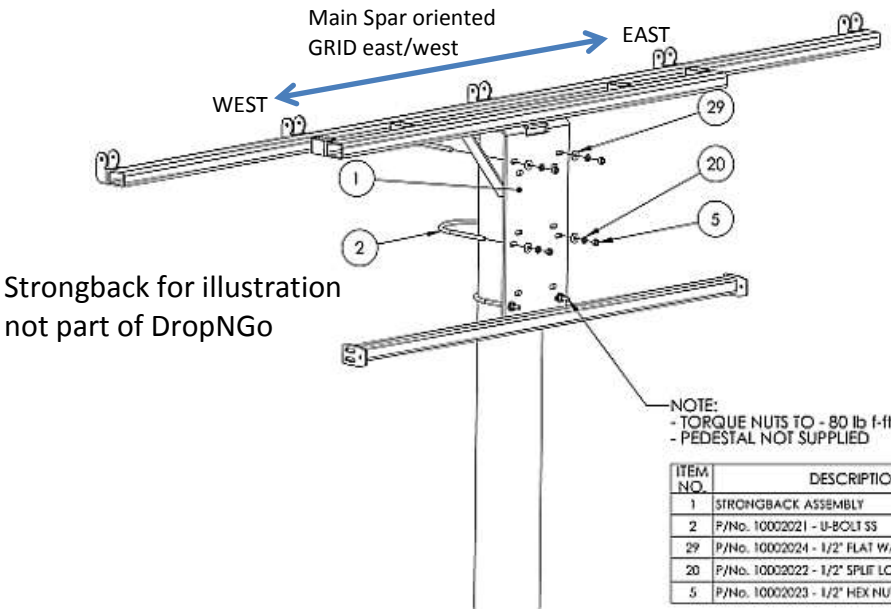
1) DropNGo is a ballast system for all PowerSeries mounts up to 16 panel systems. A preformed, steel reinforced concrete pad is placed on the prepared surface and the basemount, post and strongback are then bolted on top. You can choose to pour your own base using the general info on Page 6.
2) DropNGo ballast for the PS2400 and smaller mounts is approx. 8.6ft diameter 1.2ft thick and weighs ~ 10,500lbs. PS3000 and PS3200 ballast is 1.65ft thick and weighs ~14,800lbs.
3) Scrape off topsoil, level the surface about 9ft square and spread approx. 4-6 inches of gravel or crushed stone to assure good drainage. Consult a local soil engineer to determine if your location can support the ballast weight without sinking or causing frost heaves in cold weather.
4) Dig a 1.5-2ft deep trench up to about 5 ft (1.5m) from the center of the area. DropNGo ballast comes with 1.25" grey conduit exiting from one side of the concrete at about 4-6" above grade and can be oriented to any direction toward the trenching. Orientation of the ballast only matters for the trenching. Base Mount orientation does not matter for any mount except the PS5000. (see PS5000 instructions.)



Make your own concrete base from the guidance below. NOTE: True North Power cannot accept responsibility or suitability if you make your own pre-cast concrete ballast.



Main Spar Orientation and Attachment (Top of Stack)



ITEM NO.	DESCRIPTION	QTY.
1	STRONGBACK ASSEMBLY	1
2	P/No. 10002021 - U-BOLT SS	3
29	P/No. 10002024 - 1/2" FLAT WASHER SS	6
20	P/No. 10002022 - 1/2" SPLIT LOCK WASHER SS	6
5	P/No. 10002023 - 1/2" HEX NUT SS	6

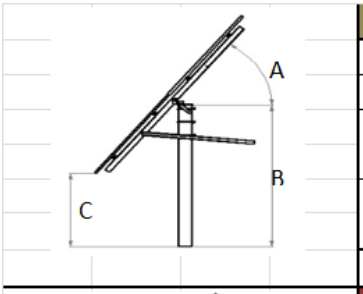
Installation - Adding to the DropNGo Stack

Basemount
Install Post
Mate Sunpoint & Strongback
Align main spar

1. Remove one of each ¾" galv nut, washer and lock washer from each threaded rod on the ballast. Install the base mount and replace the washers and nuts. Place a level on the sides or base of the basemount (Fig 2 above) Adjust the lower nuts until the unit is level and the sides are vertical. Tighten the upper basemount nuts to 180lbs torque (240nm).
2. Install the post and rotate it until the threaded holes on the post align with the base mount holes. Install 4x 5/8th" galv steel bolts with split washer and flat washer on each. Torque to 100 ft/lb or 135nm.
3. Refer to Figs 1,2. And page 9 to install the SunpointGPS Tracker if used.
4. Lift Strongback (Fig 2) onto the top of the Sunpoint saddle and mate to the strongback saddle by lining up the 6 holes. Install the Combiner/Controller Mounting Bracket and fasten the saddles together with 6x 1/2" hex nuts, flat washers and split washers. Torque to 100 ft/lb or 135nm.
5. The main steel spar of the strongback should now be aligned GRID east/west.
6. Refer to PowerSeries Top of Pole installation manual procedure to attach rail and panels.

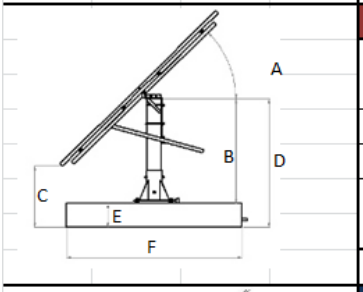
SEE THE PowerSeries INSTALL MANUAL

Height Options - With and Without DropNGo Stack or Tracker

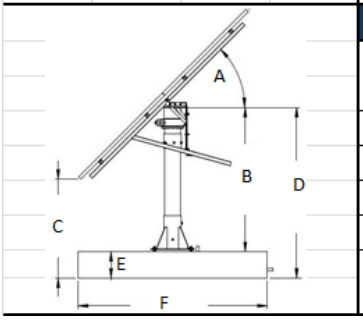


IN-GROUND PEDESTAL*	PS2000	PS2400	PS3000	PS3200
Solar Panel Orientation	5 x 2 Portrait	6 x 2 Portrait	5 x 3 Portrait	4 x 4 Landscape
Post Length	12' (3.66m)	12' (3.66m)	15' (4.6m)	15' (4.6m)
55 deg tilt (**A**) clearance above grade (**C**)	49.6" 1.26m	49.6" 1.26m	25.5" .64m	26" .66m
Pedestal Mount Pole Top - Above Grade (**B**)	8' (2.44m)	8' (2.44m)	8' (2.44m)	8' (2.44m)

* Add 1.6ft on top of dimesions (B & C) when installing SunpointGPS



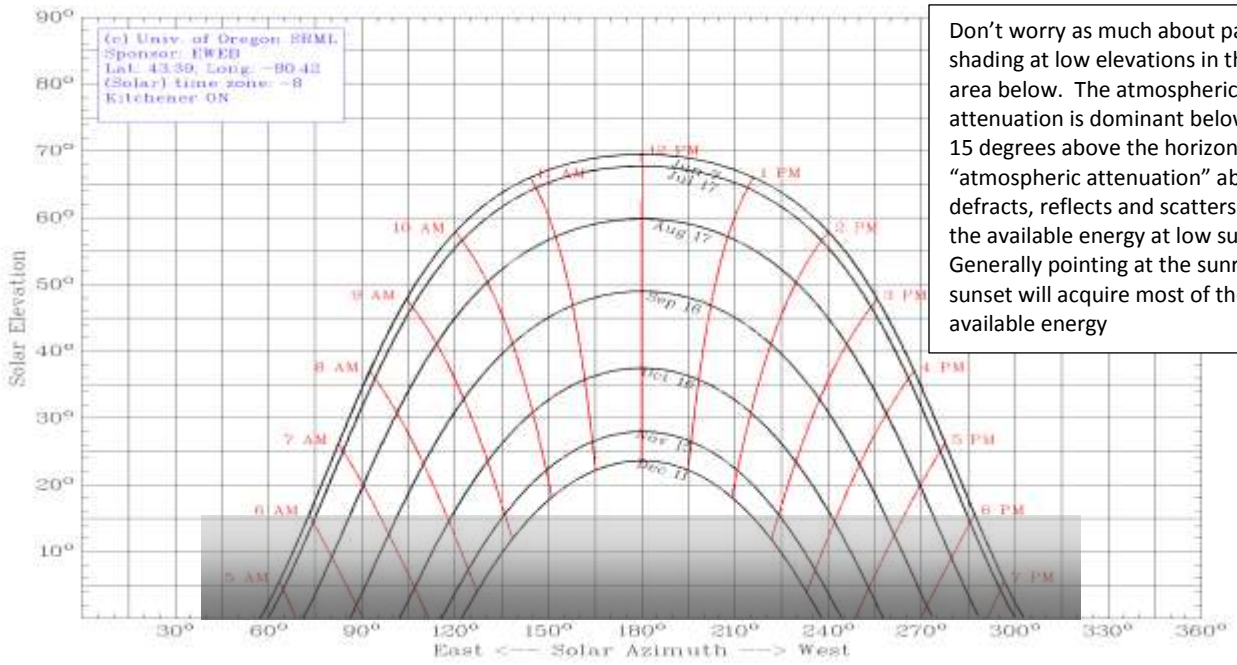
Drop N Go	PS2000	PS2400	PS3000	PS3200
Base - 8.6ft Dia. 2.6m (**F**) (**E**)	1.2' Thick	1.2' Thick	1.6' Thick	1.65' Thick
	10,450 lbs	10,450 lbs	13,927 lbs	14,400 lbs
Post Height (**B**)	5' (1.52m)	5' (1.52m)	6.5' (2m)	6.5' (2m)
Post Top - Above Grade (**D**)	6.4' (1.95m)	6.4' (1.95m)	8.3' (2.53m)	8.3' (2.56m)
45 deg tilt (**A**) clearance above grade (**C**)	36.9" (.94m)	37.6" (.96m)	37.4" (.95m)	50.4" 1.28m)



Drop N Go with SunPoint	PS2000	PS2400	PS3000	PS3200
Base - 8.6ft Dia. 2.6m (**F**) (**E**)	1.2' Thick	1.2' Thick	1.6' Thick	1.65' Thick
	10,450 lbs	10,450 lbs	13,927 lbs	14,400 lbs
Post Height	5' (1.52m)	5' (1.52m)	5' (1.52m)	5' (1.52m)
+ (**B**)	+	+	+	+
SunPoint Height	1.6' (.48m)	1.6' (.48m)	1.6' (.48m)	1.6' (.48m)
Post Top - Above Grade (**D**)	7.8' (2.38m)	7.8' (2.38m)	8.2' (2.5m)	8.2' (2.5m)
45 deg (A) tilt clearance above grade (C)	53.4" (1.36m)	54.1" (1.37m)	35.9" (.91m)	48.9" (1.24m)

Locating and placing DropNGo - Finding GRID SOUTH and TRUE NORTH

Locate the pedestal/mounting pole where it is completely clear of shadow as much as possible in all seasons of the year. Professionals will use a "Solar Pathfinder" or similar device but, if you don't have one it helps to have a diagram of the sun angles, as they might be at every time of the day for all days of the year. Google now has a great java application for visualizing solar transit for any day of the year and any location on earth, called Suncalc. http://www.suncalc.net/#/43.2873,-80.4519,14/2010.11.21/07:51. Another interesting visualization tool can be found at http://pvcdrom.pveducation.org/SUNLIGHT/SUNCALC.HTM . If you wish to see an entire year of sun angles for your specific LAT/LONG a simple chart like the one below can be generated from a website at Oregon State University. http://solardat.uoregon.edu/SunChartProgram.html . It shows the azimuth and elevation that the panels should face in order to get maximum solar energy. A "Solar Azimuth" of 180 degrees will face GRID or TRUE SOUTH in the northern hemisphere. Use "Zero" degrees to create a chart for GRID or TRUE NORTH in the southern hemisphere. You can find TRUE SOUTH or TRUE NORTH on your property by noting the direction of the solar shadow at noon. (Standard time not Daylight savings). You can also use a compass but don't forget that Magnetic South can be off by several degrees from GRID SOUTH so a compass alone will not give you an accurate angle. Using a compass you must account for "magnetic deviation" in your location. It is different everywhere on the planet. Just Google it.



Don't worry as much about panel shading at low elevations in the grey area below. The atmospheric attenuation is dominant below about 15 degrees above the horizon where "atmospheric attenuation" absorbs defracts, reflects and scatters much of the available energy at low sun angles. Generally pointing at the sunrise or sunset will acquire most of the available energy

Once you have determined GRID SOUTH or NORTH, then adjust the Strongback to be GRID EAST/WEST that is 90 degrees to North/South which is the direction the panels must face. Face the array GRID SOUTH in the northern hemisphere and GRID NORTH in the southern hemisphere. With the Strongback secured you can now adjust the angle of the array to something close to the highest point of the curved lines in the chart above (based on the time of year). The closer you follow the maximum elevation of the blue lines throughout the year, the more power your array will produce, but adjusting it more than 2 times a year does not add significant amounts of energy (possibly <1-2%) for azimuth tracking arrays. If you do adjust the angle of the array seasonally, it should only be done once after the snow is gone (set the angle to Latitude -10Deg) and again in the early fall (set the angle to Latitude + a max of 5-10 Deg), or change the angle as often as you like based if you just like playing with wrenches. Be sure to retighten all bolts to proper torque before leaving the array at a new angle.

Siting Multiple Pedestals

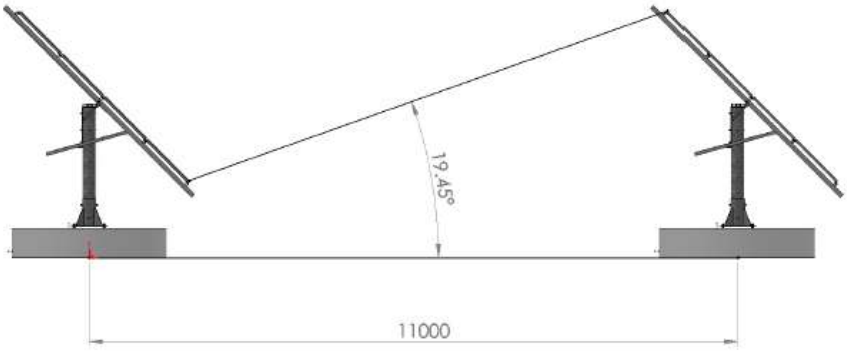
If two or more pedestals are located near each other you will need to provide spacing for them so one does not shadow the others during various times of the day or the year. This is especially important for tracking systems where early morning and late afternoon shadows are longest. Below is a typical array siting analysis that you will have to create for yourself based on the location, the ground slope and the panels you choose. This "IDEAL" case shows how the shadows from one pedestal can interfere with production of the ones around it based on how close they are. Remember however that the low sun angles of winters solstice in the Northern hemisphere occur for only a few short days per year when the solar hours are fewest all year and when you can expect a lot of cloud cover anyway.

Designing systems for this limited case is more of an academic exercise rather than offering significant performance improvements, and practical spacing of closer distances can be just as operationally productive as the ideal case. Changing the height of the front row of pedestals and reducing the maximum tilt angle of just the front row can significantly shorten the row spacing requirement of the pedestals. Perhaps mounting the panels in landscape can reduce the height of each pedestal and likewise reduce the spacing required.

Also check your ground slope on site as just a few degrees of slope can reduce the spacing significantly. In addition, siting for solar production below 15 deg above the horizon is of limited value due to atmospheric attenuation. Consider all of these parameters before choosing a pedestal spacing.

This is an IDEAL CASE of pedestal spacing for PS 2400 mounts, with 12 (1300x99mm) ~200w panels mounted, 2 up and 6 across, in Portrait mode, at various azimuth angles. You will have to study your own location, panel setup and spacing to determine what works best for you. Using your site angles chart you created from the University of Oregon website, with a piece of squared paper and a protractor may be all the accuracy you need. The example here shows best minimum shadow separation. (distances shown in mm)

PS3200 – Eg. 45deg tilt with 1640x994mm panels and about 20 degree winter noon of the sun or sunrise solar angle above the horizon.



Site preparation and post or concrete installation is not part of the equipment supplied by True North Power NG Inc. ALWAYS consult a qualified professional engineer.

1) Select the correct size and height support pole. Install according to local building codes and a with the advice of qualified professional, civil or mechanical engineer.
2) Please read this entire manual including safety precautions carefully before starting work.

Steel Post (Pedestal) Requirements

PS800	PS1200 & PS1600	PS1800, PS2000 & PS2400	Post Type	PS3000	Post Type
4" Post 4.5" OD	6" Post 6.625"OD Up to about 6.5ft above Grade	8" Post 8.625"OD Up to about 6.5ft above Grade	Hollow Structural Steel (HSS) Round .322" 5/16th wall ASTM Standard Grade 500C	6" Post 6.625"OD Up to about 8ft above Grade	Hollow Structural Steel (HSS) Round .5" 1/2 wall ASTM Standard Grade 500C

Steel Post (Pedestal) Requirements

CAUTION
Any analysis data provided is typical of civil engineering calculations and is offered for reference only. Such analysis must account for local soil conditions and peir design data neither of which is available to True North Power. True North Power only provides the top of pole load parmeters and moment requirements at the base of the post. Consult a qualified civil engineer before deciding the location and size of the supporting pier, concrete strength and/or post.

WARNING
This is not a one person job even if you have lifting devices or winching equipment as the mount is heavy and unwieldy. It can only be safely done with at least 2 or 3 people.

Strongback and Channellox Rail Materials Specifications
Including Wind, Snow and Load Bearing Test Data is available on request

Engineered stamped drawings from Ontario engineers are also available at a nominal cost.

Contact info@truenorthpower.com

