PowerSeries Solar Pedestal 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.

Channellox extrusions and universal mounting PowerSeries Strongbacks
are the highest quality and strength needed to ensure years of safe and worry free use.

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

DESIGN, ANCHORING AND INSTALLATION OF THE POLE IT MOUNTS ON IS ALSO FOR INFORMATION ONLY CONSULT A PROFESSIONAL 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. PowerSeries mounts are designed for easy installation and long life. However, the warranty can be invalidated, in the event of a claim, if there is evidence that the Strongback, rails or connectors 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. PowerSeries Pedestals with Channellox rails are intended to operate under normal climate conditions between -40 and +50degC.

2 Electrical Hazard

Photovoltaic (PV) modules generate electricity whenever they are exposed to light. Potentially lethal voltages can be present. PV modules produce DC current, special regulations may apply. Follow local building codes and panel manufacturer's instructions when working with or connecting PV panels.

2.1. Prior to Installation of the PowerSeries Mount

Ensure that the pedestal installation and wiring of solar modules is performed by a qualified installer in accordance with ALL local standards or engineering codes. The pedestal that the PowerSeries Strongback and rails attach to is NOT part of this installation guide and must be designed and installed by a qualified engineer/installer. Ensure that a structural integrity of the pedestal is sufficient to carry the weight and wind/snow loads of the entire structure including panels under all conditions anticipated in your area. Consult a qualified structural engineer. Before performing any operation involving the pedestal foundations or system electrical connections, perform a risk assessment paying particular attention to the soil and environmental conditions as well as personal protection equipment required. *ALWAYS* obtain approval from a certified professional engineer to verify the suitability of the pedestal itself to meet anticipated operating conditions such as wind gusts, snow collection and thermal expansion requirements. When connecting solar modules to other equipment (batteries, charge controllers, inverters, etc.) refer to the equipment manufacturer's instructions.

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. Strongbacks and rails are heavy and should always be handled by 2 or more people.

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 metallic adornments to avoid accidental electrical contact and use insulated tools. If installation must be done in bright sunlight, cover the front surface of all modules with an opaque material to prevent the modules from generating electricity until they are connected to open breakers and grounded. Ensure that both the front and back surfaces of the module and the sheaths of the connecting cables are undamaged, before installing them on the rails. NEVER install solar modules where the protective back covering has been damaged. Ensure that appropriate barriers are installed to prevent accidental contact between rails or other active circuit elements. Ensure that all electrical connections are properly connected, secured to the frame and protected from unauthorized personnel or animals.

3. Mechanical Installation

PV Panels normally have 4 mounting holes on the back of the panel as well as grounding points. PowerSeries mounts are designed to ensure a strong mechanical connection but avoid the stress or damage caused by top down "gripper" type clamps that may void your panel warranty. To comply with the requirements of UL1703 the modules must be fixed using hex-head bolts. For greater longevity, all PowerSeries hardware is made of 316 grade (A4) stainless steel. Prevention of corrosive effect of dissimilar metals must be considered when mounting the solar module frame (Aluminum) against other materials. Always refer to your specific panel's mounting instructions for accurate advice on mechanical connections.

4. Wiring Considerations

Always use cables and connections consistent with the anticipated environmental conditions of the installation. Cables should be selected for sunlight (UV) stability and rated for at least 90°C. Cables should be fixed & supported with adequate strain relief. A local grounding device must be electrically connected (grounded) to the pedestal.

4.1. Special Considerations

To reduce the risk of an electrical shock, always connect the frame of the module to ground by fixing an appropriate grounding cable to one of the grounding points of the module. Refer to your panel installation guide for correct grounding methods. You may use a self tapping rail penetrating screw for connecting (grounding) to any point on the rails. This helps in electrically connecting (grounding) panel's frame and rails.

If the system is to be installed in USA, then grounding methods must comply with articles 690 and 250 of the NEC. Perform initial ground fault detection (Riso) before system start-up and immediately contact your installer in the event that a ground fault is detected. Ensure that appropriate measures are taken to prevent unauthorized access and employ appropriate over-current/over-voltage protection.

5. Care and Maintenance

True North Power recommends that system inspections are carried out on a regular basis, only by qualified personnel. This inspection should include verification of the integrity of electrical and mechanical connections, confirmation of the system isolation (Riso tests), and checking that system alarms are operating correctly. The array should be set at an angle of at least 10 degrees from the horizontal to aid self cleaning.

5.1. Cleaning

Channellox rail and PowerSeries galvanized Strongbacks require minimal maintenance. Clean the rails or Strongback with a soft cloth or sponge using clean and neutral water based cleaning solution (no ammonia)

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

1) Extension ladder, step ladder, scaffolding – Possibly a small crane or lifting device >3000lb
2) A set of standard Metric Hex Keys (Allen Wrenches)
3) A set of standard Metric Open End or Adjustable Wrenches and Metric socket set.
4) T-Square or framing square.
5) Torque Wrench (>150lb) and battery powered hand drill with >10mm chuck.

Installation procedure (for smaller 2 and 3 panel mounts see pg17)

Strongback
Verticals
Tilt Support Arm to verticals
Tilt Support Arm to Strongback
Prepare Horizontal Bolts/Sq Nuts
Install Horizontals
Panel Bolts/Nuts
Adjust Tilt Torques

1. Lift the Strongback (Fig 1) onto the pole and install the 3 U-Bolt clamps. Fasten with ½" hex nuts, flat washers and split lock washers. Aim the mount so that the arms of the steel Strongback are oriented GRID EAST/WEST and Torque the U-Bolts 110 ft/lb or 150nm. If SunpointGPS Tracker is included see SunpointGPS manual Version 1.55 or later.
2. Install all the vertical rails (Pg9) with a M10 x 90mm hex head pivot bolt, 2 flat washers, a split lock washer and a galv hex nut. Two of these rails have additional side holes to accommodate the Tilt Support Arms. Place these in the pivot points that line up with the ends of the lower Tilt Support Tube. Tilt all rails to the horizontal position and lightly tighten the M10 bolts. 37 ft/lb or 50 nm is used only after final assembly.
3. Attach the "angle cut end" of each Tilt Support Arm (Pg7-8) to the inner vertical rails with M10 x 90mm hex head galv bolt, 2 flat washers, split washer and glav hex nut.
4. Attach the LOWER end of the Tilt Support Arms to the Strongback lower support as shown on PG 7-8. Points are marked as 30, 40 or 50 deg tilt and 10.26mm drill is provided. Choose or interpolate any tilt angle desired (normally only 1 summer and 1 winter angle is used).
5. Insert an M8 x 16mm socket head bolt with ribbed lock washer though each of the holes in the horizontal rails (figure 3) and loosely attach square nuts to the bolts. *This is more easily done if you hold the rail on its side or upside down and push the bolt up from underneath to loosely attach each square nut.*
6. Slide the horizontal rail onto the vertical rail with the square nuts captured in the slot of the vertical rail. Align the horizontal rails to the position required to fit your panels and torque the socket head bolts to 18 ft/lb or 25 nm for M8 (keep rails square and parallel).
7. For PORTRAIT mounting loosely mount M6 or M8 x 16mm socket head bolts (depending on your panel choice), flat washers, split lock washers and square nuts onto each PV panel mounting hole and then slide each row of panels on the horizontal rails. *HINT: measure and tighten the horizontal rail(s) closest to the pivot point first, install the outer rail for that row and keep it loose while you slide on the first panel. Roughly tighten the second rail at the near end, slide the panel to the other end to confirm the spacing and tighten all bolts in the second rail.* Space panels evenly across the mount ensuring minimum ~6mm (~1/4 inch) between panels to allow for thermal expansion and lifting device if used. Tighten each panel mounting bolt to 18 ft/lb or 25 nm for M8, and 12nm for M6 bolts. (For PS3200 LANDSCAPE panel orientation, which uses Panel-Clips, see next page +Pages 910and 11).
8. Loosen the Tilt Support Arm bolts and main pivot bolts then tilt the whole array to the desired angle and tighten Tilt Support Arms and main pivot bolts to 37 ft/lb or 50 nm.

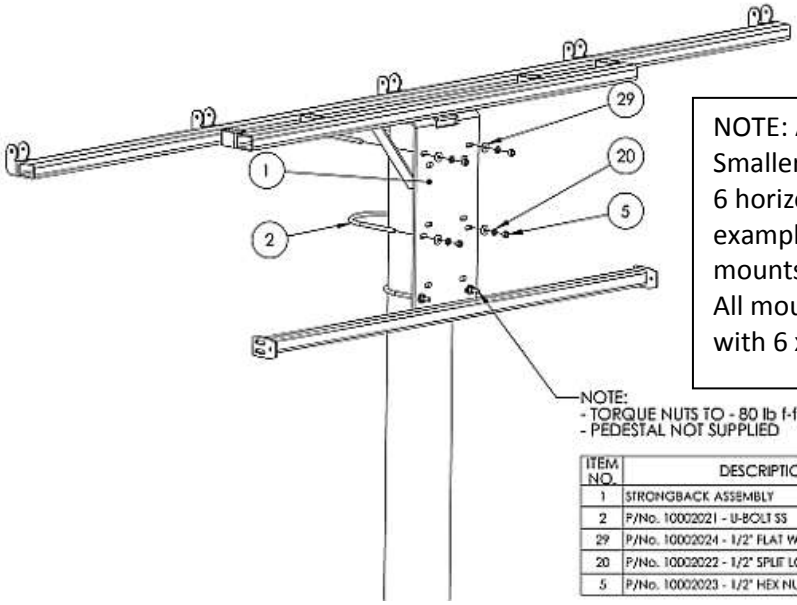
NOTE: When using Enphase micro-inverters be sure to insert 2 additional square nuts with M8x16mm SHCS on each vertical rail between each horizontal rail as they get assembled, to hook inverters onto. Keep balanced positions by weight.

Fast and EASY!

If you are spending too much time at the site measuring everything try this, especially PS3200Landscape. Install the vertical rails and lay them horizontal. Put the middle rail on and make it "in line with the pivot points and the steel Strongback". Torque it down square 18 ft/lb or 25 nm. Now add the outer rails roughly separated by a panel width (including panel clips). Let these additional rails move. Insert 4 T-bolts, 2 on one rail and 2 on the next rail and mount one panel loosely at one edge of the array. Lightly torque the loose outer rail on one end and then slide the panel to the other end, just inside the other end vertical. This now makes the two rails parallel. Torque remaining rail bolts. Do the same with the panel in the next rail and continue until all horizontal rails are torqued. NO MEASURING just check for squareness as you go.

Keep an eye on the squareness as you torque down each rail to rail connection. When they are all tight, square and parallel, slide on additional T-bolts and hang all the rest of the panels with panel clips already on them. As shown in these photos you can mount panels while the array is in either vertical or horizontal orientation whichever is easier. Use a heavy screwdriver shaft, a piece of wood or even a twig about 5-6mm diameter to keep the panel to panel spacing consistent. Saves a lot of hassle and time.

Figure 1 – Strongback Install **Note:** Check packing list for accurate bill of materials.



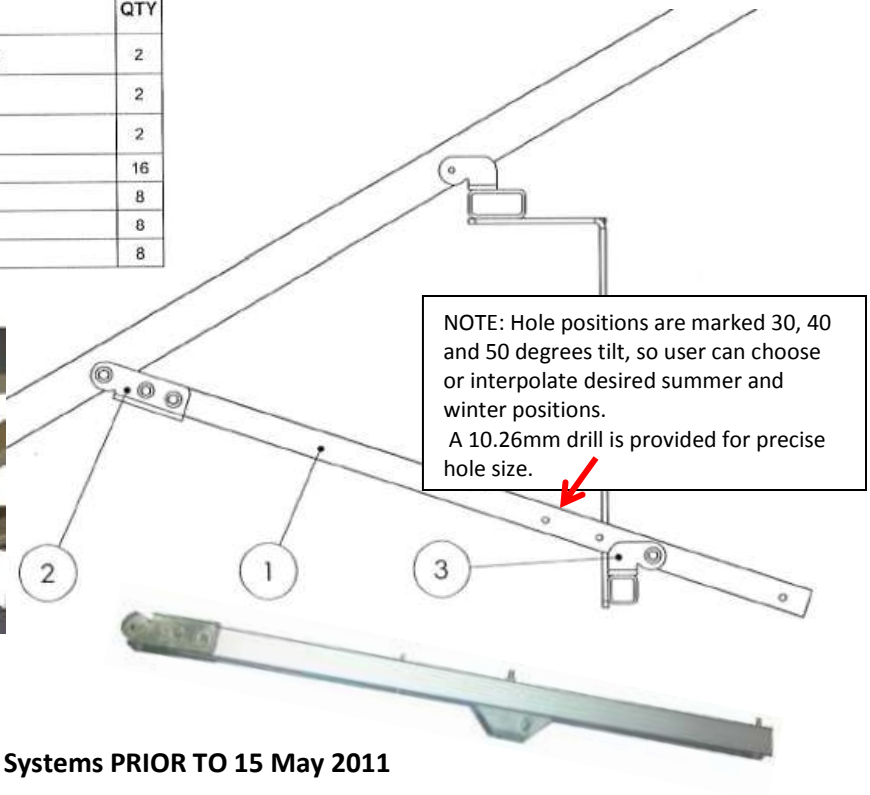
ITEM NO.	DESCRIPTION	QTY.
1	STRONGBACK ASSEMBLY	1
2	P/No. 10002021 - U-BOLT SS	3
29	P/No. 10002024 - 1/2" FLAT WASHER SS	6
20	P/No. 10002022 - 1/2" SPLIT LOCK WASHER SS	6
5	P/No. 10002023 - 1/2" HEX NUT SS	6

NOTE: All sizes and models assemble in a similar process. Smaller models have fewer vertical rails. All have 4, 5 or 6 horizontal rails that attach in the same manner. The example at left is the PS2000 or 3000 Strongback. All mounts can attach to either 6" or 8" post with U-Bolts. All mounts can also accommodate a SunpointGPS tracker with 6 x ½" galvanized bolts in place of U-Bolts.

ADJUSTING THE TILT ANGLE – PowerSeries Systems AFTER 15 May 2011

Install the tilt arms as shown with M10x90mm Galvanized bolts and lock washers. Torque to 80lb (110nm)

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	7000214	TILT ADJUSTING ARM 50mm EXTRUSION - LIGHT/HEAVY - 1250mm LG	2
2	7000123	TILT ADJUST EXTRUSION BRACKET 3/16" HRS PLATE - 165.2mm x 177.8mm (FLAT)	2
3	7000101	TILT CLEVIS 3/16" HRS PLATE 101.6mm x 165.2mm (FLAT)	2
4	1002002	M10 FLAT WASHER (GALVANIZED)	16
5	1002000	M10 x 1.5 x 80 HHCS (GALVANIZED)	8
6	1002066	M10 SPRING LOCK WASHER (GALVANIZED)	8
7	1002067	M10 x 1.5 HEX NUT (GALVANIZED)	8

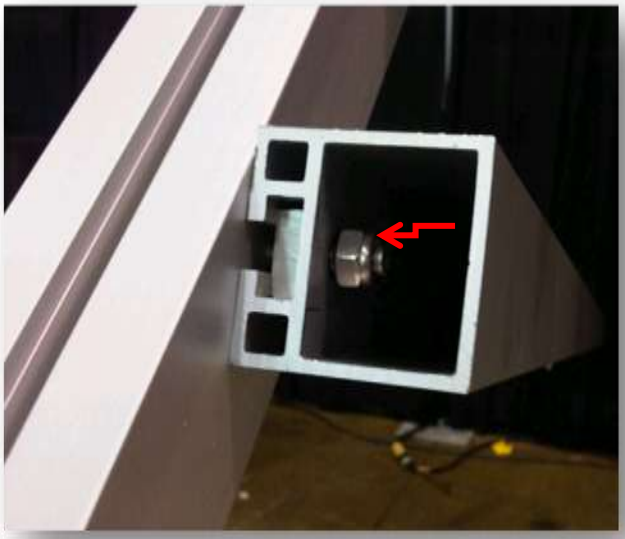


NOTE: Hole positions are marked 30, 40 and 50 degrees tilt, so user can choose or interpolate desired summer and winter positions.
A 10.26mm drill is provided for precise hole size.

ADJUSTING THE TILT ANGLE – PowerSeries Systems PRIOR TO 15 May 2011

First check to be sure the "Security Nut" is in place in case the M8x30mm bolt becomes loose. To adjust the vertical angle of the solar mount, loosen the main pivot bolts on the Strongback (Fig 2) and all bolts on the

ends of the Tilt Support Arms. Make sure the mount is held and supported when the bolts are loosened. Do not loosen bolts more than necessary to change the angle of the solar mount and never remove the bolts.

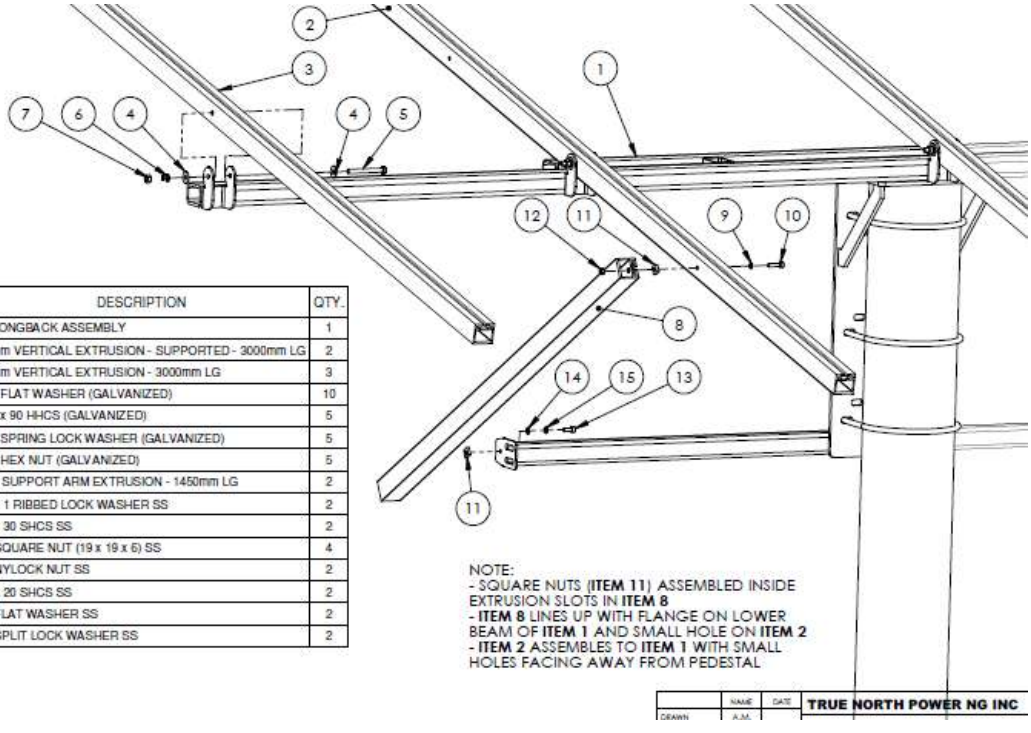


ALSO RECOMMENDED
Use 3 Square Nuts
1 x M8x20mm SHCS, Split lock washer and Flat washer
2 x M8x16mm SHCS Split lock washer and Flat washer to prevent "creep" caused by wind buffeting. Torque 18ftlb (25nm)

Adjust the solar mount to the desired angle and then re-torque the M8 bolts on both ends of the Tilt Support Arms as well as the M10 main Strongback pivot bolts to 37ftlb torque.

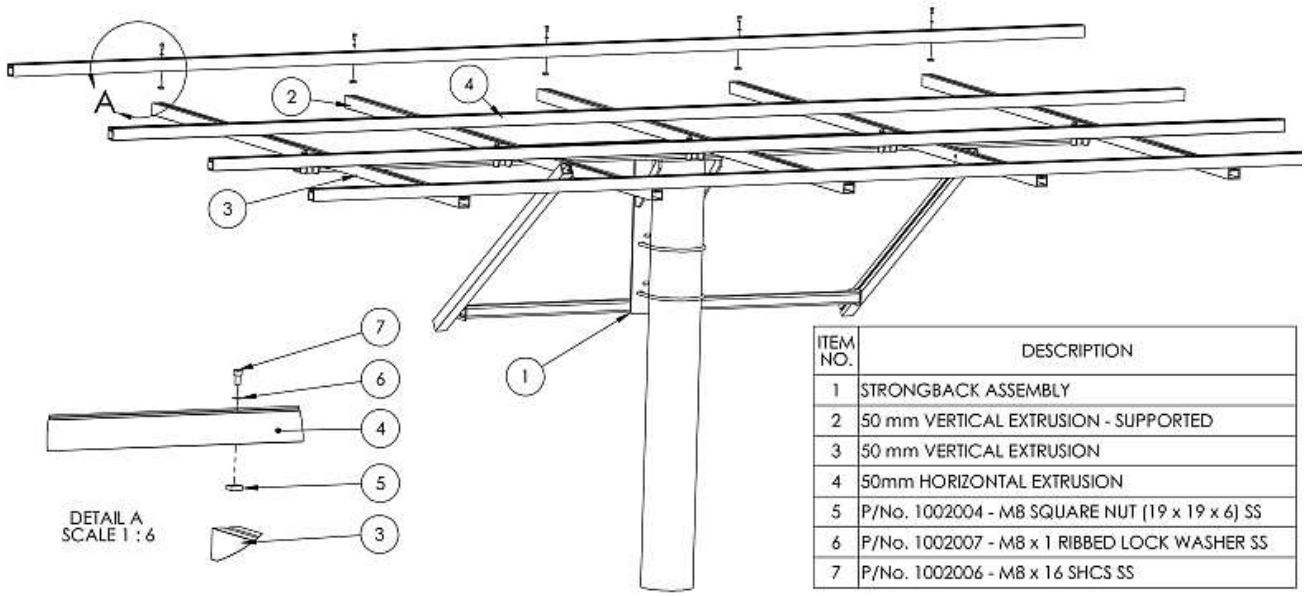
CAUTION for EARLY SYSTEMS Prior to 15 May 11
Pay special attention to the pivot bolts attached to the verticals. These M8 bolts MUST be 30mm, with a Nylock "safety Nut" inside the extrusion and torqued to 22ftlbs as a last action when the system is tilted to the desired angle. If this bolt becomes loose the tilt arm can strike the panel.

Figure 2 - Tilt Arm Hardware Prior to 15 May 2011



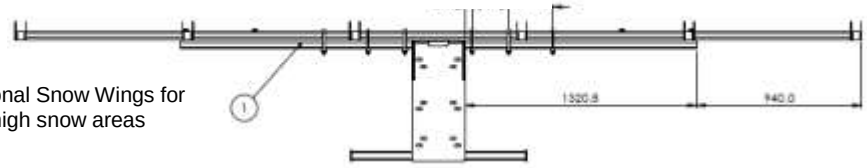
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	7500042	STRONGBACK ASSEMBLY	1
2	7000211	50 mm VERTICAL EXTRUSION - SUPPORTED - 3000mm LG	2
3	7000210	50 mm VERTICAL EXTRUSION - 3000mm LG	3
4	1002002	M10 FLAT WASHER (GALVANIZED)	10
5	1002001	M10 x 90 HHCS (GALVANIZED)	5
6	1002066	M10 SPRING LOCK WASHER (GALVANIZED)	5
7	1002067	M10 HEX NUT (GALVANIZED)	5
8	7000213	TILT SUPPORT ARM EXTRUSION - 1450mm LG	2
9	1002007	M8 x 1 RIBBED LOCK WASHER SS	2
10	1002065	M8 x 30 SHCS SS	2
11	1002004	M8 SQUARE NUT (19 x 19 x 6) SS	4
12	1002009	M8 NYLOCK NUT SS	2
13	1002005	M8 x 20 SHCS SS	2
14	1002014	M8 FLAT WASHER SS	2
15	1002013	M8 SPLIT LOCK WASHER SS	2

Figure 3 – Horizontal Rail Install (this example is PS2000 – PS3000 mount)



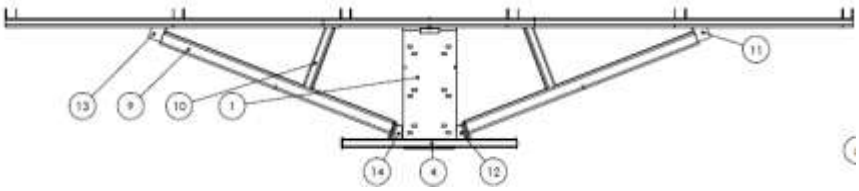
ITEM NO.	DESCRIPTION
1	STRONGBACK ASSEMBLY
2	50 mm VERTICAL EXTRUSION - SUPPORTED
3	50 mm VERTICAL EXTRUSION
4	50mm HORIZONTAL EXTRUSION
5	P/No. 1002004 - M8 SQUARE NUT (19 x 19 x 6) SS
6	P/No. 1002007 - M8 x 1 RIBBED LOCK WASHER SS
7	P/No. 1002006 - M8 x 16 SHCS SS

PS2400F
Standard Strongback

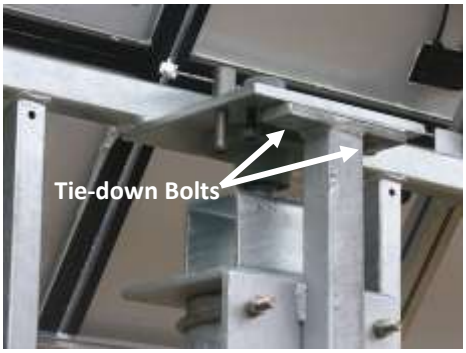


Optional Snow Wings for high snow areas

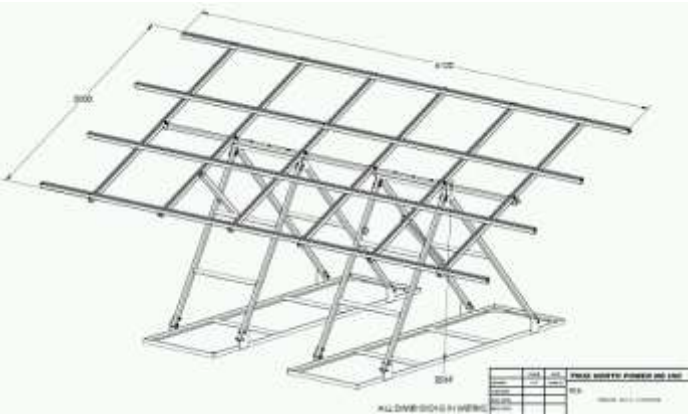
PS2400 HW and PS3200 Strongback "V-Mount"



SWIVEL MOUNTS OPTION. Optional swivel mounts install the same way by mounting the Strongback first, followed by vertical and then horizontal rails, before adding the panels. Once the panels are secure and the Tilt Support Arms are installed and tilted to the desired angle you can unbolt the upper and lower swivel attachments and swivel the entire array up to 180 degrees or more in azimuth. Always tighten the tie-down bolts before leaving the array after pointing it. When square the Strongback arms should orient GRID EAST/WEST.



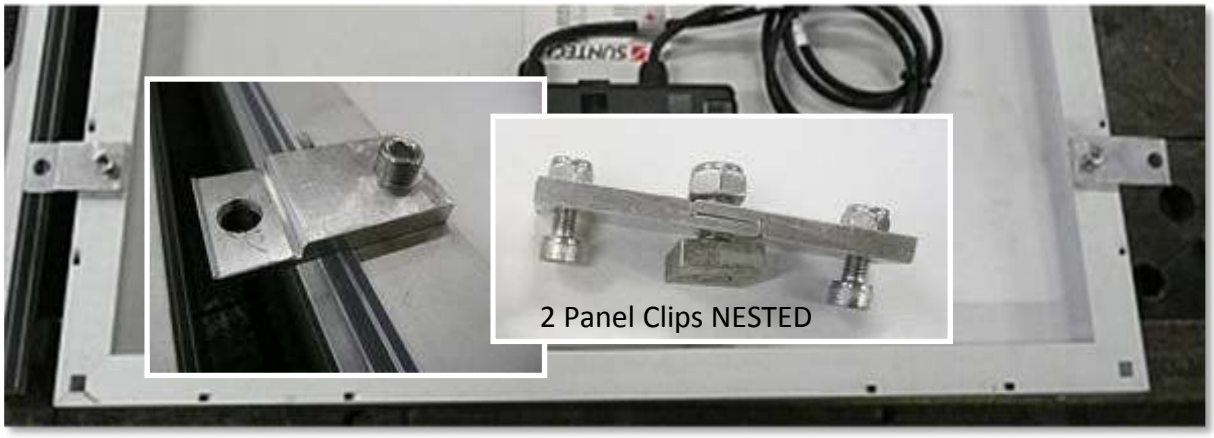
PS2400G. The Big Eh! Versatile ground mount.
This rail configuration is identical to the PS2400F series pedestal mounts but the Strongback is supported by two A Frames as shown here. The assembly is bolted together and then affixed to a concrete pad, soil anchors or ballasted sand bags or large 400lb concrete blocks that can be acquired from a concrete supplier.



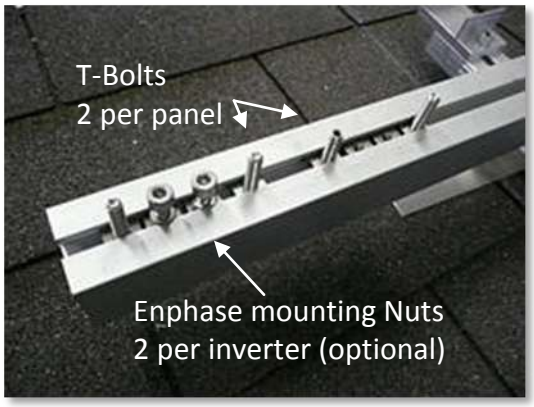
CAUTION
1) The setup of a solar panel mounts should only be attempted on a calm day with little or no wind. Sudden wind gusts can catch solar panels and result in costly panel damage or personal injury.
2) Unconnected PV panels can build up dangerously high voltages especially when they are wired together in series. Exercise caution around PV panel connectors and follow the manufacturer's instructions when connecting and disconnecting panels.
3) Setup of this solar panel mount and installation of the solar panels is not a one person job and requires at least 2 or more people for a safe install. The heavier High Wind models may require a small lifting device to put the Strongback in position safely.
4) There is a significant pinch hazard to fingers and skin. Wear gloves.

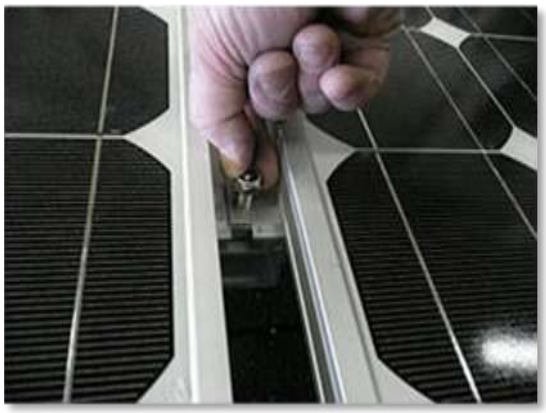
PS3200 use of Panel-Clips

1. Pre-mount Panel-Clips on panel mounting holes with M6 x 16mm socket head bolt, flat washer and Nylock nut. We normally recommend using the panel inner holes for strength and also to shorten the required rail length. Ensure that the first panel of the row has all Panel-Clips flat side DOWN. Then the remaining panels should have both the clips on one side flat side UP to nest with the upper row clips and both clips on the other side flat side DOWN. Panel-Clips are symmetrical and designed to nest with each other so each has a flat side and a nesting side between the panels. Use the 1mm ridge on the Panel-Clips to install the clip against the panel frame for a square fit to the edge of the panel. *For M6 use ~12nm torque.*



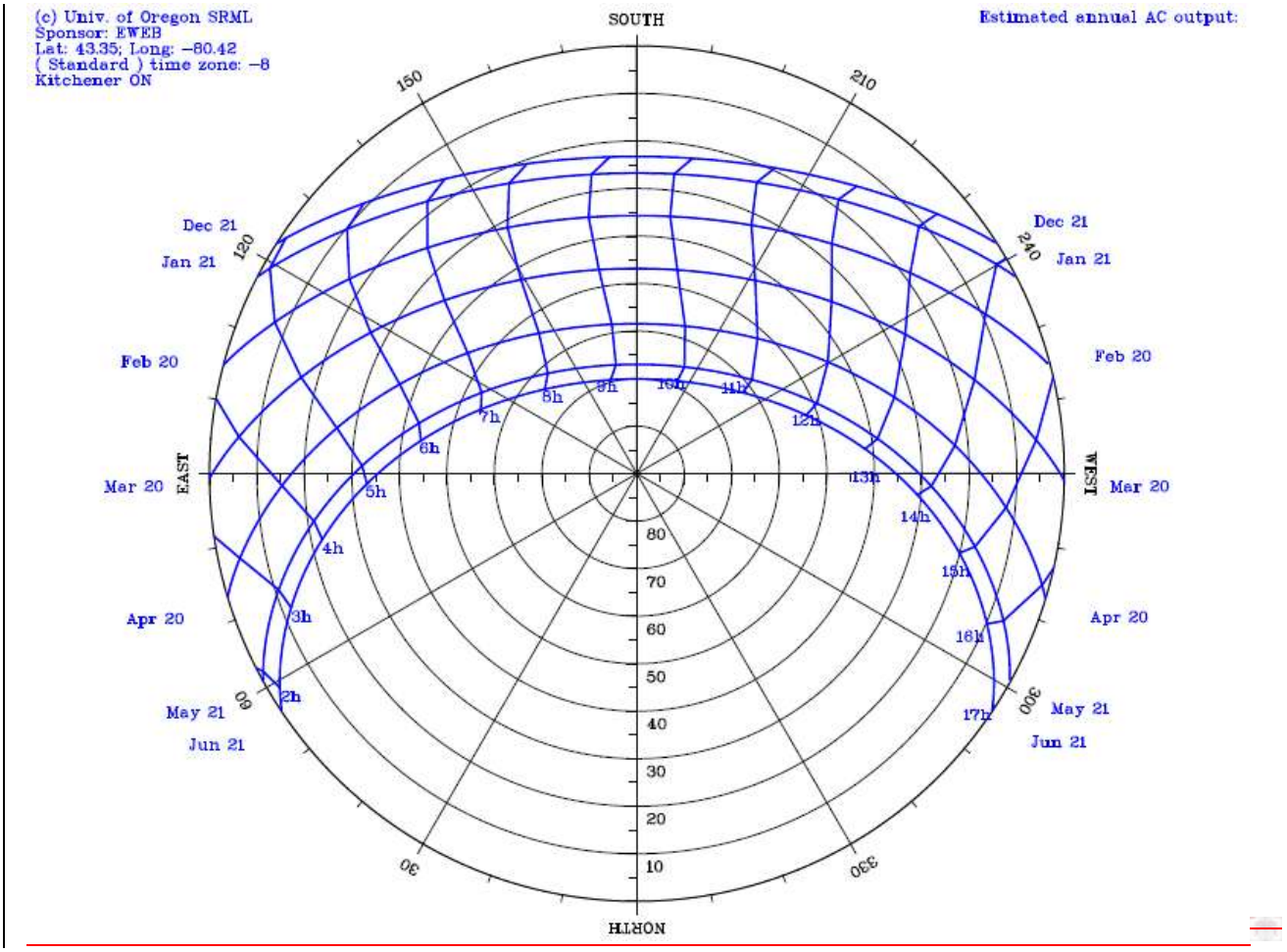
2. Slide two (2) M8 x 25mm T-Bolts onto each horizontal rail for each panel in that row.
3. Hang the first row of panels on the upper T-Bolts. These bolts have the square nut head captured within the rail with the bolt pointed upward through the channel. To mount Enphase inverters be sure to add 2 extra M8 x 22mm socket head bolts on vertical rails as each horizontal rail goes on, with split lock washer and square nuts to mount the inverters later. Start at either end.





4. Secure the upper row of T-Bolts with M8 flat washer, split lock washer and hex nut using a torque wrench or automatic torque driver set to 18 ft/lb or 25nm of torque.
5. Now mount the next rows of panels the same way, nesting each Panel-Clip to the Panel-Clip in the row above. Secure each T-Bolt as you go.

Adjusting the Solar Mount Direction



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" 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. A simple way to do that is to go to Oregon State University. http://solardat.uoregon.edu/SunChartProgram.html . There you will find a simple fill in the blanks form that with Latitude, Longitude and a few other parameters it will generate a graph like the one below that is specific to your location. 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). Don't forget that Magnetic South can be off by several degrees from GRID SOUTH so a compass will not give you an accurate pointing angle. If you use a compass you'll have to account for "magnetic deviation" in your location and that is different everywhere on the planet. Just Google it.

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 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 2-4 times a year does not add significant amounts

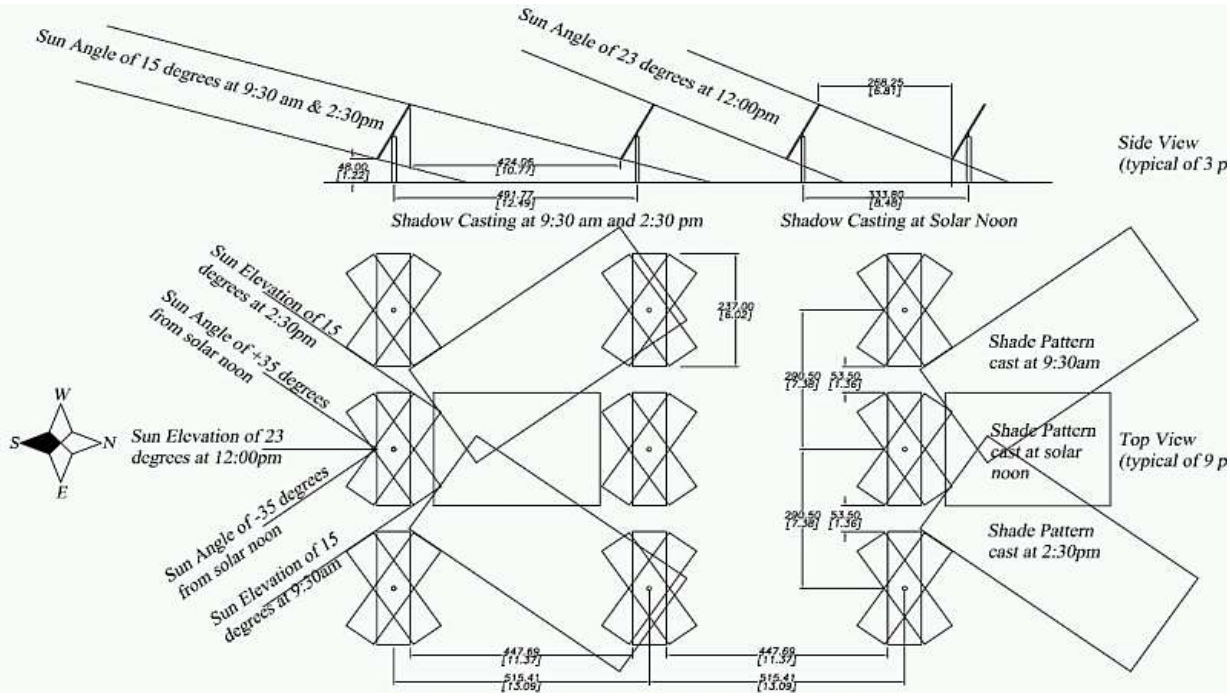
of energy. If you do adjust the angle of the array seasonally, it should at least be done once in late winter or early spring (set the angle to Latitude -15Deg) and again in the early fall (set the angle to Latitude +15 to 20Deg), or change the angle as often as you like based on the chart you produce for your location.

Siting Multiple Pedestals

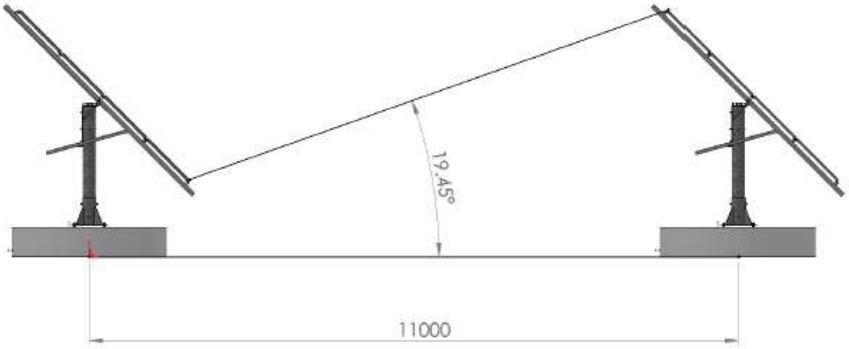
If two or more pedestals are located near each other you will need to provide spacing for them so one does not shadow the others during various times of the day or the year. Below is a typical array siting analysis that you will have to create for yourself based on the location, the ground slope and 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 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.



PS3200 – E.g. 45deg tilt with 1640x994mm panels and about 20 degree winter noon or sunrise solar angle.



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

Select the correct size and height support pole. Install according to local building codes and with the advice of qualified professional, civil or mechanical engineer.

BasePost
8.625”OD
5 or 6.5ft

BaseMount 4 hole mount
(20” centers) 1inch holes

Separate Post (typically 5ft or 6.5ft with DropNGo)

Please read this entire manual including safety precautions carefully before starting work. The following chart is for information in selecting the appropriate galvanized post.

CAUTION
Moving or adjusting the assembled mount is best accomplished with 2 persons, one to support the position of the solar mount and one to loosen and tighten the bolts. The same applies to the Swivel option mounts where high wind can cause the mount to move rapidly and cause injury or damage to solar panels or wiring. The direction of the assembled mount should only be adjusted in low wind conditions (<10mph, 16km/hr 4.5m/s) because the panels may experience unexpected and hazardous movement when the anchoring bolts are loosened.

WARNING
Only loosen U-Bolts just enough to turn the solar mount under control. Never remove the nuts completely as this poses a significant injury risk. If any of the 0.50 inch SS hex nuts are removed after installation the unit may possibly fall off the pole and injure someone.

AZIMUTH DIRECTION ADJUSTMENT
To adjust the direction of the fixed solar mount, loosen the 0.50 inch SS hex nuts on the U-Bolts only until they are a little looser than snug. Handling only the Strongback, turn the solar mount to the desired direction and then re-tighten the M10x70mm galvanized hex nuts. Torque to 80 ft/lb or 110nm.

SWIVEL MOUNT ADJUSTMENT
Once installed the swivel mount option can be adjusted by loosening and removing the two tie-down bolts on the swivel plate, turning the array to the desired direction and then reinserting and tightening the tie-down bolts.

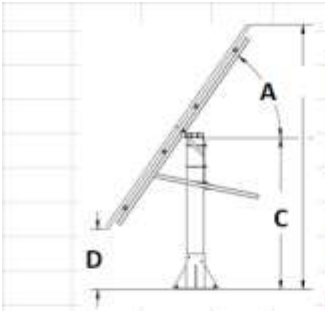
ADJUSTING THE TILT ANGLE
To adjust the vertical angle of the solar mount, (Refer to pg 7) and choose 30, 40 or 50deg bolt holes for adjustment . Make sure the mount is held and supported when the bolts are loosened. Do not loosen bolts more than necessary to change the angle of the solar mount and never remove the bolts.

Adjust the solar mount to the desired angle and then re-torque the main tilt bolts and all bolts on the Tilt Support Arms.

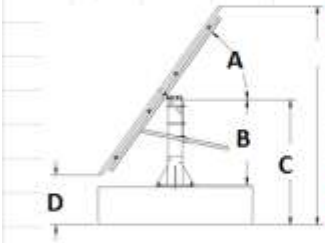
Site Preparation and Post or Pole installation is not part of the equipment supplied by True North Power NG Inc. ***ALWAYS consult a qualified professional engineer.***

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

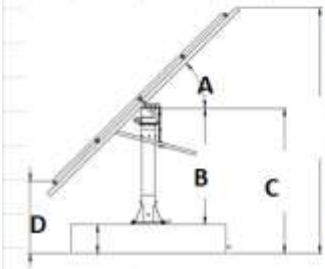
Height Options – With and Without Drop*N*Go Stack or SunpointGPS



Array Panel/Orientation			10 Panel 5x2 Portrait	12 Panel 6x2 Portrait	15 Panel 5x3 Portrait	16 Panel 4x4 Landscape	18 Panel 6x3 Portrait
IN-GROUND PEDESTAL			PS2000P	PS2400P	PS3000P	PS3200L	PS3600
Post Length			12' (3.66m)	12' (3.66m)	15' (4.6m)	15' (4.6m)	15' (4.6m)
Array Angle		A	55^0 Tilt From Horizontal				45^0 Tilt
Top Of Pole Above Grade		C	8ft (2.44m)	8ft (2.44m)	8ft (2.44m)	8ft (2.44m)	8ft (2.44m)
Ground Clearance		D	49.6" (1.26m)	49.6" (1.26m)	25.5" (.66m)	29.9" (.76m)	25.5" (.66m)
In-ground Concrete			Local Design only				



DropNGo			PS2000	PS2400	PS3000	PS3200	PS3600
Post Length			5Ft	5Ft	6.5ft	6.5ft	5Ft
Array Angle		A	45^0 Tilt From Horizontal				45^0 Tilt
Array Center	Above Ballast	B	5' (1.52m)	5' (1.52m)	6.5' (2m)	6.5' (2m)	7.23' (2.21m)
	Above Grade	C	6.4' (1.95m)	6.4' (1.95m)	8.3' (2.53m)	8.3' (2.53m)	8.9' (2.7m)
Panel Ground Clearance		D	36.9" (.94m)	37.6" (.96m)	37.4" (.95m)	50.4" (1.28m)	40.84'(1.04m)
8.6ft Diameter Ballast			1.2ft thick ~10,780lbs		1.67ft thick ~14,450lbs		2ft thick ~17,400lbs



DropNGo with SunpointGPS			PS2000	PS2400	PS3000	PS3200	PS3600
Post Length			5Ft	5Ft	5Ft	5Ft	5Ft
Array Angle		A	45^0 Tilt From Horizontal				45^0 Tilt
Array Center	Above Ballast	B	5' (1.52m)	5' (1.52m)	5' (1.52m)	5' (1.52m)	7.6' (2.3m)
	Above Grade	C	7.8' (2.38m)	7.8' (2.38m)	8.2' (2.5m)	8.2' (2.5m)	9.6' (2.9m)
Panel Ground Clearance		D	53.4" (1.36m)	53.4" (1.36m)	35.9" (.91m)	48.9" (1.24m)	47.8'(1.2m)
8.6ft Diameter Ballast			1.2ft thick ~10,780lbs		1.67ft thick ~14,450lbs		2ft thick* ~17,400lbs
							* 10 ft Diameter

Steel Post (Pedestal) Requirements

PS800	PS1200 & PS1600	PS1800, PS2000 & PS2400	PS3000 & PS3200	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	8" Post 8.625"OD Up to about 8ft above Grade	Hollow Structural Steel (HSS) Round .322" 5/16th wall ASTM Standard Grade 500C

CAUTION

The following analysis is typical of civil engineering calculations and is provided for reference only. It accounts for assumed soil and peir data. True North Power only provides the top of pole load requirements at the top 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.

Assembling PS400 and 600 series Top of Pole "Split Mounts"

These smaller mounts consist of two short steel rails that hold 2 horizontal aluminum extrusions. They are normally mounts near the top of the pole separated by about 400mm. This distance can then be adjusted along with the tilt arms in order to achieve the desired tilt angle. Note: 2 panels can be mounted side pole or top of pole using the PS400 split mounts however PS600 3 panel split mount should only be done at top-of-pole as shown in the diagrams below.

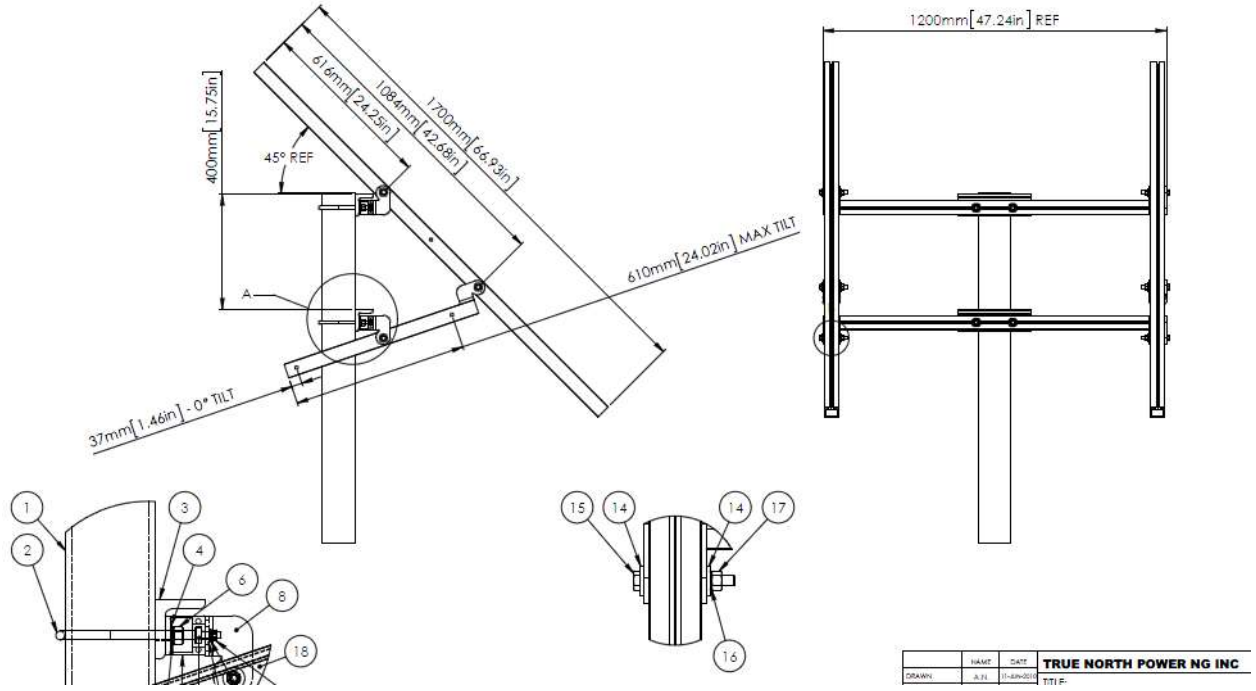
Mount the L angle pieces with the 4" U-Bolts with the horizontal 50x50mm x 1250 mm rails first. Then mount 2 tilt clevis on each end and space them appropriate for the width of the vertical rails needed. When mounting in LANDSCAPE this is usually the distance between the panel mounting holes on the longest rail of the chosen panel. Now mount the Vertical rails using M10x90mm HH Galv bolts. (you may wish to drill additional 11mm holes as needed or repsace the U-Bolts to get the desired tilt angle.

Mount the panel clips on each of the panel mounting holes and then slide T-bolts onto the vertical rails and fix the first panel. This is often best done while the vertical rails are in a horizontal position so the panels stay in place before they can be tightend. Once both or all three panels are on (panel clips nested) tighten the hex nut, split washer and flat washer on each T-Bolt and then tilt to the desired angle and insert the M10x90 tilt bolts. Tighten all tilt arm bolts and you're done. Torque on M10x90 bolts should be 24lbs.

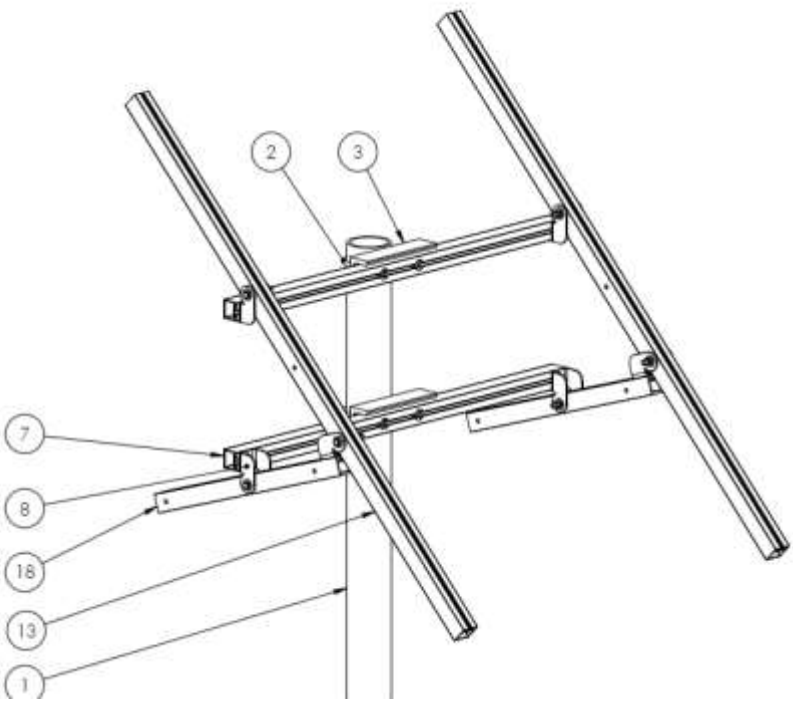
Refer to the diagrams on the next page.

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

Contact info@truenorthpower.com



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	POST	6.5" OD x .337" WALL HSS TUBE	1
2	1002030	U-BOLT 4in SCH 40 x 6-1/2in x 1-1/2in (THREAD) SS	2
3	BRACKET	POST MOUNT BRACKET - 2" x 3" x 1/2" WALL ANGLE	2
4	FLAT WASHER	1/2" NARROW FLAT WASHER (GALVANIZED)	4
5	1002022	1/2" SPLIT LOCK WASHER (GALVANIZED)	4
6	1002023	1/2" HEX NUT (GALVANIZED)	4
7	VERTICAL	50mm EXTRUSION x 1575mm - HEAVY - PANEL SUPPORT	2
8	7000111	PIVOT CLIP (GALVANIZED) 101.6 x 165.2 x 4.76 mm	6
9	1002008	M8 x 25 SQUARE HEAD BOLT (19 x 19 x 6) SS	6
10	1002014	M8 FLAT WASHER (GALVANIZED)	6
11	1002013	M8 SPLIT LOCK WASHER (GALVANIZED)	6
12	1002109	M8 x 1.25 HEX NUT (GALVANIZED)	6
13	TBD	50mm EXTRUSION x 1700mm - HEAVY - PANEL SUPPORT	2
14	1002002	M10 FLAT WASHER (GALVANIZED)	12
15	1002001	M10 x 1.5 x 90 HHCS (GALVANIZED)	6
16	1002006	M10 SPRING LOCK WASHER (GALVANIZED)	6
17	1002007	M10 HEX NUT (GALVANIZED)	6
18	TILT STRUT	TILT ADJUSTING ARM 50mm EXTRUSION - 700mm LG	2



The following post anchoring calculation is for reference only and may not be suitable for your location or tower height or mount choice
Always consult a Professional Engineer.

"POLEFDN.xls" Program
Version 1.7

POLE FOUNDATION ANALYSIS

For Free-Top Round Piers Using UBC Method
Subjected Vertical Load, Horizontal Load, and/or Moment

Job Name:	Pole Mount PV Array	Subject:	Foundation Design		
Job Number:	09-351	Originator:	CJG	Checker:	

Sheet 8

Input Data:

Pier Data:

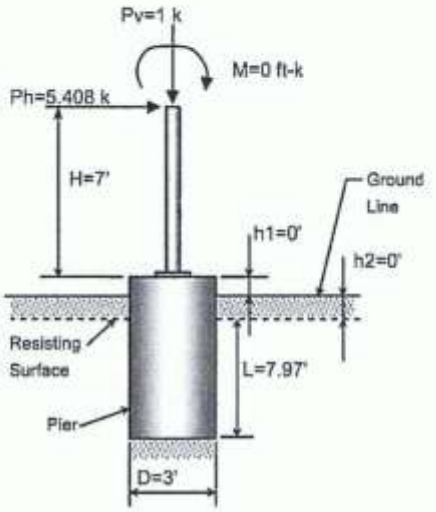
Pier Foundation Diameter, D =	3.000	ft.
Pier Height Above Soil, h1 =	0.000	ft.

Soil Data:

Unit Weight of Soil, γ =	0.120	kcf
Angle of Internal Friction, ϕ =	32.00	deg.
Depth to Resisting Surface, h2 =	0.000	ft.
Allow. Soil Bearing Pressure, Pa =	2.000	ksf

Pier Loadings:

Axial Load, Pv =	1.000	kips
Horizontal Load, Ph =	5.408	kips
Distance from Ph to Top/Pier, H =	7.000	ft.
Externally Applied Moment, M =	0.000	ft-kips



Nomenclature

Results:

Pier Embedment and Total Length:

Pe =	5.408	kips	Pe = Ph+(M/(H+h1+h2)) ("equivalent total" horizontal load)
Kp =	3.255		Kp = TAN^2(45+ϕ/2) (passive pressure coefficient)
Pp =	3.111	ksf	Pp = Kp*γ*L (passive pressure at bottom of pier)
S1 =	1.037	ksf	S1 = Pp/3 (passive pressure at 1/3 embedment depth)
A =	4.068		A = 2.34*Pe/(S1*D)
L =	7.97	ft.	L = A/2*(1+SQRT(1+(4.36*(H+h1+h2)/A))) (UBC Eqn. 6-1, page 2-45)
Lt =	7.97	ft.	Lt = h1+h2+L (total length)

Pier End Bearing Pressure:

Af =	7.07	ft.^2	Af = π*D^2/4 (pier base area)
Wf =	8.45	kips	Wf = (Af*Lt)*0.150 (pier weight)
ΣPv =	9.45	kips	ΣPv = Pv+Wf (total vertical load)
P(bot) =	1.336	ksf	P(bot) = ΣPv/Af

Pa>=P(bot), O.K.

Reference: 1997 Uniform Building Code (UBC), Section 1806.8, page 2-45

Comments:

