

BERGEY XL-15 INSTALLATION QUICK GUIDE



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*****BEFORE PERFORMING ANY LIFTING OPERATION ENSURE ALL PARTS
ARE FREE AND CLEAR FROM OBSTRUCTIONS AND ARMORED CABLE
WILL NOT BE CRUSHED OR DEFORMED IN ANY WAY*****

*****DO NOT ALLOW TURBINE TO FREE SPIN*****

*****DO NOT ALLOW TURBINE TO OPERATE WITH BACK UP
GENERATOR SUPPLYING POWER*****

*****DON'T LET IT RAIN IN THE BACK OF THE ALTERNATOR WHEN ITS
STORED FACE DOWN*****

RECOMMENDED TOOL LIST

Please note the below list is to serve as a general reference of what tools you should have available. However in no way is it meant to be a comprehensive list of tools required to complete the installation.

- Torque wrench -150 FT LBS
- 1-1/16 deep socket
- 17 MM socket and wrench
- 24 MM socket
- 22 MM socket
- 5/32 or 4MM allen key
- 1/8th allen key
- Screw drivers
- Wire strippers
- Wire crimpers
- Diagonal cutters
- Razor blade knife
- Drill bits
- Step bit – at least 1 inch
- Volt meter/megger
- Spud wrench
- Tag line
- Chain hoist

TORQUE VALUES

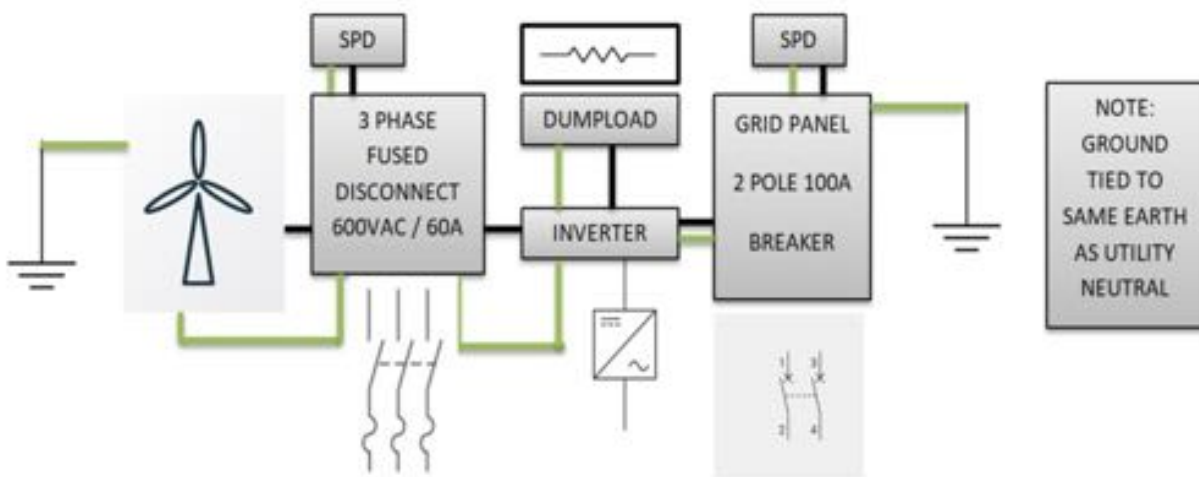
TASK	TOOL	HARDWARE	TORQUE
Attach tailboom to mainframe	17 MM	10 MM	35 ft·lb
Attach tailfin to tailboom	17 MM	10 MM	35 ft·lb
Torque bracket to alternator	24 MM	16 MM	100 ft·lb
Blades/clamp plate to alternator	24 MM	16 MM	*SEE PG 20
Spinner mounting	17 MM	10 MM	20 ft·lb
Turbine to tower	1-1/16"	5/8 (UNC)	120 ft·lb (wax) 198-240 ft·lb
Inverter grid side connections		5/32 or 4mm allen key	90 inch lbs
Inverter Turbine side connections		#2 flathead screwdriver	40 inch lbs
Dumpload +/- connections	3/16" or 5MM		90 inch lbs
Dumpload fan connections	Wire crimpers	Butt splice	

TURBINE HARDWARE

HK-XL15	HARDWARE KIT XL15	HK0010-B / HK0010-TB / HK0010-TF
HK0010-B	BLADE ATTACHMENT HARDWARE	KIT
15811GALV	XL15 ROTOR CLAMP PLATE-SRK, MACH, HOT-DIP GALV	1 CLAMP PLATE
15061	XL15 TORQUE BRACKET ASSEMBLY	3 NOSE CONE ATTACHMENT
HBM160PLT	BOLT M16-2 x 150MM	15 BLADE BOLT
WASHERS:HWM1600	WASHER, M16 SS	15 BLADE WASHERS
HBM160PLT	BOLT M16-2 x 150MM	6 TORQUE BRACKET BOLTS
WASHERS:HWM1600	WASHER, M16 SS	6 TORQUE BRACKET WASHERS
SF0064	THREAD LOCK - BLUE 2ML	1 APPLY TO ALL BOLTS
HK0010-TB	TAIL BOOM ATTACHMENT HARDWARE	1 KIT
HMB1030	BOLT M10-1.5 x 20MM HHCS,SS	16 TAIL BOOM BOLTS
HW6004	WASHER 2/8 SAE FLAT SS 12/16OD	16 TAIL BOOM WASHERS
SF0064	THREAD LOCK - BLUE 2ML	1 APPLY TO ALL BOLTS
HK0010-TF	TAIL FIN ATTACHMENT HARDWARE	1 KIT
HBM105	BOLT, M10-1.5 x 20MM HHCS, SS	8 TAIL FIN BOLTS
HW6010	3/8 X 1-1/2 STAINLESS FENDER WASHER	8 AGAINST TAIL FIN
HN101	NUT M10-1.5 NYLOC SS	8 TAIL FIN NUTS
HW6004	WASHER 3/8 SAE FLAT SS 13/16OD	8 AGAINST TAIL BOOM
HM0040	ANTISEIZE COMPOUND - 2mL	1 APPLY TO ALL BOLTS

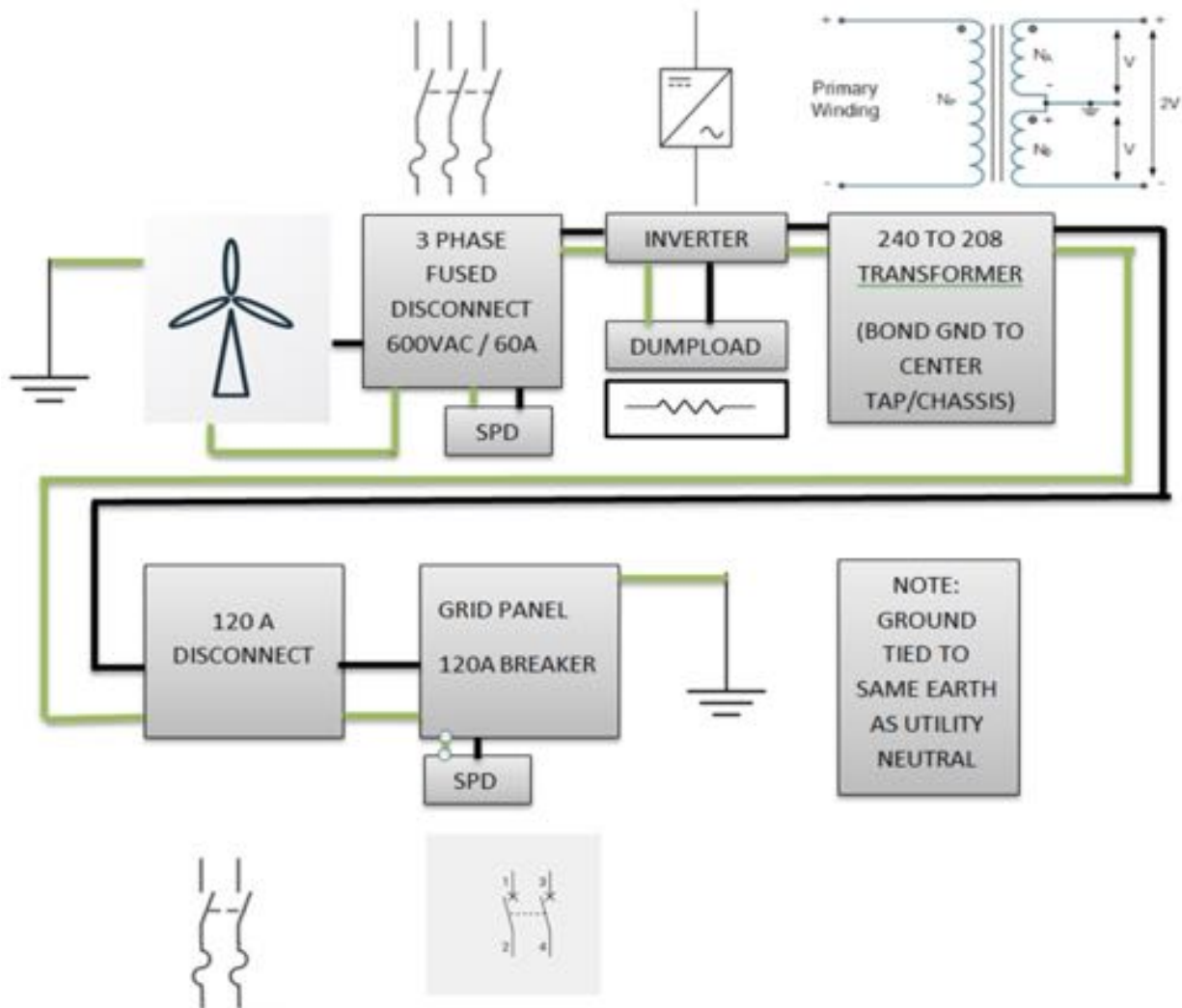
ELECTRICAL –STANDARD 240VAC 60Hz

This is how a typical 240 VAC grid tied installation will look once installed. For deviation to the one line follow all local codes.



ELECTRICAL TRANSFORMER REQUIRED

This configuration is typical for a grid tied system that is not a standard 240VAC. A 25KVA transformer is sized appropriately. A number of manufactures make transformers that are suitable for installation. For this example we will use the single phase transformer from Maddox.



NOTE: The 120A fused disconnect is not mandatory but could be required by local code.

WIRE SIZING

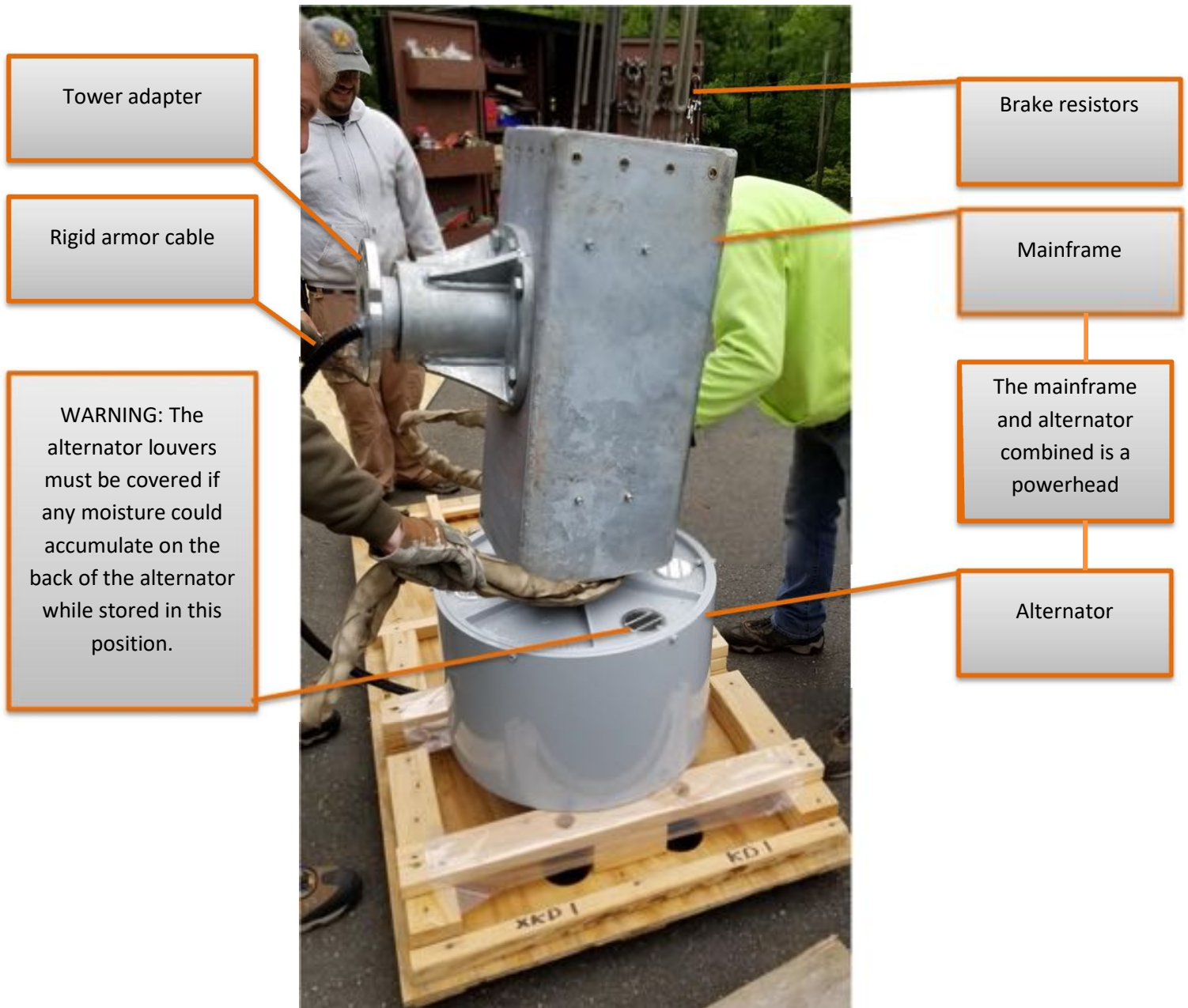
Wire run limit for performance equal to WindCAD estimation						
	Tower Height (in feet)					
	60	80	100	120	140	160
	wire run distance to base of tower (feet)					
6 AWG	210	190	170	150	130	110
4 AWG	340	300	270	240	210	180
3 AWG	420	380	340	300	260	220
2 AWG	530	480	430	380	330	280
0 AWG	850	771	690	610	529	449
00 AWG	1080	980	880	780	670	560
000 AWG	1370	1240	1110	980	850	720

Recommended Wire Size for BWC EXCEL 15 Installations

Note that wire run lengths correspond to performance values estimated by WindCAD. Annual Energy Output losses of 4.5% were factored into the WindCAD model to account for energy losses due to wire sizing.

GETTING STARTED

The unit will come in three packages. Below is the power head crate that has been open and stripped down to begin turbine assembly. Note the alternator is bolted to the pallet.



POSITIONING THE UNIT FOR TAIL ASSEMBLY

A mechanical advantage will be required to lower the powerhead on its side as it weights over 1,000 lbs. Careful attention must be given to the armored cable and brake resistors to ensure this is not crushed in the process. Damage to the armored cable could result in a non-operational turbine.



TAIL INSTALLATION

Take caution to ensure the tail is not installed upside down, note it will bolt on incorrectly. Leave all bolts finger tight until all bolts are started. Ensure extreme caution is taken to avoid damaging the brake resistors protruding from the rear of the mainframe when joining mainframe and tail together.



WARNING: The tailboom bolts must be installed with hand tools. Using an impact driver WILL damage the nuts.



Tailboom incorrectly installed upside down

TAIL INSTALLATION CONTINUED

A quick check to ensure you are installing the tailboom correctly: While looking down the turbine, from the alternator to the tailboom the tail fin should be located on the right side of the machine.



Tailboom installed correctly

TAIL FIN INSTALLTION

Shown below are images of how it will look after proper installation.



RIGGING THE TURBINE FOR THE LIFT

The turbine has two eye bolts atop the mainframe. Ideally a separate strap is attached to each eye bolt. It has been reported when picked in this manner the tower adapter does not “sit” parallel with the tower top. A chain hoist can provide for fine adjustments.

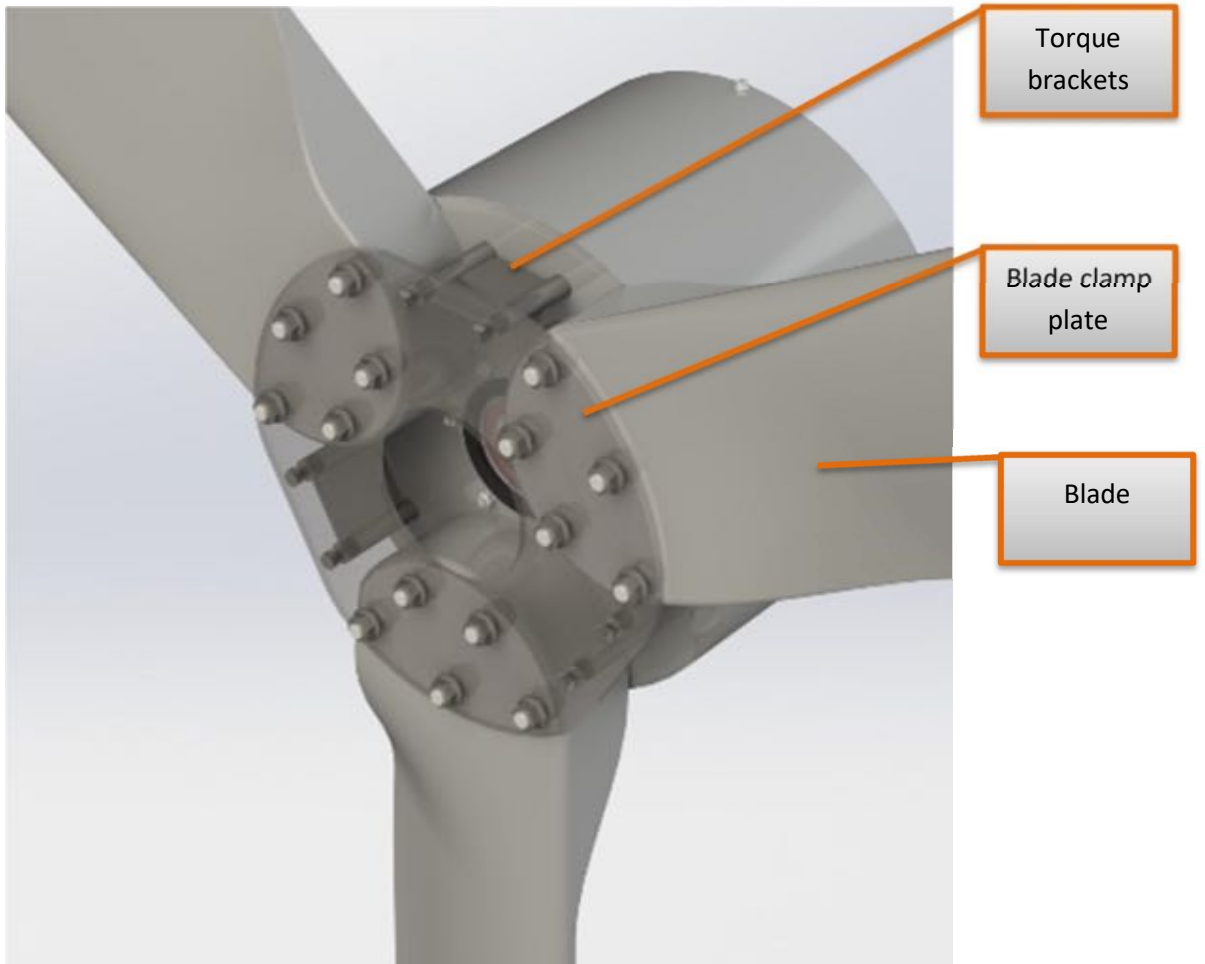
Blades should not be installed yet. However, take note of blade orientation, with one blade straight up

Lift Weight: ~1,350 LBS



Tag line to control turbine swing

BLADE INSTALLATION



TORQUE BRACKETS

Install the blade clamp plate and the torque brackets. Notice the bolt goes through the clamp plate then through the plate spacers into the alternator. Leave all hardware loose.



NOTE: The clamp plate spacers are from a previous revision. Current production will have hardware to mount the nose cone already installed

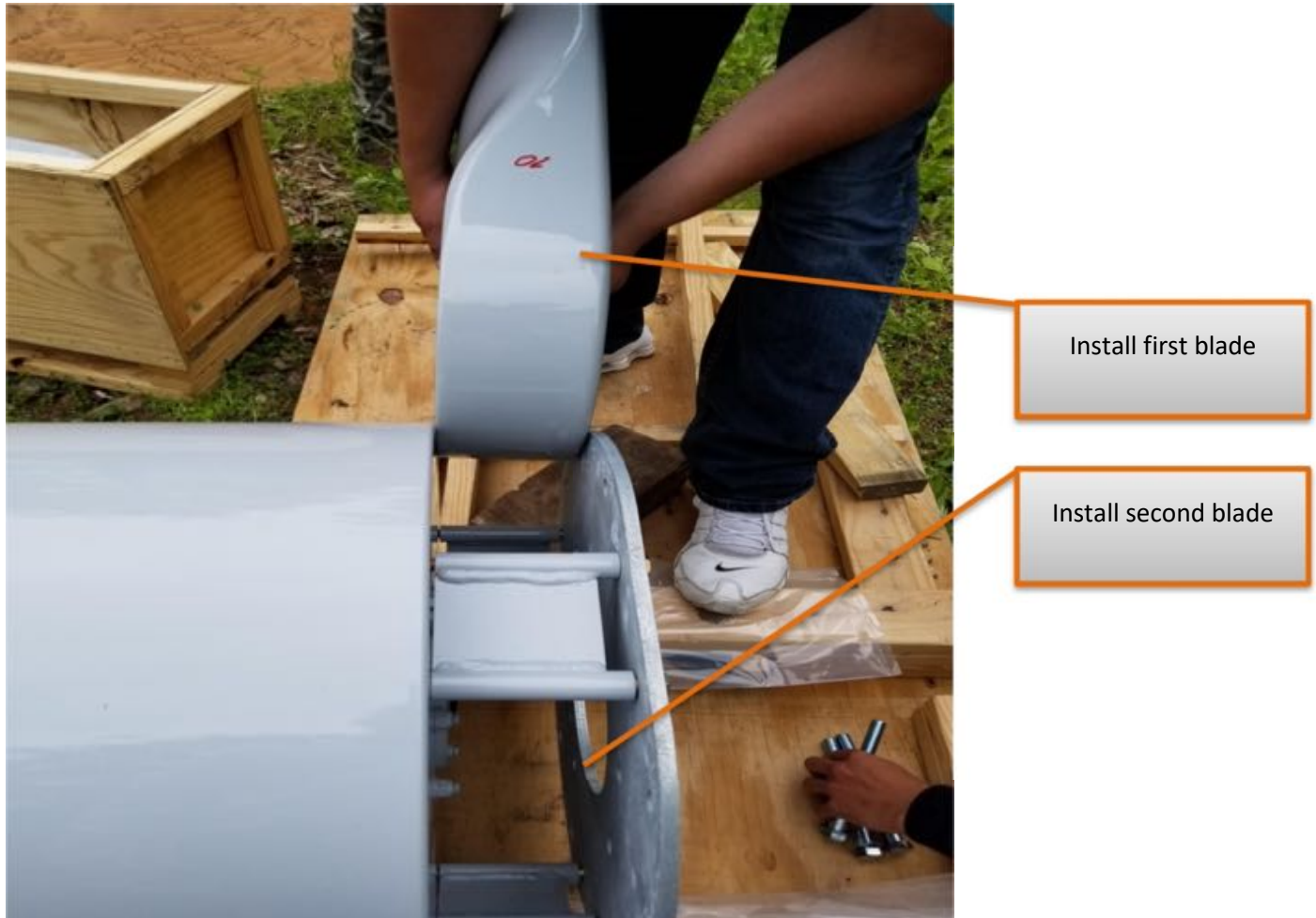
BLADE ORIENTATION

The blades can bolt onto the alternator backwards. It is important to ensure this does not happen. Although the blades come with stickers that indicate which side of blade root should face the alternator, close scrutiny should be applied to ensure they are correct. When facing the alternator looking towards the tailboom the blades should rotate counterclockwise. The leading edge (thick) portion should turn into the wind.



FITTING BLADES

Now that the blade clamp plate and clamp plate spacers are installed loosely. We can install the first blade. Fit the blade between the alternator and clamp plate as documented below.



Two blades can be installed before the turbine is lifted. While the turbine is being lifted they can be rotated around for the easiest installation of the third blade.

BLADE TORQUE

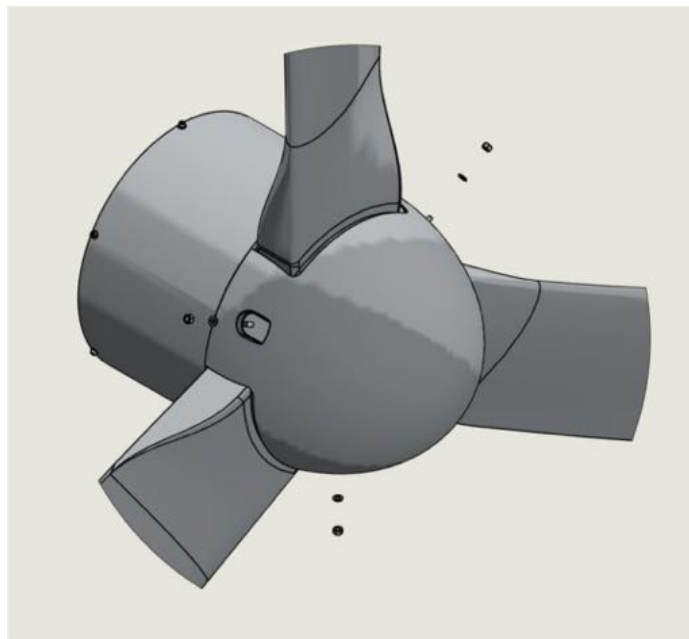
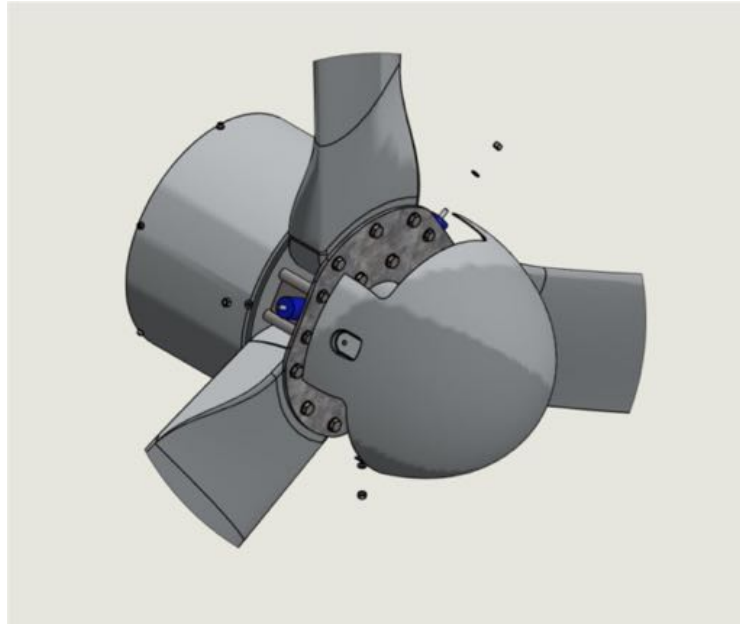
While lifting the turbine pay attention to the armored cable and ensure that it is not crushed at any point in the process. The blades have a procedure for being torqued. Start with 50 ft·lb. then back off a $\frac{1}{4}$ turn, 75 ft·lb. then back off a $\frac{1}{4}$ turn, 100 ft·lb. then back off a $\frac{1}{4}$ turn, 125 ft·lb. then back off a $\frac{1}{4}$ turn and final torque at 150 ft·lb.



At this time the tag line should be installed to assist in raising the turbine.

NOSE CONE INSTALLATION

The nose cone will line up with the rubber mounts factory installed on the torque brackets. One bolt and fender washer are used per torque bracket to install the nose cone.



APPLYING A PHASE TO PHASE SHORT

At this time a phase to phase short should be applied in the down tower disconnect box. Use two 10 gauge solid strand wires to jump between the bottoms of the fuses as shown below. This short should be left in place until the system is commissioned.



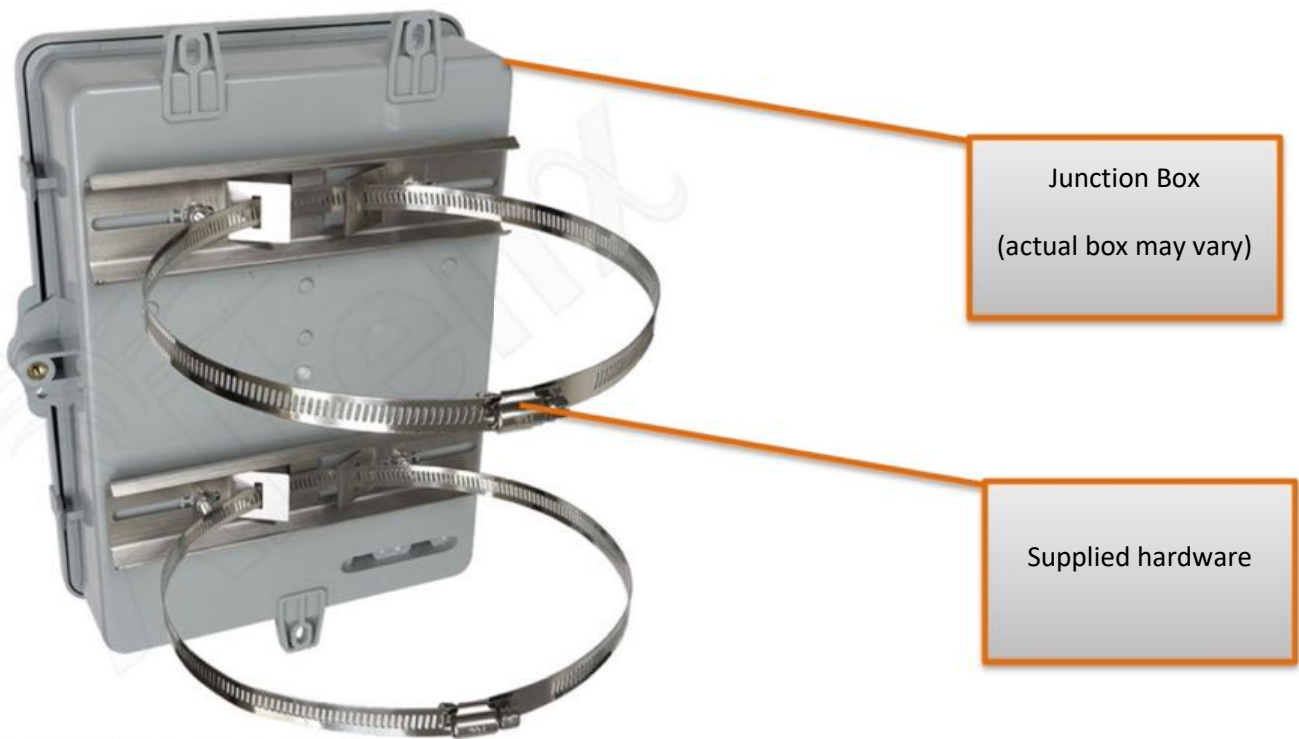
RAISING THE TURBINE

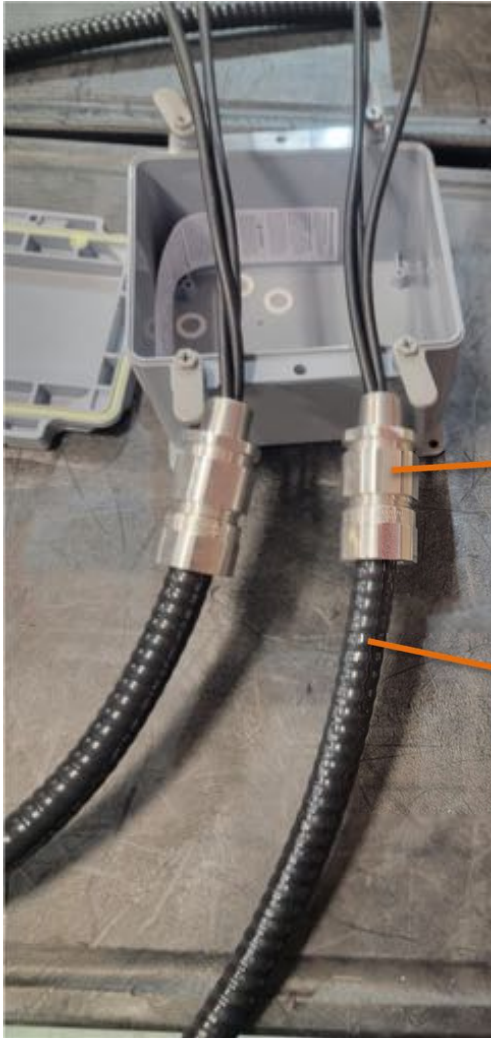
The top blade should be tied off to the lifting eye bolt to physically stop the alternator rotation. Once the electrical connections are made the phase to phase short applied in the disconnect will electrically stop the alternator rotation and the blade should be untied.



TOWER LEG JUCTION BOX

Attach the supplied hardware to the junction box. Attach the junction box to the tower leg, a couple feet below the turbine mounting plate. Use a step bit to drill a 1" hole, in the bottom of the junction box, for the armored cable connector. Attach the armored cable connector to the armored cable from the turbine. Install the armored cable connector into the junction box. (If a wiring kit was purchased it will include the same size armored cable connectors for the wire run between the junction box and the fused disconnect at the base of the tower.) Install the down tower cable into the junction box. Use the Polaris taps to connect the wire from the turbine to the down tower wire. (1/8th Allen key)





Armored cable
connector

Armored cable



Polaris taps
Actual style may vary

SYSTEM COMMISSIONING

Megger Test

The installation of the wiring must be checked to ensure adequate insulation. This will require a megger (insulation breakdown tester) with a 1000V scale. The test should show any damage to the wire run from the turbine to the inverter.

While performing these tests the underground wire run must be disconnected from the inverter, the tower wire run disconnected from the turbine and adequate measures taken to ensure the turbine does not free spin while the test is being conducted.

The first reading taken is with a phase to phase short applied to the down tower disconnect. This reading will give an overall health report of the insulation. The test is conducted phase to ground. A satisfactory reading will be 100 MΩ or higher.

With the phase to phase short applied we have tested all three phases of the system wire run in its entire length.

Next we want to double check the initial test readings by conducting, an individual test to each phase of the underground wire run, down tower disconnect and up tower wire run. All readings should be 100 MΩ or higher to proceed with turbine commissioning.

NOTE: During all tests the turbine and inverter were not included in the testing circuit.

SYSTEM COMMISSIONING

Inverter / Dump load

Perform a visual inspection of the inside of the inverter; look for any damage that might have occurred in shipping. Double check all inverter and grid connections are tight and in good repair.

Open the dump load and locate the two copper bus bars. Take an OHM reading between the two buss bars and ensure that you have 10 OHMS.

Press in the emergency stop button on the inverter.

Bring on grid power to the inverter via the grid side breaker. At this time the dump load fans should start, but the inverter display should remain dark. Check that the incoming grid voltage to the inverter is correct.

Pull out the emergency stop and observe that the display comes on. At this time the inverter has started its initialization process. The process takes a total of five minutes prior to connecting to the grid for power transfer.

Toward the end of the five minute countdown the inverter should make a high pitched hum. While reaching the end of the countdown a loud “bang” should be heard, this is the contactor closing.

NOTE: These tests are all performed while the turbine is in a phase to phase shorted.

SYSTEM COMMISSIONING

Alternator output

With the inverter fully powered up and having completed its initialization process of five minutes, remove the phase to phase short in the down tower disconnect.

With enough wind, the blades should begin to rotate and the alternator output variable voltage variable frequency alternator current.

Check with a voltmeter that the phase to phase voltage is equal across each pair. Label the phases from left to right A / B / C we should take three phase to phase readings A-B / A-C / B-C

NOTE: These readings are taken phase to phase NOT phase to ground.

The VAC of the alternator output is variable, so a specific number is not expected to be observed rather a comparison between all three readings they should be within a couple of volts of one another. This test often misleads people as the readings change in between the time required to take the three readings. This test might take a few tries to be confident of the results depending on how steady the wind is while taking the test or multiple voltmeters.

SYSTEM COMMISSIONING

Checklist

- Ensure all turbine wiring has proper insulation by performing 1000 volt megger testing. Do not test wiring with turbine or inverter in the circuit. (see page 23)
- Check all inverter and dump load connections.
- Test the resistors in the dump load, a correct reading should be 10 ohms between the buss bars
- With the emergency stop closed bring on grid power to the inverter, ensure dump load fans come on and proper grid VAC is being supplied to the inverter (see page 24)
- Pull out the emergency stop ensuring the inverter fully powers up and starts the five minute initialization process
- Observe the end of the initialization process hearing the humming and contactor close, the inverter should now be in a “waiting for wind” state
- Remove the phase to phase short in the down tower disconnect
- Test for balance phase to phase voltage from the alternator (see page 25)
- Observe the unit transfer power, ideally to maximum power output

ADDITIONAL INFORMATION

- A junction box is required to install the down tower cable with the armored cable that is protruding from the 15KW tower adapter. This will also require a source for connecting the wires, Bergey WindPower recommend Polaris IT-4 connections.
- The inverter fans are controlled by a thermostat, the dump load fans run continually
- Upon initial commissioning ensure the Emergency stop is pulled out
- Use a 100 amp breaker for the grid side connection. If the panel cannot support this size of breaker consult a local electrician to see if a line side tap is an option.
- Generally the XL15 is going to require a specific mounting plate to make the attachment to the tower, tower attachment hardware is not supplied with the turbine, it is supplied in the adapter plate kit, contact the BWC Sales Department to find out if a premade kit is available for your application
- Dumpload must be installed vertically with chimney facing “up”