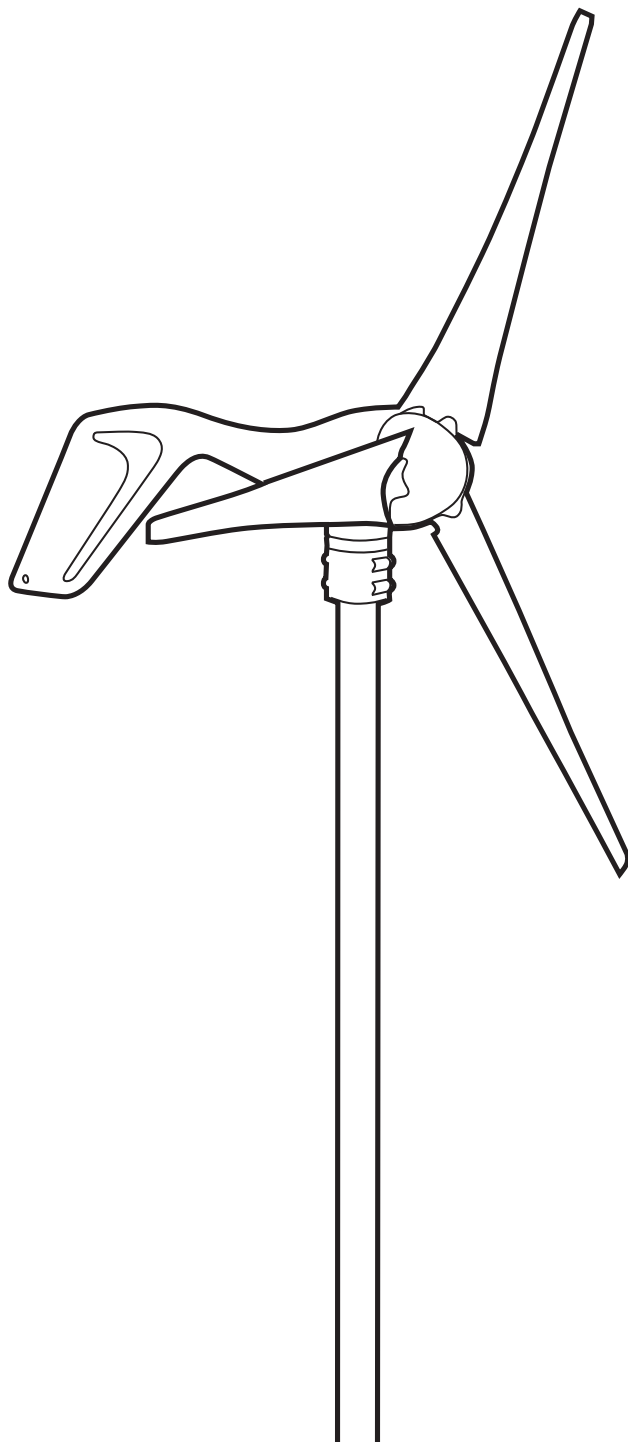




aiRTM

OWNER'S MANUAL

Installation • Operation • Maintenance

aiRTM BREEZE

aiRTM 40

aiRTM 30

Primus Wind Power, Inc.
938 Quail Street
Lakewood, CO 80215 USA
Phone: 303.242.5820

www.primuswindpower.com

MADE IN THE **USA**

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Primus Wind Power, Inc.

Congratulations on your purchase and welcome to our family!

Dear AIR Owner,

Thank you for your purchase of an AIR wind turbine. You have purchased the most advanced battery charging wind turbine in the world! We believe you will find it easy to install your AIR and are confident you will experience years of dependable service from it.

Before going any further, please complete and return the Warranty Registration Card or register on-line at www.primuswindpower.com/warranty. The five-year warranty is effective only after the product has been registered. Note - Primus Wind Power does not sell or distribute your personal information to any third party. We understand and respect your privacy.

If you have any questions or comments, we would like to hear from you. Please call during working hours (Monday-Friday – 8:00am to 5:00pm Mountain Standard Time). Our number is (303)-242-5820. You can also email our Customer Service Department at customer.service@primuswindpower.com.

Again, welcome to our family and thank you for investing in the future of wind energy with a Primus Wind Power AIR turbine.

Sincerely,

Primus Wind Power, Inc.



Enter the serial and model numbers below

Serial Number _____

Model Number _____

The CE marking is a mandatory compliance requirement in EMEA and the UK and although it is self-certified, testing and evidence to support that testing is preferred from an independent test house. All Primus Wind Power turbines are third party tested and fulfil all the relevant provisions of the following Directives:

Machinery Directive 2006/42/EC, Low Voltage Directive 2004/95/EC, Electromagnetic Compatibility Directive 2004/108/EC. The report and the declaration of conformity are available for inspection on request.

The serial number stated on the inside front cover of this owner's manual refers to a specific Primus Wind Power product. This product is considered compliant to CE.

IMPORTANT SAFETY INSTRUCTIONS

Read these instructions in their entirety before installing or operating.

 **SAVE THESE INSTRUCTIONS.** Enclosed are important instructions that must be followed during installation and maintenance.

 Turn AIR “OFF” and contact Primus Wind Power Customer Service Department if unusual noise or operation is observed.

 Install AIR on a calm day - no wind at ground level.



In this manual

 **IMPORTANT:** Please take note

 **TIP:** Helpful information

 **WARNING:** Risk of injury or death - proceed with extreme caution

 **MARINE:** Information specific to corrosive environments

 **AIR 30:** Information specific to AIR 30 only

 Properly torque all fasteners.

 Use grounding techniques as established by the NEC. Install turbine in accordance with this manual and local and national building codes. Failure to comply may affect and possibly void your warranty.

 Properly complete the Warranty Registration Card or register your product online at www.primuswindpower.com/warranty.

 Rotating blades are a serious mechanical hazard. Install AIR wind turbines so no one can come into contact with blades.

 Observe wire size and fuse recommendations listed in the Wiring Section of this manual.

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Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

AIR Technical Specifications

Model	AIR Breeze and AIR 40
Weight	13 lb / 6 kg
Rotor Diameter	46 in / 1.17 m
Start Up Wind Speed	7 mph / 3.1 m/s
Kilowatt Hours/month	38 kWh/month @ 12 mph / 5.4 m/s avg. wind speed
Maximum Wind Speed	110 mph
Rated Power	160 watts @ 28 mph / 12.5 m/s wind speed
Operating Temperature Range	AIR Breeze and AIR 40 are certified under IEC requirements applying to the temperature range 14° F (-10° C) to 104° F (40° C). AIR 40 is CSA certified.

Voltage Regulation Set Point (factory setting)

12 Volt Systems	14.1 Volts
24 Volt Systems	28.2 Volts
48 Volt Systems	56.4 Volts

Regulator Adjustment Range

12 Volt Systems	13.6 to 17.0 Volts (approximately)
24 Volt Systems	27.2 to 34.0 Volts (approximately)
48 Volt Systems	54.4 to 68.0 Volts (approximately)

Recommended Fuse Size (AIR 40 and AIR Breeze)

12 Volt Systems	20 amp (slow blow)
24 Volt Systems	10 amp (slow blow)
48 Volt Systems	5 amp (slow blow)

Recommended Fuse Size (AIR 30)

12 Volt Systems	40 amp (slow blow)
24 Volt Systems	20 amp (slow blow)
48 Volt Systems	10 amp (slow blow)

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Tower Loads

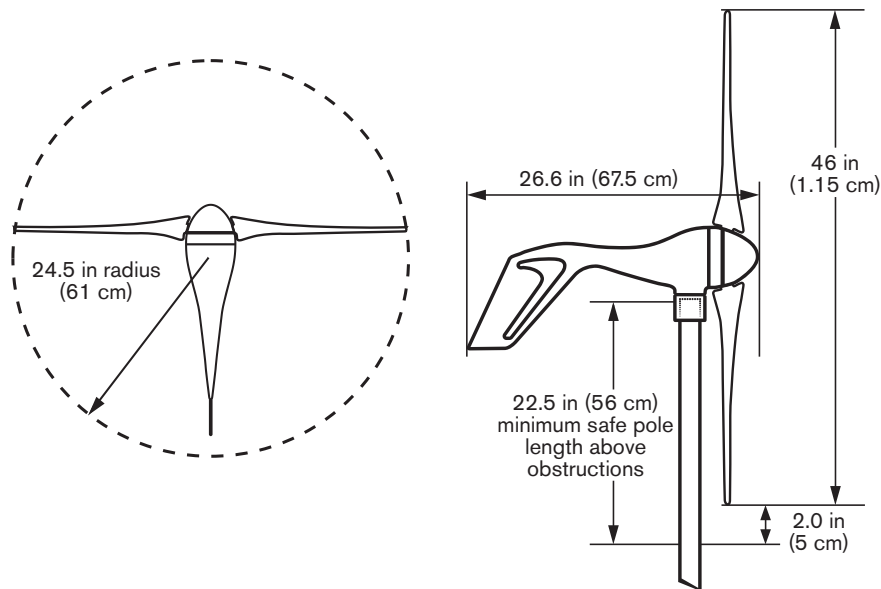
Shaft Thrust* 52 lb @ 100 mph wind speed (230 N @ 45 m/s)

*Value does not include safety factor. Primus Wind Power recommends safety factor of 1.5.

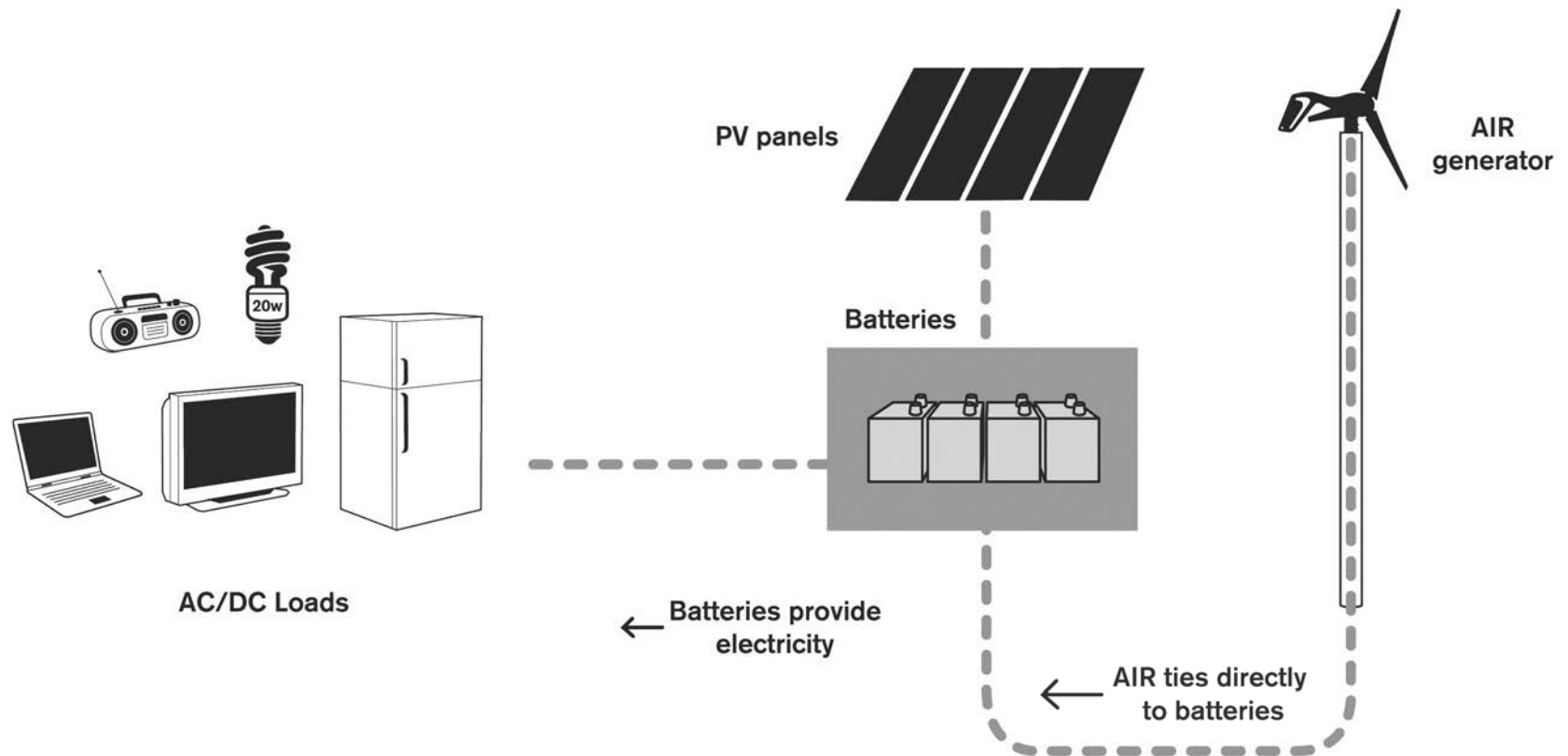
Model	AIR 30
Weight	13 lb / 6 kg
Rotor Diameter	46 in / 1.17 m
Start Up Wind Speed	8 mph / 3.6 m/s
Kilowatt Hours/month	30 kWh/month @ 12 mph / 5.4 m/s avg. wind speed
Maximum Wind Speed	110 mph
Rated Power	400 watts @ 28 mph / 12.5 m/s wind speed
Certifications	CSA, CE

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AIR 30 wind turbines are eligible to bear the CSA mark with "C" and "US" indicators. The "C" and "US" indicators signify that the product has been evaluated to the applicable CSA and ANSI/UL standards for use in Canada and the US.



EXAMPLE OF AN OFF-GRID HYBRID INSTALLATION



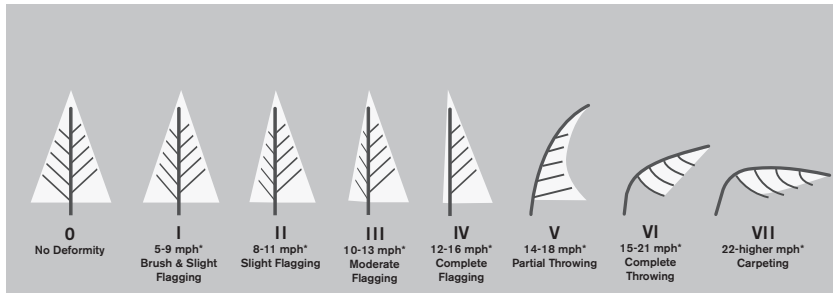
Please Note: AC loads require an inverter

PRIOR TO INSTALLATION

Siting Tips for Permanent Installations



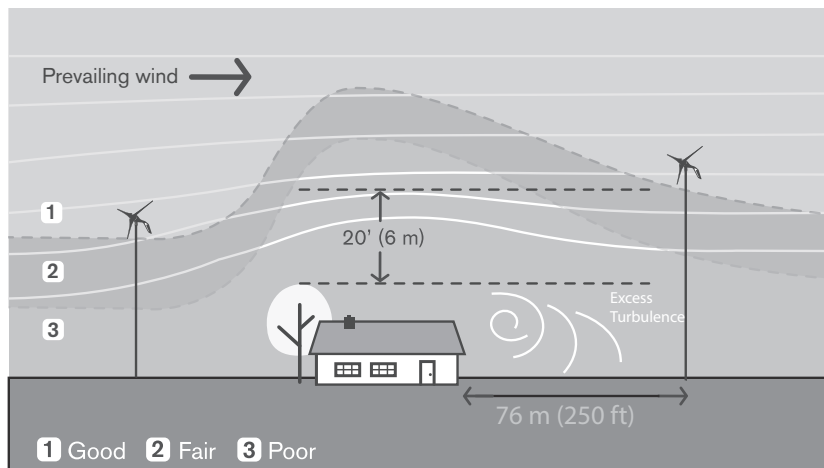
PROPER SITING = Better Performance & Increased Longevity
Look at vegetation deformation to determine best area and prevailing wind direction.



Griggs-Putnam Index. *Probable mean annual windspeed. Data prepared by E.W. Hewson, J.E. Wade, and R.W. Baker of Oregon State University



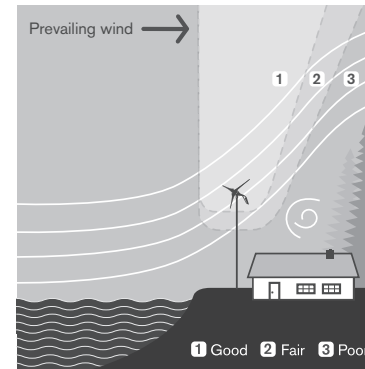
EXCESSIVE TURBULENCE = Fatigue Damage & Shorter Turbine Life



Turbine should be a minimum of 76m (250 ft) away from and 6m (20 ft) above obstacles.

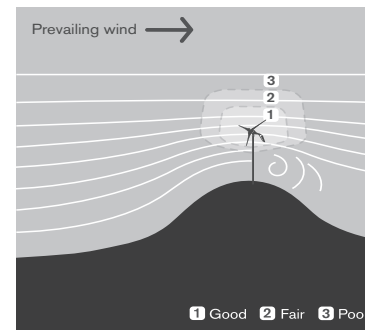


ATYPICAL SITING CONSIDERATIONS



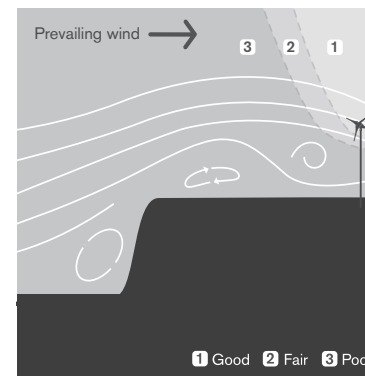
Coastal or Lakeside

Trees and taller structures can be down-wind.



Ridge Tops

Wind compresses as it blows over the top of a hill, increasing the wind speed.



Plateau/Mesa

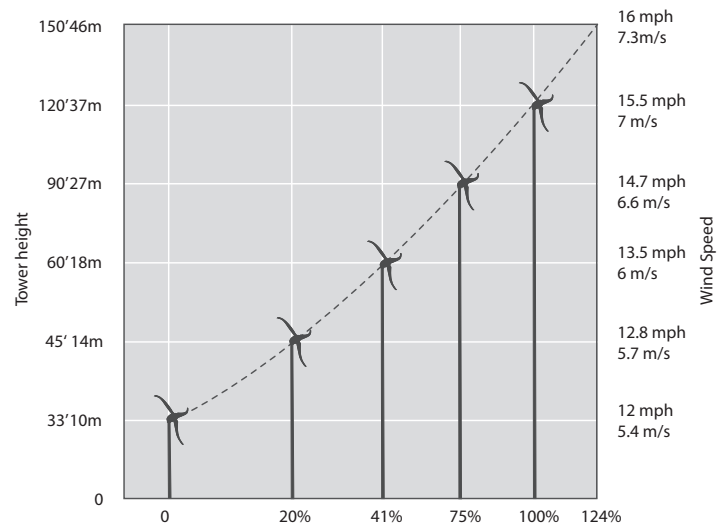
Site the generator far enough from the cliff to avoid turbulent wind.

Tower Selection and Installation

Tower Selection

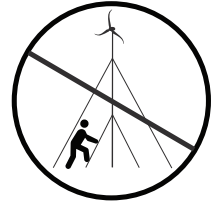
- ⚡ Soil and wind conditions vary; towers and tower foundations must be designed for your specific location.

Wind speed increases with height. Higher towers also raise generators above the air turbulence that can exist close to the ground.



Calculations are based on Power Law
Exponent 0.02 (in areas of tall row crops,
hedges, a few trees.)

- ⚡ Prevent tower climbing by unauthorized persons or children. Never climb without proper safety equipment.



- ⚡ Always stop the blades before climbing the tower. Both falling from the tower and contact with the spinning blades can be lethal.

Simple Tips for Deep Cycle Battery Bank Sizing



In preparation for battery sizing, know:

ELECTRICAL USAGE - the amount of energy consumed 1 day in Watt-hours (Wh)

DAYS OF AUTONOMY - days of battery back-up required if unable to charge the batteries by any means.

DEPTH OF DISCHARGE - limit of energy withdrawal to which you will subject the deep cycle battery bank.

*Deeper discharge = Shortened battery life.

- Recommended: never discharge a deep cycle battery below 50% of its capacity
- Off-grid applications, a 25% DoD will extend battery life significantly

TEMPERATURE - Standard for most battery rating is 25 °C (77 °F).

Cold temperatures = reduced battery capacity
High temperatures = shortened battery life



RECOMMENDATION - Keep the number of parallel strings of batteries to three or fewer. More than three strings of batteries, risks shortening battery life due to uneven charging.

- Batteries in Series = Voltage is Additive
- Batteries in Parallel = Ah is Additive

*Example: 2 12V 100Ah Battery Bank

Series	24V	100 Ah
Parallel	12V	200 Ah

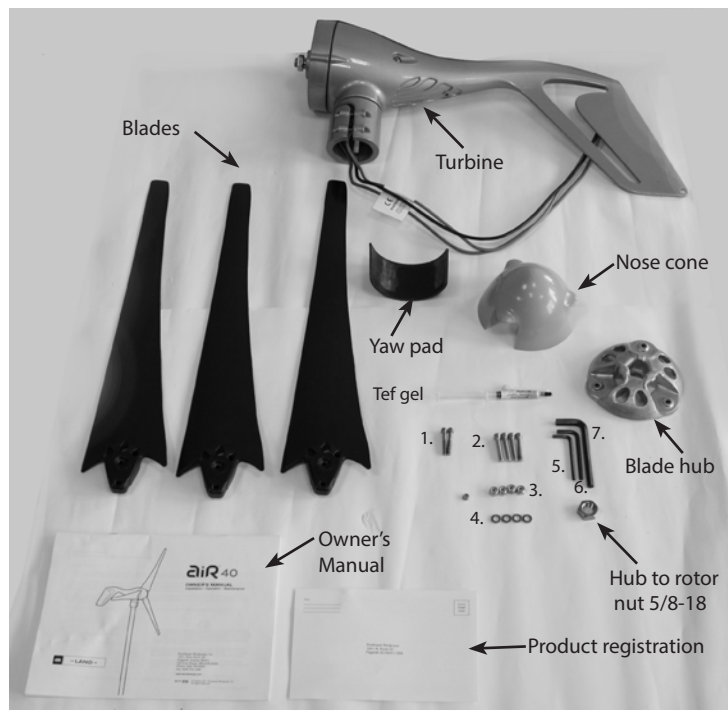
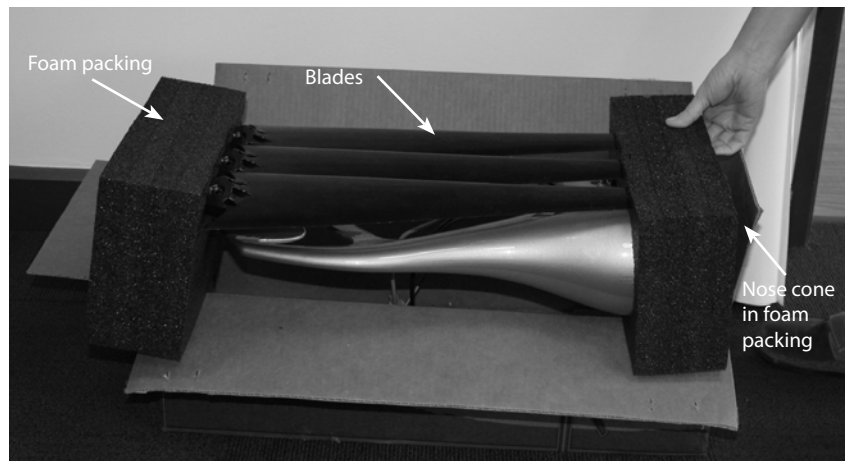


CALCULATIONS - calculate battery bank size, use example below:

- A system load of 6,000 Watt-hours per day
- 3 Days of Autonomy (back-up) needed
- Planned Depth of Discharge (DoD): 40%
- Battery bank ambient average low 15.6 °C (60 °F)
- A 48V system

STEPS:	EXAMPLE:																								
1.) Identify total daily use in Watt-hours (Wh)	6,000 Wh/day																								
2.) Identify Days of Autonomy (back-up days); multiply Wh/day by this factor.	3 days of Autonomy: $6,000 \times 3 = 18,000 \text{ WH}$																								
3.) Identify Depth of Discharge (DoD) and convert to a decimal value. Divide result of step 2 by this value.	40% DoD: $18,000 / 0.4 = \mathbf{45,000 \text{ Wh}}$																								
4.) Select the multiplier corresponding to the lowest average temperature your batteries will be exposed to. Multiply result from Step 3 by this factor. *Result is minimum Wh capacity of battery bank: Temp in degrees <table><tr><th>°C</th><th>°F</th><th>Factor</th></tr><tr><td>26.7</td><td>80 +</td><td>1.00</td></tr><tr><td>21.2</td><td>70</td><td>1.04</td></tr><tr><td>15.6</td><td>60</td><td>1.11</td></tr><tr><td>10</td><td>50</td><td>1.19</td></tr><tr><td>4.4</td><td>40</td><td>1.30</td></tr><tr><td>1.1</td><td>30</td><td>1.40</td></tr><tr><td>-6.7</td><td>20</td><td>1.59</td></tr></table>	°C	°F	Factor	26.7	80 +	1.00	21.2	70	1.04	15.6	60	1.11	10	50	1.19	4.4	40	1.30	1.1	30	1.40	-6.7	20	1.59	$15.6 \text{ }^{\circ}\text{C (60 }^{\circ}\text{F)} = 1.11$ $45,000 \times 1.11 = 49,950 \text{ Wh}$
°C	°F	Factor																							
26.7	80 +	1.00																							
21.2	70	1.04																							
15.6	60	1.11																							
10	50	1.19																							
4.4	40	1.30																							
1.1	30	1.40																							
-6.7	20	1.59																							
5.) Divide result from Step 4 by system voltage. Result is the minimum Amp-hour (Ah) capacity of your battery bank.	$49,950 / 48 = \mathbf{1,040 \text{ Ah}}$																								

ARRIVAL KIT



1. Extra yaw clamp bolts
2. 1/4-20 socket head bolts (4)
3. 1/4-20 Nylock nuts (4)
4. Flat washers
5. 5/16 hex wrench
6. 3/16 hex wrench
7. 5/32 hex wrench

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DIFFERENCES FOR AIR 30:

- Different blades and hub
- 1/4-20 7/8 socket head bolts (7)
- 1/4-20 Nylock nuts (7)
- No flat washers

TURBINE ASSEMBLY

Your AIR wind turbine is delivered partially assembled. Assembly requires:

1. Mounting the blades on the blade hub.
2. Securing the hub to the turbine body.
3. Installing the nosecone on the blade hub. The necessary hex (Allen) wrenches are furnished with your AIR wind turbine.

Step 1: Blade to Hub Assembly

Attach all blades to the blade hub. (See Figure 1 for AIR Breeze and AIR 40 procedure and Figure 2 for AIR 30 procedure.)

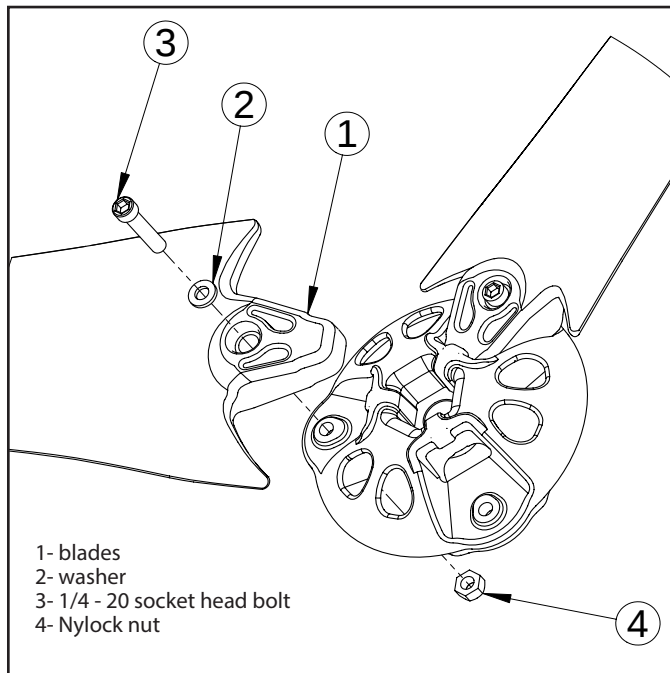


Fig. 1 AIR Breeze & AIR 40 wind turbine Blade Attachment Detail.

Torque Specifications:

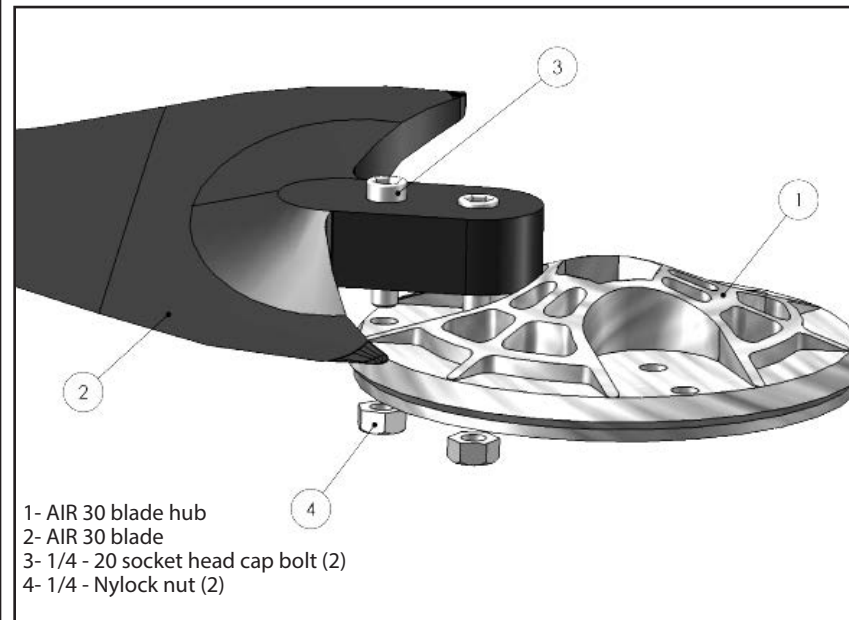
Blade to hub bolt, 1/4 - 20 x 1.375, socket head bolt 72 in-lb (8.0 N·m)

Hub to rotor nut, 5/8-18, 40 lb-ft (55 N·m)



WARNING: Nylock nuts may only be used one time; replace after each use.

aiR 30



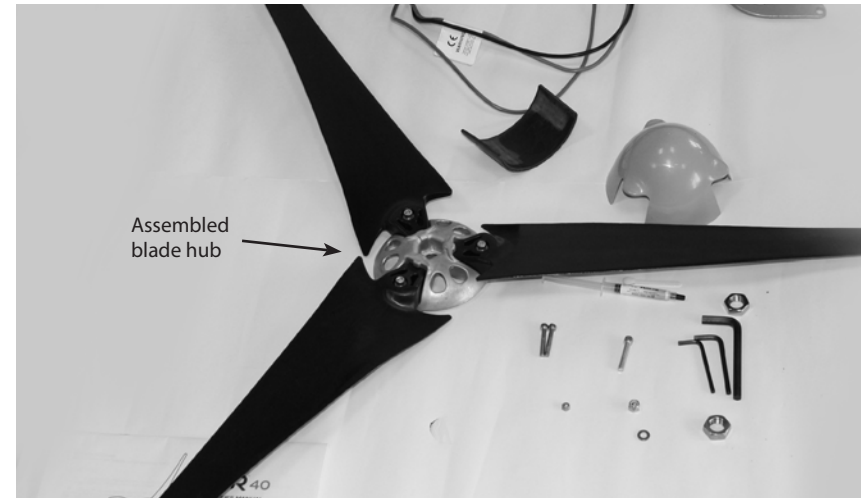
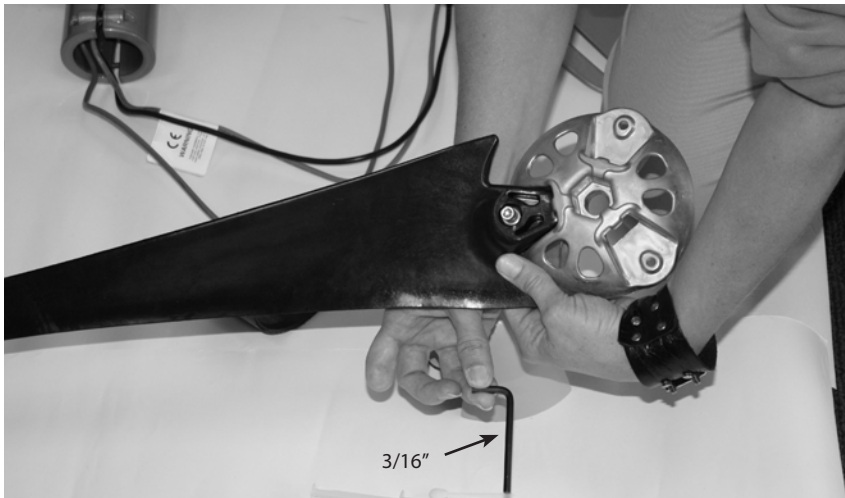
Torque Specifications:

Fig. 2 AIR 30 Blade Attachment Detail.

Blade to hub bolts, 1/4-20 x 0.875 inch, Socket Head Bolt, 72 in-lb (8.0 N·m)

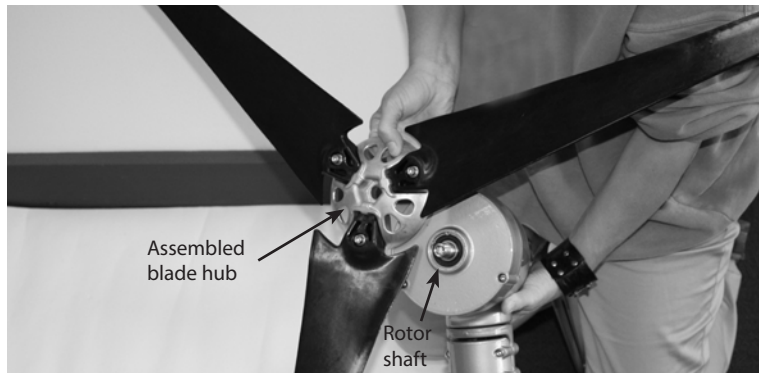
Hub to rotor nut, 5/8-18, 40 lb-ft (55 N·m)

Blade to Hub Assembly



TURBINE ASSEMBLY

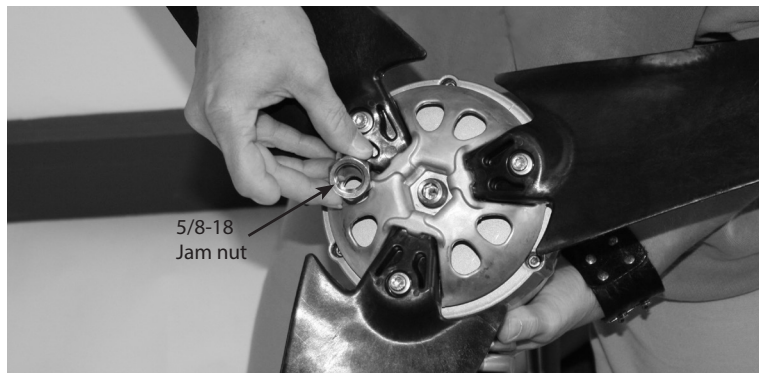
Step 2: Mount Blade Hub to Turbine



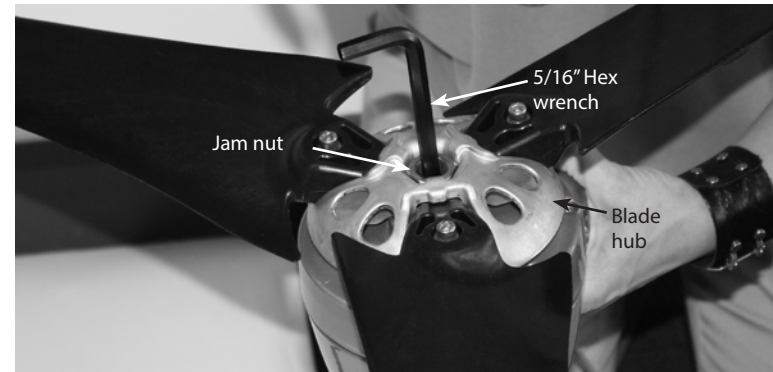
- 1.) Coat rotor shaft threads and blade hub with Tef Gel.
- 2.) Slide blade hub onto rotor shaft.



IMPORTANT: Tef-Gel is a corrosion inhibitor and is especially important in marine applications.



- 1.) Start 5/8-18 jam nut on rotor shaft.
- 2.) Carefully and slowly "spin" the blades to begin tightening the nut.

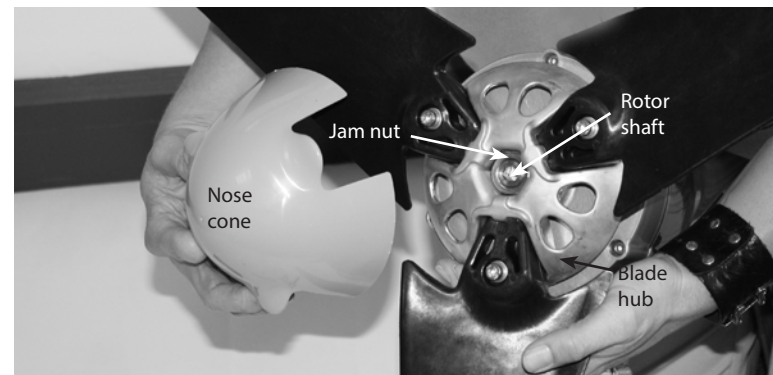


- 1.) Insert 5/16" hex wrench in rotor shaft.
- 2.) Carefully and slowly "spin" the blades to completely secure the blade hub to the turbine.



WARNING: Don't attempt to mount the turbine while blades are spinning.

Step 3: Attach Nose Cone

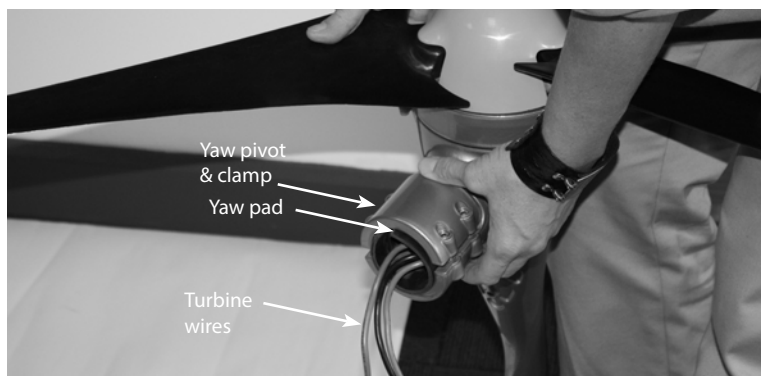


- 1.) Attach nose cone to blade hub. You will feel it snap into place.
- 2.) Tug on nose cone to ensure it is secure.



Turbine assembly is now complete.

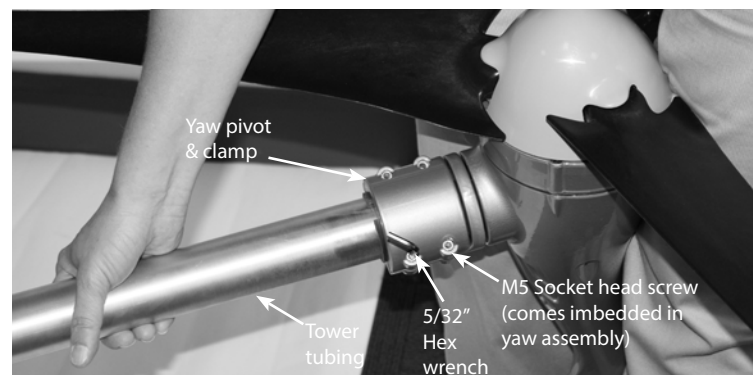
Step 4: Attach Turbine to Tower



- 1.) Insert yaw pad into yaw pivot point/clamp assembly.
- 2.) NOT SHOWN: Complete turbine wiring connections.



WARNING: The yaw pad is critical to ensuring secure turbine mounting to tower; however, it sometimes makes it difficult to tell if the tower is fully inserted into the yaw assembly. Check this carefully before raising the tower.



- 1.) Insert tower into yaw assembly.
- 2.) Ensure yaw pad is in place.
- 3.) Tighten screws to secure turbine to tower.



IMPORTANT: Observe torque specs.



- 1.) Ensure turbine is securely attached to tower.

AIR Wind Turbine Towers

1. The AIR wind turbine mounts on tubing with a nominal 1.875 – 1.900 inch outside diameter.
2. Typical tower construction use: 1 1/2 inch Schedule 40 steel pipe or 2 inch SS-20 galvanized fence tubing (0.090 inch wall thickness).
3. DO NOT use plastic pipe to construct a tower.

Tower Options

Primus Wind Power offers a number of tower choices for your AIR wind turbine. The following section provides a summary of the available tower kits. User manuals for the towers and tower kits are available online and you are encouraged to review them in order to make the most informed tower selection.



IMPORTANT: User manuals for towers and tower kits are available online at www.primuswindpower.com. Primus Wind Power recommends reviewing them to make an appropriate tower selection for your AIR wind turbine.

27 ft (8.3 m) Tower Kit

The 27 ft (8.3 m) Tower Kit includes a tower clamp/guy wire assembly and all necessary hardware and fasteners to erect a 27 ft tilt-up tower using Schedule 40 steel pipe or tubing with an outside diameter of 1.875 inch. See Fig. 3.

Note: Anchors and tubing are not furnished with the kit.

29 ft (8.8 m) EZ – Tower

The 29 ft (8.8 m) EZ Tower is a complete kit that includes all materials required to assemble a 29 ft guy wire tilt-up tower. Anchors, guy wire assemblies, galvanized steel tubing and all fasteners. See Fig. 4.

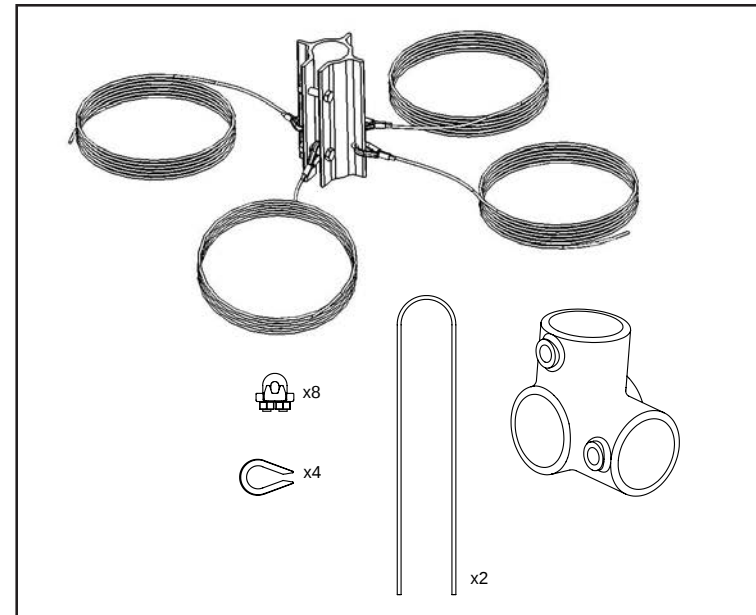


Fig. 3. 27 ft (8.3 m) Tower Kit

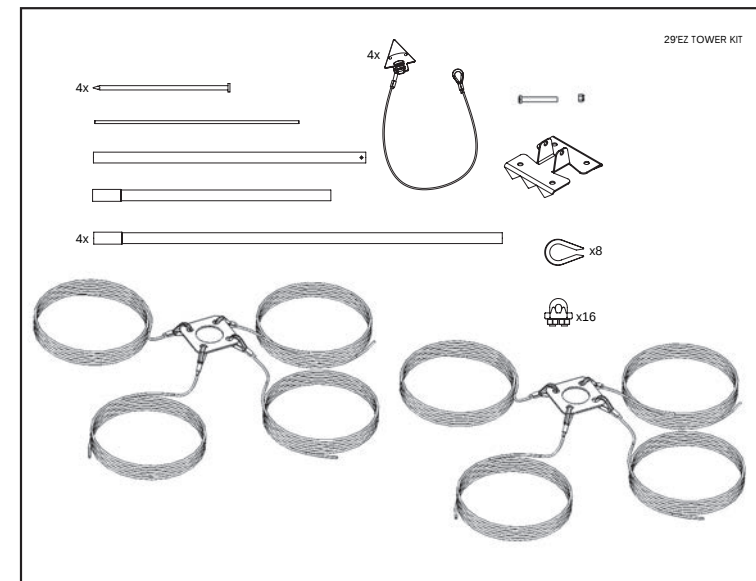


Fig. 4. 29 ft (8.8 m) Tower Kit

45 ft (13.7 m) Tower Kit

The 45 ft (13.7 m) Tower Kit includes tower clamp/guy wire assemblies and all necessary hardware and fasteners to erect a 45 ft tilt-up tower using Schedule 40 steel pipe or tubing with an outside diameter of 1.875 inch. See Fig. 5.

Note: Anchors and pipe or tubing are not furnished.

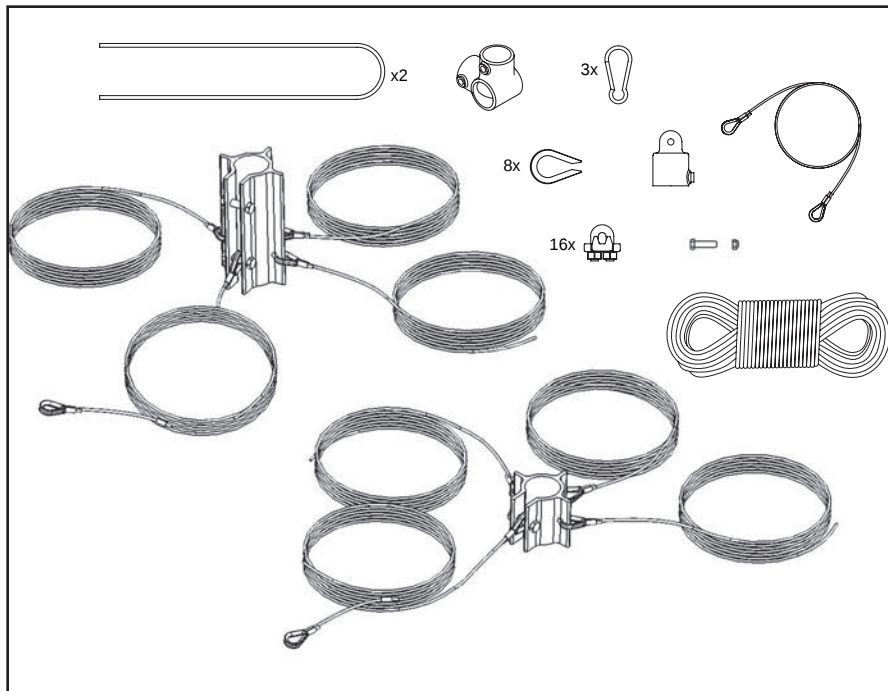


Fig. 5. 45 ft (13.7 m) Tower Kit



IMPORTANT: User manuals for towers and tower kits are available online at www.primuswindpower.com. Primus Wind Power recommends reviewing them to make an appropriate tower selection for your AIR wind turbine.

Marine Tower Kit



The Marine Tower Kit is specifically designed to aid mounting the turbine on a boat deck. Kit includes powdercoated aluminum mast and stays, vibration damping mounts and all necessary marine grade hardware to install the kit. See Fig. 6.

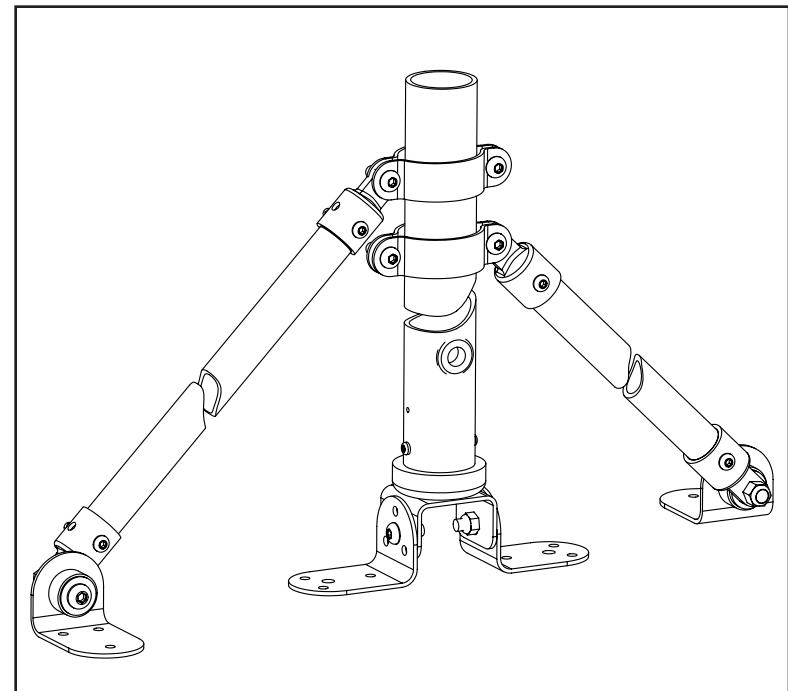


Fig. 6. Marine Tower Kit

Roof Mounting Kit

The Roof Mount Kit allows the pole for your AIR wind turbine to be mounted to the wall or roof truss of a structure and extend above its roofline. The kit includes isolators, base plates and all hardware, clamps and straps. Your AIR can be mounted flush to the side of the structure or via a penetrating hole through the roof or eaves. If mounted via penetrating hole, we recommend purchasing the roof mount kit with seal. See Fig. 7.

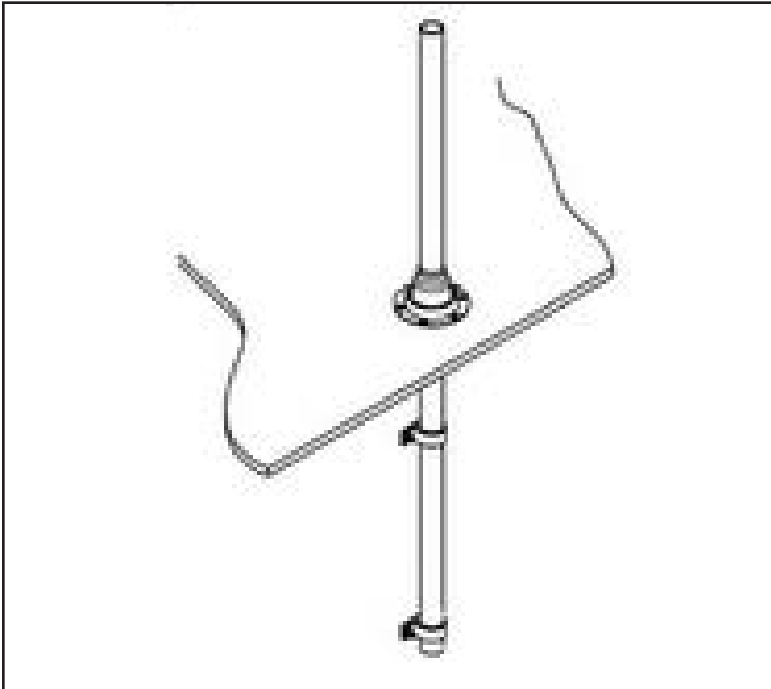


Fig. 7. Roof Mounting Kit

AIR Wind Turbine Wiring Options

The recommended way to connect the turbine to your battery bank is to wire the turbine directly to its own set of battery posts; allowing the turbine to operate independently. The AIR turbine's internal regulator will monitor the battery and maintain the charge as necessary.

Figs. 8 and 9 represent typical single turbine installations. Fig. 9 includes an up-tower junction box for UL (Underwriters Laboratory) compliance.

Contact Primus Wind Power for more information about this configuration.

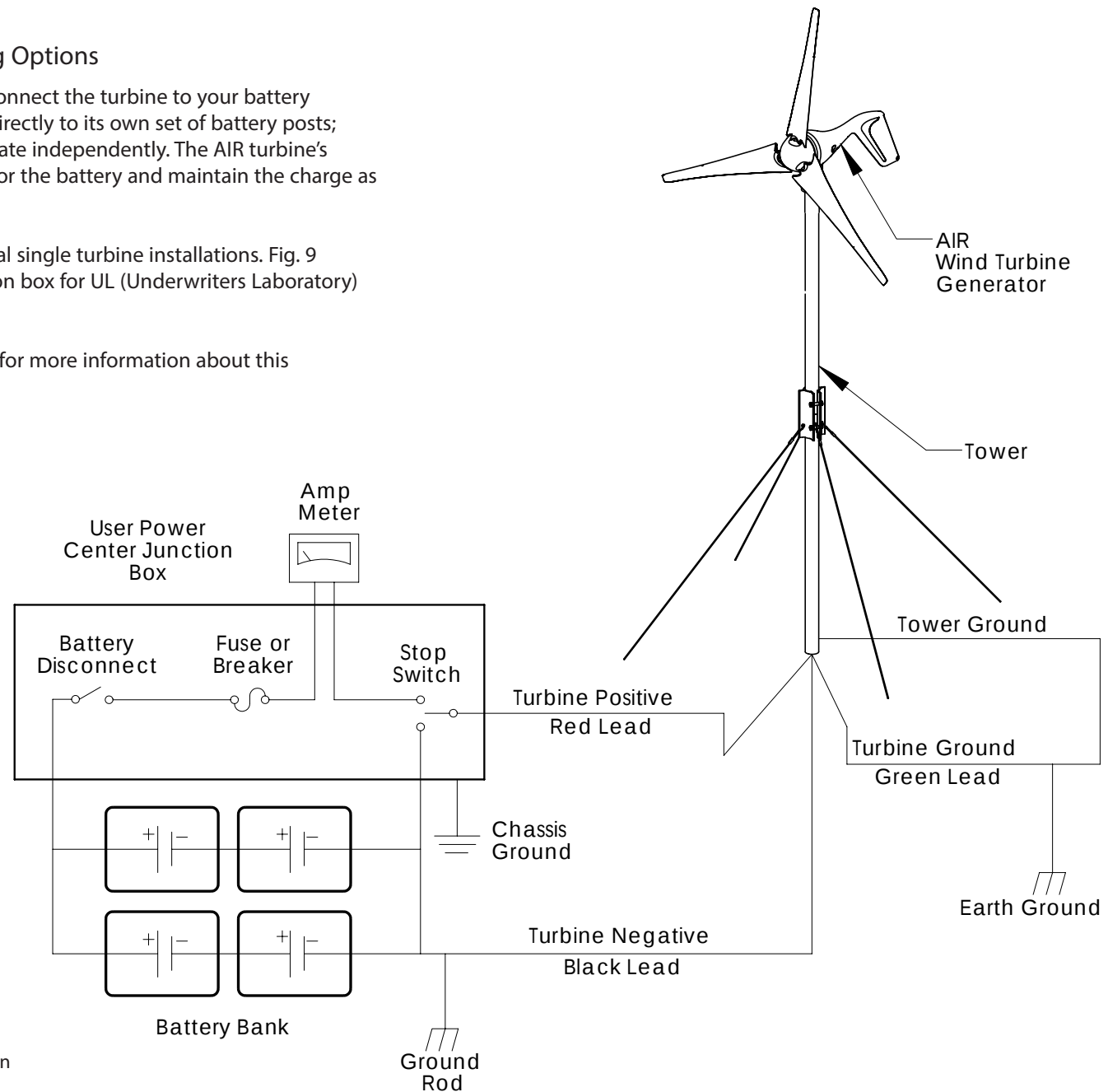


Fig. 8. Single Turbine Installation

Fig. 9 represents a system with an Up Tower Junction Box.

1. Install close to the top of the tower to ease installing a Lightning Arrestor or
2. Mount close to the tower base to incorporate the stop switch.



WARNING: Typically installing the box requires drilling holes in the tower – be careful not to compromise the tower strength.

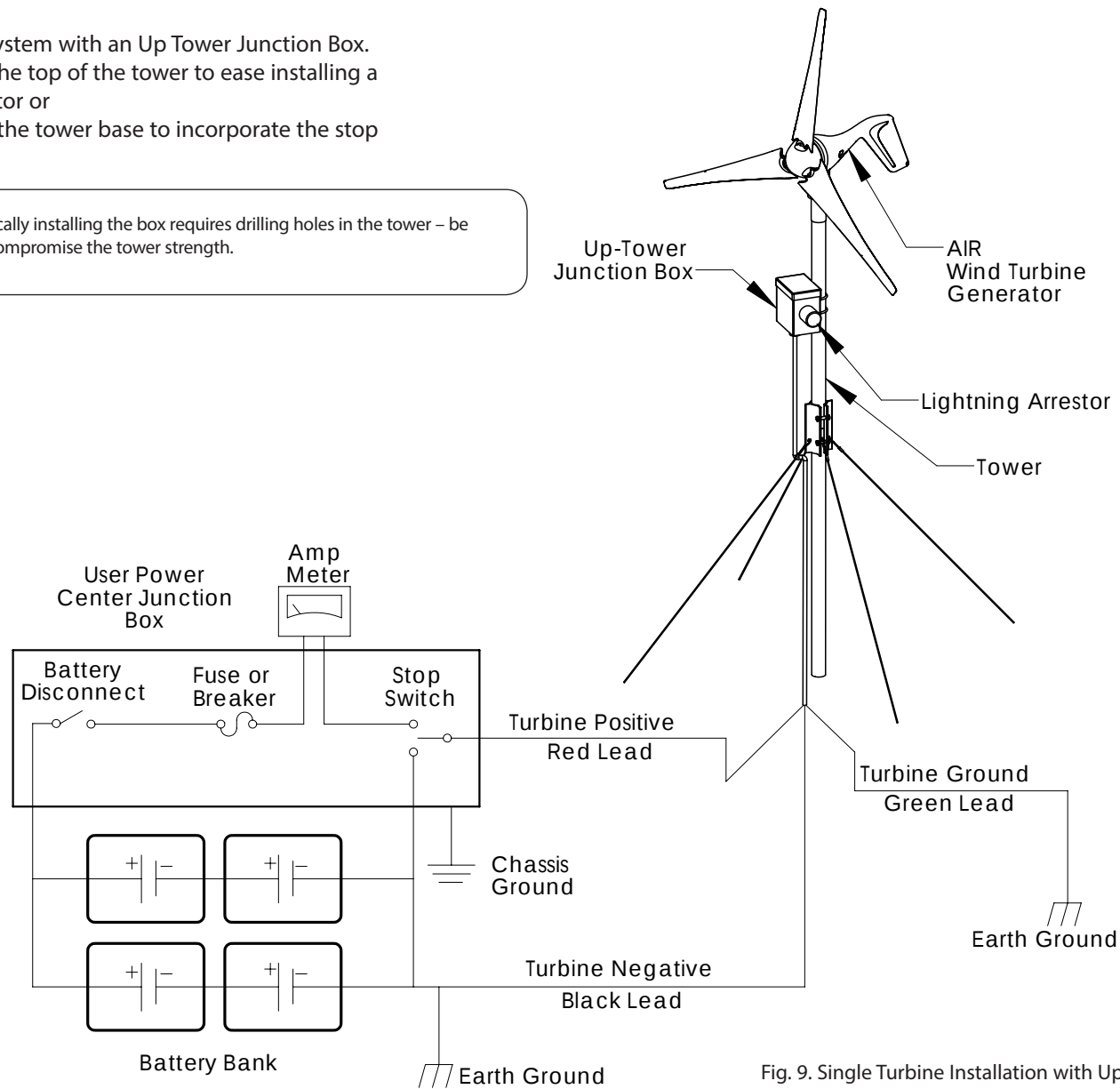


Fig. 9. Single Turbine Installation with Up-Tower Junction Box

Hybrid System Wiring

Fig. 10 represents a typical “hybrid” system with solar panels. Some charging sources (solar panels, fuel-powered generators, additional wind generators, etc.) connected to the same system may interfere with the AIR turbine’s internal charge regulation process. This will not harm the turbine, however it may spin slowly as if “braked” or may stop completely. Test for possible interference by disconnecting the other charging sources to determine the possible cause.

Contact Primus Wind Power Customer Service for guidance.



TIP: In this figure the AIR wind turbine internal regulator is used. A diversion type external regulator could also have been used.



TIP: Voltage “pre-regulation” may be prevented by increasing the regulation set point.



WARNING: If additional sources are connected to the same battery bank, it is necessary to increase battery bank size.

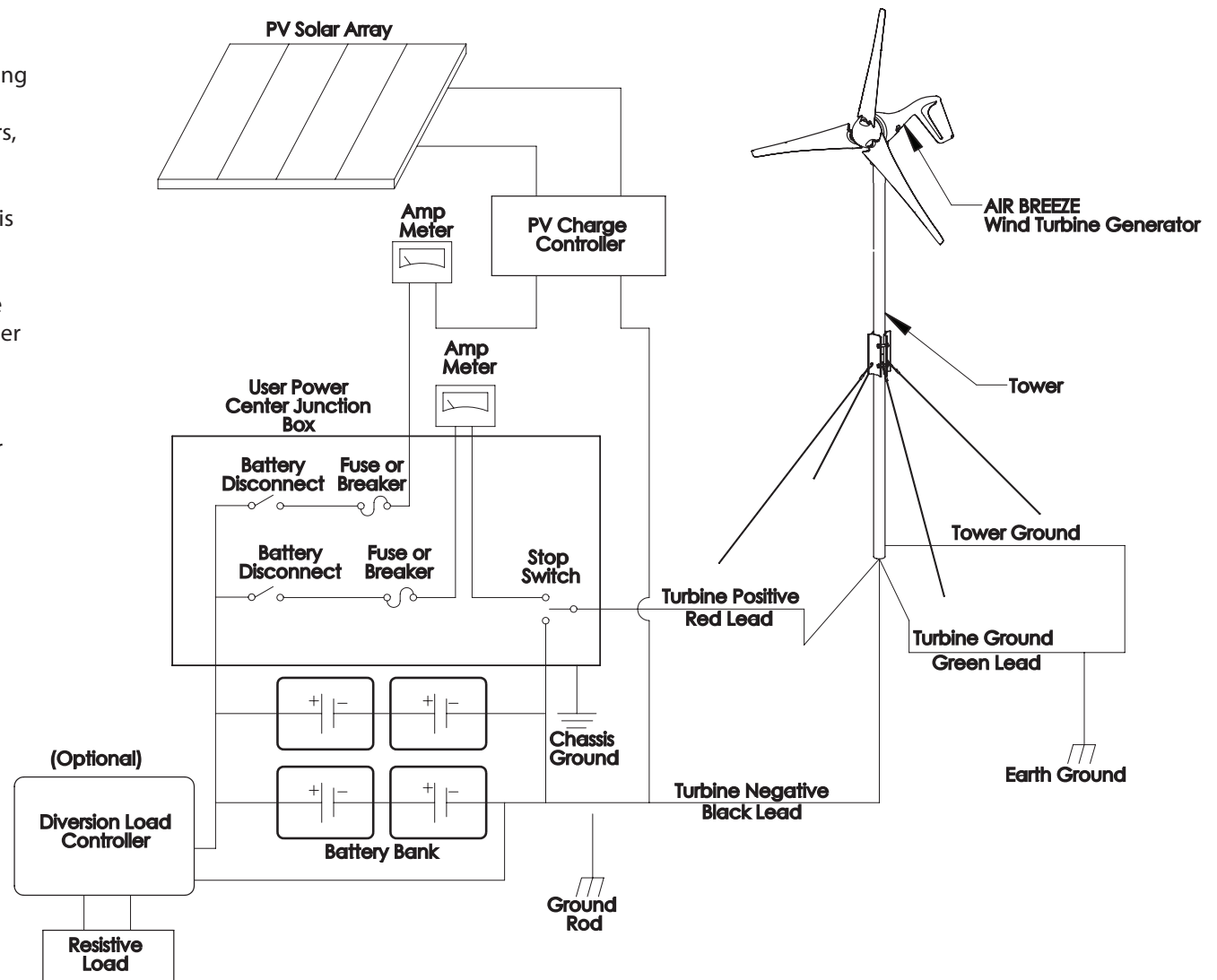


Fig. 10. Hybrid System with Solar Panels

Multiple AIR wind turbine wiring

It is possible to wire multiple AIR wind turbines together. A typical multi-turbine system is depicted in Fig. 11.

There are two methods used to accomplish this task.

Method One: (Fig. 11)

Each AIR wind turbine is treated separately. Each turbine has its own wires, stop switch and fuse and connects directly to the battery. This configuration uses the internal regulator to control charging.

Method Two:

Wire each turbine to a "bus" and then run one set of wires from the bus to the battery. Each turbine's internal regulator or an external diversion type regulator may be utilized. A "bus" system typically results in reduced wire costs.

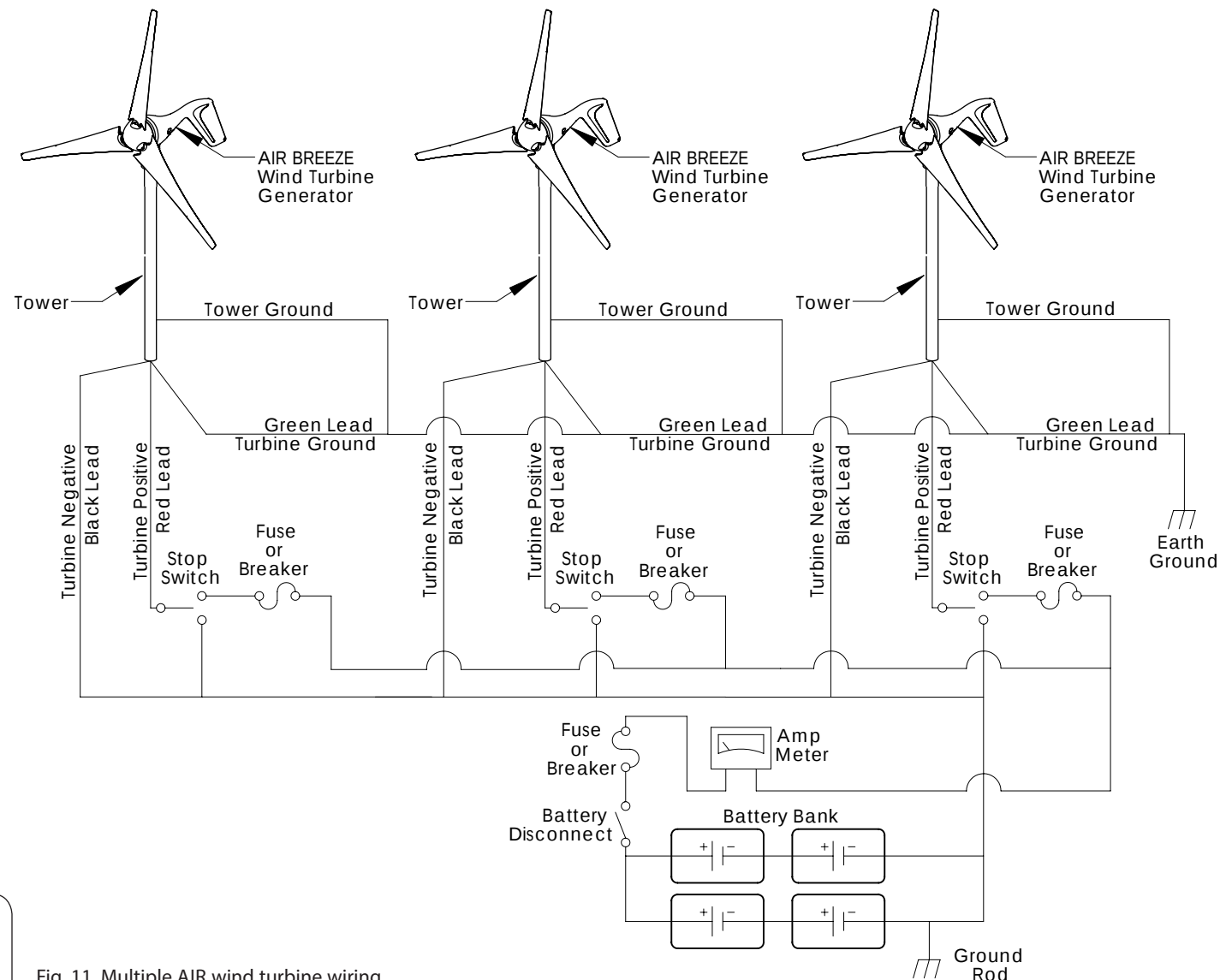


Fig. 11. Multiple AIR wind turbine wiring



WARNING: If additional sources are connected to the same battery bank, it is necessary to increase battery bank size.

Wire Size

All electrical systems lose energy due to resistance in the wires.

- Large wires have less resistance but are more costly.
- Resistance losses increase with increasing current. High wind sites will benefit from using a larger size wire to take advantage of the greater power production potential.
- Conversely, in low wind sites it may not be cost effective to increase the wire size.

The following wiring sizes provide maximum annual energy losses of 5% or less for sites with a 12 mph average wind speed (assuming the standard Rayleigh distribution of wind speeds) which is sufficient for most sites.

To determine the size wire, measure the distance from the batteries to your AIR wind turbine; including tower height. Reference the chart matching your system voltage and number of turbines and select the wire size.

We recommend these as the minimum wire sizes; for optimal performance use the largest wires that are practical and affordable. Local, state, and national electrical codes have precedence over these recommendations and must be followed to ensure the safety of your system.

Note: Wiring Resistance and Regulation

Depending on your exact system configuration including other charging sources in your system, wiring resistance may affect the regulation set point of the turbine. Higher wiring resistance (smaller wires) will tend to lower the voltage at which the turbine enters regulation and stops charging. The recommended wiring sizes should provide little effect on the regulation set point, but all installations should be observed over time to ensure that the batteries are charged to the proper voltage.



TIP: Smaller wires will lower the voltage at which the AIR wind turbine enters regulation and stops charging.

12 Volt Systems, AWG / Metric Wire Size mm²

Number of Turbines:	0-30 ft (0-9 m)	30 ft-60 ft (9-18 m)	60 ft-90 ft (18-27 m)	90 ft-150 ft (27-46 m)	150 ft-190 ft (46-58 m)	190 ft-250 ft (58-76 m)	250 ft-310 ft (76-95 m)	310 ft-390 ft (95-119 m)	390 ft-500 ft (119-152 m)
1	8/10 mm ²	6/16 mm ²	4/24 mm ²	2/35 mm ²	1/50 mm ²	0/50 mm ²	00/90 mm ²	000/90 mm ²	000/90 mm ²
2	6/16 mm ²	4/25 mm ²	1/50 mm ²	00/70 mm ²	000/90 mm ²	0000/120 mm ²	***	***	***
3	4/25 mm ²	2/35 mm ²	0/50 mm ²	000/90 mm ²	0000/120 mm ²	***	***	***	***

*** If your system requires this length of wire, consider using parallel wires.

24 Volt Systems, AWG / Metric Wire Size mm²

Number of Turbines:	0-30 ft (0-9 m)	30 ft-60 ft (9-18 m)	60 ft-90 ft (18-27 m)	90 ft-150 ft (27-46 m)	150 ft-190 ft (46-58 m)	190 ft-250 ft (58-76 m)	250 ft-310 ft (76-95 m)	310 ft-390 ft (95-119 m)	390 ft-500 ft (119-152 m)
1	14/2.5 mm ²	12/4 mm ²	10/6 mm ²	8/10 mm ²	6/16 mm ²	4/50 mm ²	4/90 mm ²	4/90 mm ²	2/90 mm ²
2	12/4 mm ²	8/10 mm ²	6/16 mm ²	4/25 mm ²	4/25 mm ²	2/35 mm ²	2/35 mm ²	1/50 mm ²	0/50 mm ²
3	10/6 mm ²	8/10 mm ²	6/16 mm ²	4/25 mm ²	2/35 mm ²	2/35 mm ²	1/50 mm ²	0/50 mm ²	00/10 mm ²



12 Volt Systems, AWG / Metric Wire Size mm²

Number of Turbines:	0-30 ft (0-9 m)	30 ft-60 ft (9-18 m)	60 ft-90 ft (18-27 m)	90 ft-150 ft (27-46 m)	150 ft-190 ft (46-58 m)	190 ft-250 ft (58-76 m)	250 ft-310 ft (76-95 m)	310 ft-390 ft (95-119 m)	390 ft-500 ft (119-152 m)
1	8/10 mm ²	6/16 mm ²	4/25 mm ²	2/35 mm ²	1/50 mm ²	0/50 mm ²	00/70 mm ²	000/90 mm ²	000/90 mm ²
2	6/16 mm ²	4/25 mm ²	1/50 mm ²	00/70 mm ²	000/90 mm ²	0000/120 mm ²	***	***	***
3	4/25 mm ²	2/35 mm ²	0/50 mm ²	000/90 mm ²	0000/120 mm ²	***	***	***	***

*** If your system requires this length of wire, consider using parallel wires.

24 Volt Systems, AWG / Metric Wire Size mm²

Number of Turbines:	0-30 ft (0-9 m)	30 ft-60 ft (9-18 m)	60 ft-90 ft (18-27 m)	90 ft-150 ft (27-46 m)	150 ft-190 ft (46-58 m)	190 ft-250 ft (58-76 m)	250 ft-310 ft (76-95 m)	310 ft-390 ft (95-119 m)	390 ft-500 ft (119-152 m)
1	14/2.5 mm ²	12/4 mm ²	10/6 mm ²	8/10 mm ²	6/16 mm ²	4/90 mm ²	4/90 mm ²	000/90 mm ²	000/90 mm ²
2	12/4 mm ²	8/10 mm ²	6/16 mm ²	4/25 mm ²	4/25 mm ²	2/35 mm ²	2/35 mm ²	1/50 mm ²	0/50 mm ²
3	10/6 mm ²	8/10 mm ²	6/16 mm ²	4/25 mm ²	2/35 mm ²	2/35 mm ²	1/50 mm ²	0/50 mm ²	00/70 mm ²

48 Volt Systems, AWG / Metric Wire Size mm²

Number of Turbines:	0-90 ft (0-27 m)	90 -250 ft (27-76 m)	250 -310 ft (76-95 m)	310 -500 ft (95-152 m)
1	14/2.5 mm ²	12/4 mm ²	10/6 mm ²	8/10 mm ²
2	12/4 mm ²	8/10 mm ²	6/16 mm ²	4/25 mm ²
3	10/6 mm ²	8/10 mm ²	6/16 mm ²	4/25 mm ²

Stop Switch (Switch Kit part number 2-ARAC-101)

Primus Wind Power recommends the use of a stop switch to provide a convenient and safe method for shutting down your AIR turbine.

A stop switch is supplied with the AIR Breeze and is available from Primus Wind Power for the other AIR turbines.

Fig. 12 shows proper installation:

- The turbine operates in battery charging mode with the switch in the UP position
- With the switch in the DOWN position the turbine blades will stop (or spin slowly in a strong wind), but the turbine will not charge the batteries

NOTE: Do not leave the switch in the middle position; this will place the turbine in an Open Circuit condition – not stopped and not able to charge the batteries.

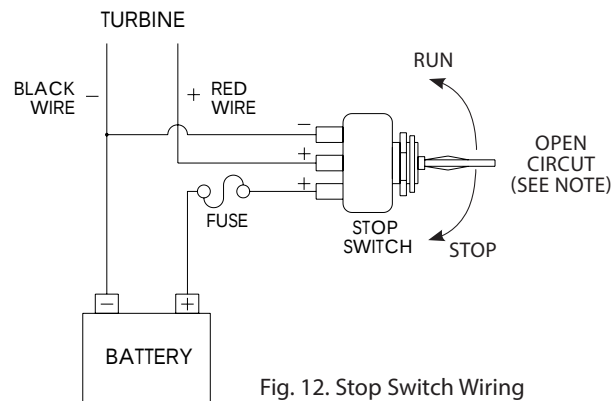


Fig. 12. Stop Switch Wiring

Stop Switch Assembly

1. Drill a 12 mm (0.47 inch) hole to mount the switch.
2. Screw the jam nut fully onto the switch. Item 3 in Fig. 13.
3. Place the switch in the panel and secure from the back of the panel with the rubber sleeved nut or the knurled nut.
4. Use mounting nuts to adjust the height of the switch in the panel.
5. Use no larger than 8 AWG wire. If a larger gauge wire is required use a few inches of 8 AWG wire to transition to the switch. Use ring terminals at the switch connections.
6. Support the wires to prevent shorts and provide strain relief for the wire connections.

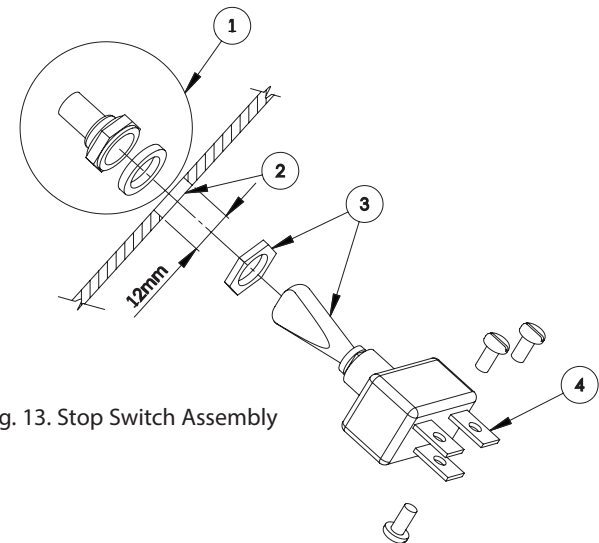


Fig. 13. Stop Switch Assembly

Fuses, Circuit Breakers and Ammeter

AIR can produce high amperages. Protect your turbine with fuses or circuit breakers. Wire with an appropriate size “slow-blow” fuse or circuit breaker between AIR and the batteries. If a stop switch is used, the fuse or circuit breaker should be placed between the switch and the batteries.

Recommended Sizes for Circuit Breakers or Slow-Blow Fuses are detailed on Technical Specifications page.

Circuit Breakers are available from Primus Wind Power.

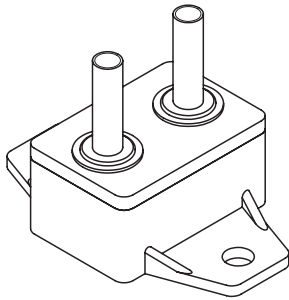


Fig. 14 Circuit Breaker

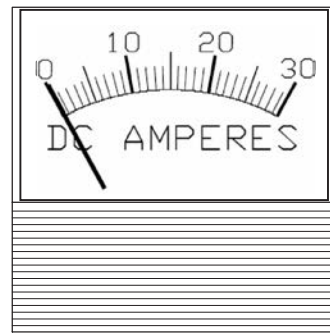


Fig. 15 Ammeter
(Amp Meter)

An optional ammeter (sometimes called an Amp Meter) is an excellent addition to any system. It allows you to monitor the instantaneous current output of your turbine. Place it between your turbine and the battery on the positive lead.

Batteries

Deep cycle batteries are required. Types include: flooded lead acid, absorbed glass mat (AGM), gel cell and NiCad. See Simple Sizing Tips for guidelines on battery sizing.

Also for more information see: www.batterycouncil.org.



IMPORTANT: Never use “automotive” batteries or any battery other than a “deep-cycle” battery.

Turbine Grounding

Proper grounding of the AIR wind turbine protects people and equipment by eliminating dangerous voltage potentials.

The following section describes tower grounding in detail. To ground the AIR body, connect the ground (green) conductor to the tower ground rod. Alternately the ground (green) conductor may be connected to the negative (black) conductor in which case it will be grounded through the battery bank ground rod. Refer to Figs. 8 -11.

Note that all system grounds should be connected using conductors of the same size as the positive and negative wires.

If you choose to not set up an earth ground system (not required for systems under 50 volts), the green and black conductors **MUST** be connected to each other or severe damage to the turbine may result and void your warranty.

Primus Wind Power strongly recommends that boat installations be grounded according to American Boat and Yacht Council recommendations. There are special grounding requirements for boats, in particular boats that connect to shore AC power, that **MUST** be observed or a serious shock hazard may result. Contact the American Boat and Yacht Council at +1 410.990.4460 or at www.abyc.com.

Tower Grounding (Fig. 16)

Every wind turbine and tower should be grounded at the tower base even if the turbine is grounded at the battery bank or service panel by means of the yaw ground lead.

The following sections are a guide and should not be considered comprehensive. Reference the National Electrical Code (NEC) and local building and zoning regulations for complete requirements. Relevant sections of the National Electrical Code are referenced.

Electrodes Driven in Soil

Electrodes must be a minimum of 8 ft (2.5 m) in length and free of non-conductive coatings such as paint. Hollow (pipe or conduit) electrodes must not be smaller than trade size 3/4 (metric designator 21) and must be galvanized or otherwise protected from corrosion. Solid rod electrodes must be at least 5/8 inch (16 mm) diameter. Stainless steel rods less than 5/8 inch diameter, nonferrous rods or their equivalent less than 1/2 inch diameter shall be "listed" by an organization having jurisdiction in the area. For example: UL in the USA and CSA in Canada.

Electrodes shall be installed such that 8 ft (2.5 m) is in contact with the soil. They should be driven into undisturbed soil within 1 ft of the tower foundation. If rock is encountered the electrode may be driven at an angle not to exceed 45 degrees from vertical. Some local authorities permit burial of the electrode in a trench at least 30 inches (76 cm) deep.

The upper end of the electrode including the grounding conductor should be below grade. If above ground it must be protected from damage.

Bonding the grounding conductor to the electrode and to the tower may be accomplished by exothermic weld or by a "listed" mechanical connector. Solder connections are not permitted. Most local authorities require a minimum grounding conductor size of 6 AWG for copper and 4 AWG for aluminum (if aluminum is permitted).

The grounding conductor may be buried directly or contained in conduit. It is important to have no sharp bends to keep its inductance low.

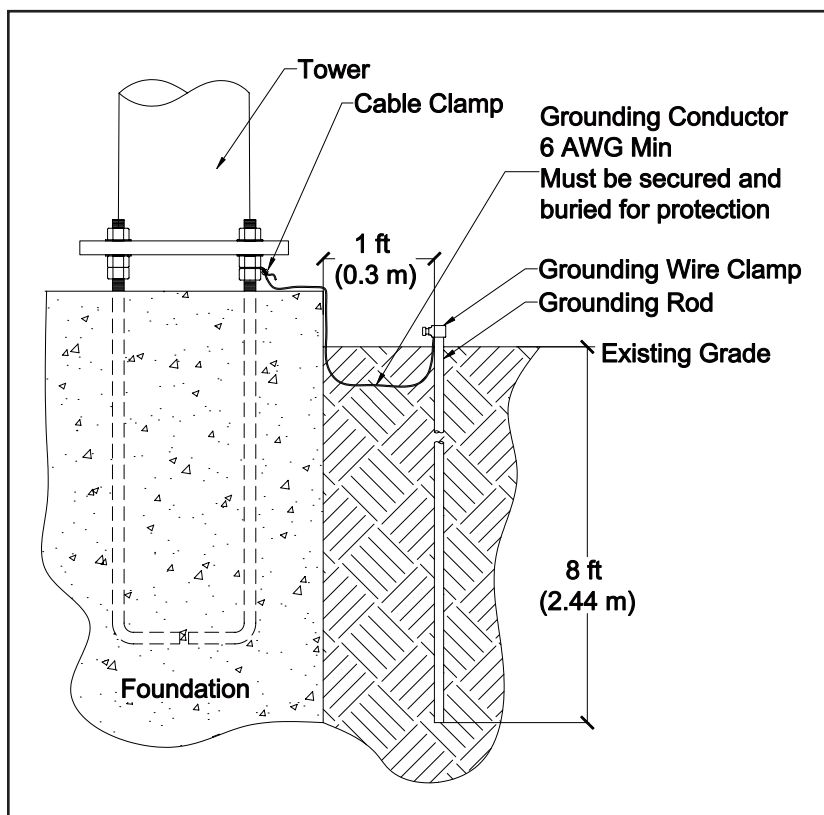


Fig. 16 Tower Grounding

2005 NEC Section	Topic
Article 250.52, item 5	Tower Grounding
Article 250.53, item A	Tower Grounding
Article 250.53, item G	Grounding Electrode Installation
Article 250.64	Grounding Conductor Routing and Placement
Article 250.66, item A	Grounding Conductor Size
Article 270.70	Bonding of Grounding Conductor

Wire Connections to AIR wind turbine



WARNING: Do not connect wires to batteries until all electrical connections are completed.

Secure connections using “split bolt” or solder connectors. Use color coded wires – red for battery positive, black for battery negative, and green for earth ground. Size wiring based on wiring tables provided. Insulate connections with heat shrink tubing or good quality electrical tape. Leave sufficient service loop in the wires to accommodate removal of the turbine from the tower.

Final Connections

Follow system wiring diagram and run wires to disconnect switch, fuse or circuit breaker and ammeter.

Before making battery connections, make sure circuit breakers and stop switch (highly recommended) are in the OFF position. Attach wires to battery; red to positive battery terminal and black to negative battery terminal.



WARNING: Reversed wire connections will damage the AIR wind turbine’s electronics. The polarity of the AIR wind turbine’s wires may be checked by connecting a voltmeter to the wires and spinning the rotor by hand.

Complete battery connections and switch ON circuit breakers and stop switch. When power is switched on, the turbine LED will illuminate for two seconds, go off for two seconds and illuminate for four seconds. This indicates the internal controller is functioning. The LED remains illuminated if the turbine is charging the battery.

The installation is now complete.

AIR Wind Turbine Operation

Operational Summary

AIR converts wind to rotational motion which turns the alternator and produces electrical power. The voltage is regulated for battery charging and integrated controls prevent overcharging the batteries, allowing the turbine to continue charging as battery voltage drops. AIR also uses integrated controls to protect the wind turbine from extreme wind damage.

AIR incorporates a three-phase brushless permanent magnet alternator and microprocessor controlled electronics to optimize its power production capability. The microprocessor continuously adjusts the loading of the alternator to keep the turbine operating efficiently in most wind regimes.

The result:

- high power production
- high blade efficiency
- lower blade noise

Operating Modes

Charging:

AIR charges batteries when:

- the batteries state of charge is below the voltage set point and
- sufficient wind is available

Charging continues until:

- the batteries are fully charged (at voltage set point) or
- the wind is excessively high

AIR's integrated controls allow it to generate energy in wind speeds up to 22 m/s (50 mph). Over 22 m/s (50 mph), the turbine blades drop in speed to control heat build-up.

AIR requires a minimum battery voltage to begin charging (example: 10.5 volts on a 12-volt system). Without the minimum voltage, the controller will behave as if in an open circuit.

In charging mode, the turbine's LED is continuously illuminated.



AIR 30 Differences: AIR's integrated controls allow it to generate energy in wind speeds up to 14 m/s (35 mph). Over 14 m/s (35 mph), the turbine blades drop in speed to control heat build-up.

Regulation: When the battery voltage reaches the regulation set point, the AIR goes into "regulation" and stops charging the battery; blades will slow dramatically or stop. The turbine remains in regulation until the battery voltage drops below the regulation set point (cut-in voltage). The blades then resume spinning in response to the available wind.

In regulation mode, the turbine's LED blinks approximately once per second.

Over Speed Protection: In gusty or sustained high winds, over 22 m/s (50 mph), AIR enters overspeed protection where the blades come to a near stop. The turbine stops the blades for 30 seconds then allows them to begin spinning. If the wind is still high or gusty, the cycle is repeated until the wind speeds drop below 22 m/s (50 mph).

Overspeed protection is stressful on the turbine. Primus Wind Power recommends taking measures to protect the turbine in excessively high wind situations.

In overspeed protection mode, the turbine's LED blinks approximately 10 times per second.



AIR 30 Differences: AIR 30 enters overspeed protection in gusty or sustained winds over 14 m/s (35 mph) and remains there (as described above) until the wind speeds drop below 14 m/s (35 mph).

Braking Mode: AIR may be placed in braking mode by directly shorting the turbine positive and negative wires together or by using a stop switch. The stop switch first disconnects the turbine from the battery and then shorts the positive and negative wires. In very strong winds the blades may rotate slowly even with the switch activated.

No Load Operation /Open Circuit /Free Spinning: AIR spins freely if disconnected from an electrical load. This results in a cycle of rapid blade speed increases followed by rapid braking. This accelerates turbine wear and is non-productive. Primus Wind Power recommends:

- Using a properly installed switch to turn AIR off for short periods of time
- Lowering the turbine completely or securing the blades to prevent rotation if the turbine will be shut down for an extended period of time

Voltage Regulation

AIR continually monitors battery voltage and compares it to the voltage regulation set point. The voltage regulation set points are factory set to the values listed on the AIR Technical Specifications page. These values are adjustable for individual applications.

AIR enters regulation mode when the voltage set point is reached and remains there until the battery voltage drops to the cut-in voltage; which is slightly lower than voltage set point. The difference between the two values is “hysteresis” and is purposely done to prevent the turbine from bouncing in and out of a single regulation set point.

Adjusting Regulation Voltage

The voltage regulation set point is adjustable using the potentiometer on the side of the AIR turbine body.

To accurately set the regulation voltage, disconnect the turbine from the batteries and use an adjustable voltage source and multi-meter to apply the desired voltage across the positive and negative turbine leads. With the target voltage applied, turn the potentiometer fully clockwise, then slowly turn it counter-clockwise until the LED just illuminates. The regulation set point is now fixed to the voltage applied across the turbine leads.

Alternatively, the regulation set point voltage may be adjusted using a trial and error method. Use the accompanying chart as a guide to increase or decrease the voltage regulation set point. Monitor the battery voltage over a period of time and make small adjustments until the regulation set point voltage is at the desired level.



CAUTION: Increasing the voltage regulation set point above the initial factory setting will NOT increase the power output of the AIR wind turbine. This adjustment changes the point at which the turbine stops charging the batteries. By setting the voltage too high you may increase the probability of overcharging and damaging the batteries.

System Voltage	Voltage Regulation Set-Point Adjustment Range*	Voltage Change due to 1/8 Turn of Potentiometer**
12 Volt	13.6 – 17.0 Volts	0.56 Volts
24 Volt	27.2 – 34.0 Volts	1.12 Volts
48 Volt	54.4 – 68.0 Volts	2.24 Volts

* Adjustment ranges are approximate; actual ranges may be greater.

** Turn clockwise to increase voltage, counter-clockwise to decrease voltage.

Using an Alternate Charge Controller

There are some conditions under which the AIR wind turbine’s internal regulator is not appropriate as the primary regulator. These conditions include:

- Systems where battery temperature varies widely: Battery charge efficiency varies in extreme temperatures. If these conditions exist, use an external regulator with a temperature compensation sensor to optimize the charge rate.
- Batteries that are extremely sensitive to charge voltage: Follow the recommendations of the battery manufacturer. For most batteries the turbine’s internal voltage regulator is adequate.
- Multiple turbine installations with a bus system will typically function best using a single voltage regulator close to the battery bank. This is particularly true if the wire lengths connecting each turbine to the bus vary by distance or wire gauge.

The turbine's internal voltage regulator cannot be completely turned off; however, by setting the voltage regulation set-point to its highest value the internal regulator is virtually nullified. If an external charge controller is utilized, it must be a diversion style regulator which diverts the excess power to a resistive load.

Do not use a pulse width modulated (PWM) or shunt style controller; the AIR wind turbine is not designed to work with these types of controllers. Additionally, most controllers designed to work with solar panels are not suitable for use with the AIR wind turbine. These controllers "disconnect" the solar panels – or in this case the AIR - from the battery bank when the batteries are charged, allowing the turbine to spin free, which is not recommended.



CAUTION: Never approach the turbine during operation.

AIR Wind Turbine Maintenance

Although your AIR has been designed to run for long periods with minimal maintenance, moving parts must be maintained to ensure maximum performance and reliability. As part of complying with the conditions of the Limited Five Year Warranty, please adhere to the below.

After one month and every six months thereafter:

- Check blades for chips or nicks. Replace blades if damaged. Do not operate the turbine with chipped or unbalanced blades. This will cause severe wear, damage and possible failure. Operating the wind turbine with unbalanced blades may void your warranty. Do not install individual blades as they are balanced as a set
- Check blade bolts and hub nut for proper tightness. Refer to installation section for proper specifications
- Check nosecone for any cracks and proper fit
- Wash off any built-up dirt or debris from the blades for optimal performance.
- Check all electrical connections to make sure they are tight and free from corrosion
- Check to see that your tower is plumb. A leaning tower will decrease energy production

Every five years:

- Replace the blades regardless of their condition. The blades contain UV inhibitors; however, the sun will eventually erode the composite material. New blades enhance safety and performance

Every seven years:

- Replace the circuit board. Some components on the PCB require periodic replacement due to stress from temperature and voltage fluctuations seen under normal operating conditions
- While changing the circuit board, check the condition of the brushes and slip rings. With the turbine open and the yaw shaft removed, observe the brushes and slip rings for grooving or other signs of wear

AIR Wind Turbine Trouble Shooting

Three quick bench tests can verify if your AIR wind turbine is working correctly. Test 1 does not require any equipment. For tests 2 and 3 you will need a battery bank and a power drill.

TEST 1

- 1) Remove the blade/hub assembly from the turbine and place in a safe location. Replace the rotor hub nut on the rotor shaft.
- 2) Attempt to quickly spin the rotor shaft with your fingers while connecting and disconnecting the red and black wires (turbine must not be connected to batteries). A second person may be helpful to perform this test.
- 3) With the red and black wires connected to each other, the shaft should be more difficult to turn. Replace the rotor hub nut on the rotor shaft. With the yaw wires disconnected it should spin freely. Spinning the shaft quickly makes difference easier to detect. If these conditions do not exist, you should contact your turbine dealer or Primus Wind Power.

TEST 2

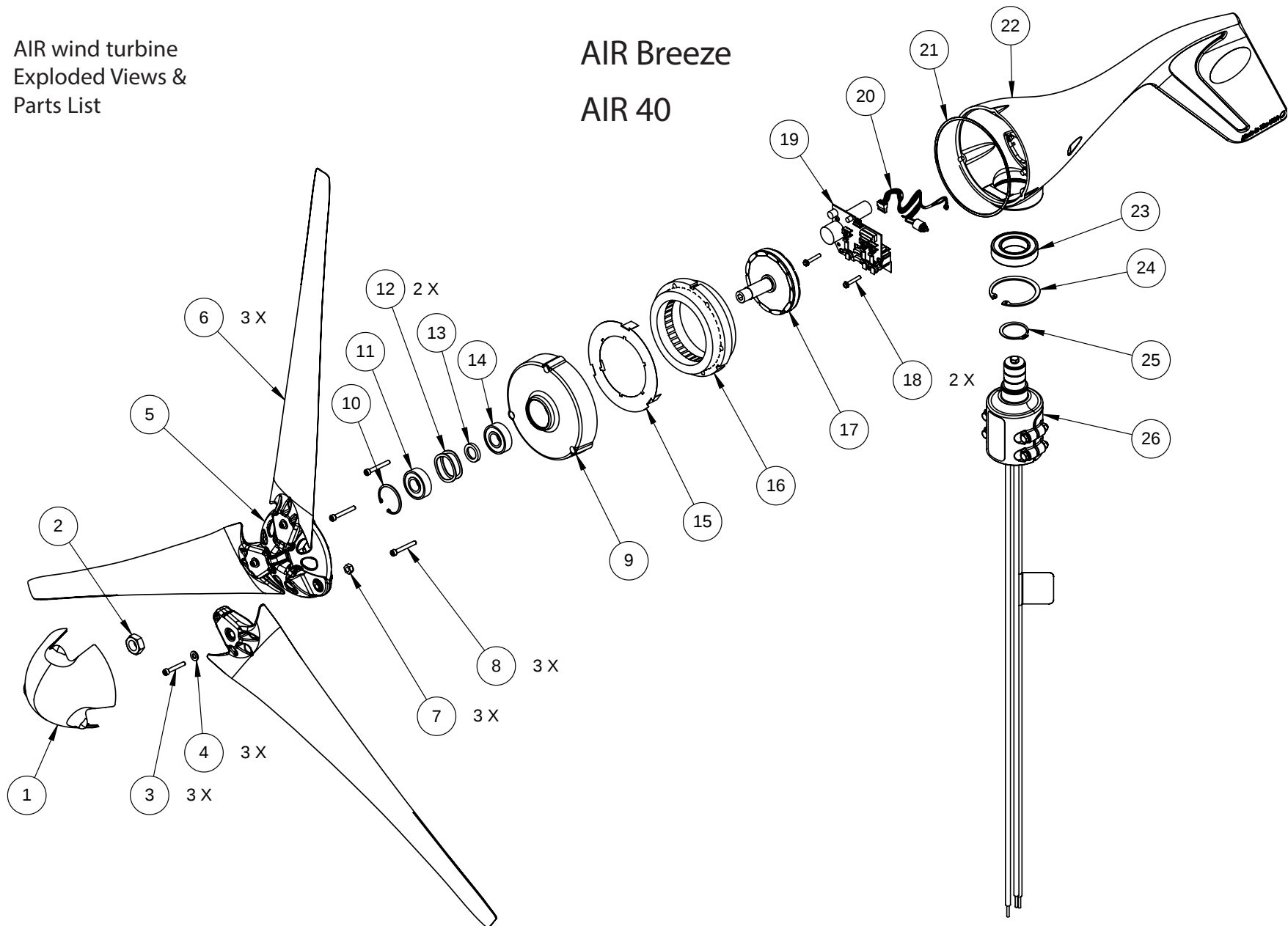
- 1) Remove blade/hub assembly from turbine and place in a safe location.
- 2) Connect the turbine power wires to the appropriate terminals on your battery: RED= Positive, BLACK = Negative.
- 3) Each time the AIR wind turbine is connected to a battery, the LED will come on for two seconds, go off for two seconds and come back on for four seconds to indicate that the controller is running properly. You may need to wait 10 seconds between iterations of this test in order to let the microprocessor reset. Turbine is in Brake Mode while initializing the controller. If the LED does not blink when the AIR wind turbine is connected to a battery, you should contact your turbine dealer or Primus Wind Power.

TEST 3

- 1) With the AIR wind turbine connected to your battery bank, use an electric drill to spin the rotor shaft while observing the LED. A short length cut from the 5/16 inch hex key wrench can serve as a drive if necessary.
- 2) Below 400 RPM, the rotor should spin freely and the LED should remain off.
- 3) At 420 RPM and above, the AIR wind turbine should be charging the battery. There should be resistance on the rotor shaft and the LED should turn on. If the shaft is cogging (difficult to rotate), contact your turbine dealer or Primus Wind Power. Be sure your battery voltage is not high enough to activate the regulation mode during this test.

AIR wind turbine
Exploded Views &
Parts List

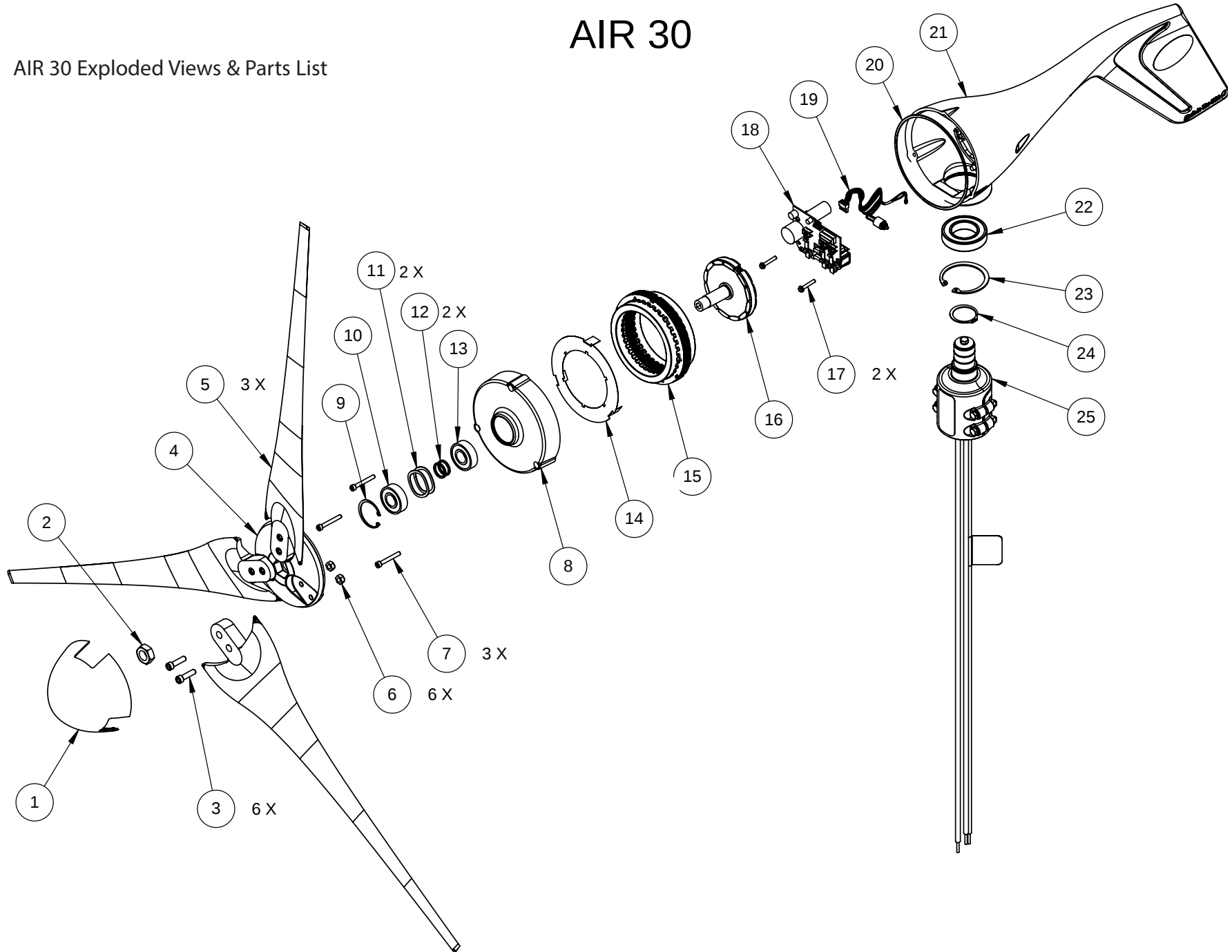
AIR Breeze
AIR 40



ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
1	NOSE CONE	3-CMBP-2015-01 (AIR 40)	1
		3-CMBP-2015-02 (AIR Breeze)	1
2	JAM NUT 5/8-18 - SS	3-HDNT-912	1
3	SCREW - SOCKET HEAD - 1/4-20 X 1-3/8 - SS	3-HDBT-1024-007	3
4	WASHER - FLAT - 1/4" - SS	3-HDWA-919	3
5	MACHINED - HUB - AIR	3-CMBP-2016-01 (AIR 40)	1
		3-CMBP-2016-02 (AIR Breeze)	1
6	BLADE - BLACK	3-CMBP-2017-03	3
7	NUT - NYLOCK - SAE - SS - 1/4"-20	3-HDNT-102-10	3
8	SCREW - SOCKET HEAD - 10-24 X 1-1/2"	3-HDBT-1000-577	3
9	MACHINED - FACE - AIR	3-CMBP-1003-01	1
10	SNAP RING - 44MM INTERNAL	3-CAOT-1005	1
11	BEARING - 6203-RLBZD - SEALED/SHIELDED	3-CABR-1002	1
12	WASHER - WAVE SPRING	3-CAOT-1012	2
13	SPACER - BEARING	3-CAOT-1010	1
14	BEARING - 6203-ZZ - SHIELDED	3-CABR-1001	1
15	ISOLATOR - STATOR	3-CMBP-1341	1
	STATOR - 16 AWG 17 TURNS	3-CMBP-1019-02	
16	STATOR - 18 AWG 34 TURNS	3-CMBP-1019-03	1
	STATOR - 21 AWG 60 TURNS	3-CMBP-1019-05	
17	ROTOR - HP	3-CMBP-1313	1
18	SCREW - TAPTITE - 8/32 X 1"	3-HDBT-9000	2
	CIRCUIT & RECTIFIER ASSEMBLY - 12V	3-CMBP-1021-12	
19	CIRCUIT & RECTIFIER ASSEMBLY - 24V	3-CMBP-1021-24	1
	CIRCUIT & RECTIFIER ASSEMBLY - 48V	3-CMBP-1021-48	
20	WIRE HARNESS - POTENTIOMETER	3-CMBP-1033-02	1
21	O-RING	3-CAOT-1002	1
22	MACHINED - BODY - AIR	3-CMBP-1000-01	1
23	BEARING - 6007 2RS	3-CABR-1000	1
24	SNAP RING - INTERNAL - 69MM - ZINC	3-CAOT-1067 (AIR 40)	1
		3-CMBP-1011 (AIR Breeze)	1
25	SNAP RING - 32MM STAINLESS STEEL	3-CAOT-1219	1
26	YAW ASSEMBLY	3-ARYW-101-01 (AIR 40)	1
		3-ARYW-101-02 (AIR Breeze)	1

AIR 30

AIR 30 Exploded Views & Parts List



ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
1	NOSE CONE - GRAY	3-CMBP-1007-01	1
2	JAM NUT 5/8-18 - SS	3-HDNT-912	1
3	SCREW - SOCKET HEAD - 1/4-20 X 7/8" - SS	3-HDBT-1000-04	6
4	MACHINED - HUB	3-CMBP-1005-01	1
5	BLADE	3-CMBP-1008	3
6	NUT - NYLOCK - SAE - SS - 1/4"-20	3-HDNT-102-10	6
7	SCREW - SOCKET HEAD - 10-24 X 1-1/2"	3-HDBT-1000-577	3
8	MACHINED - FACE - AIR	3-CMBP-1003-0 1	1
9	SNAP RING - 44MM INTERNAL	3-CAOT-1005	1
10	BEARING - 6203-RLBZD - SEALED/SHIELDED	3-CABR-1002	1
11	WASHER - WAVE SPRING	3-CAOT-1012	2
12	WASHER - BEARING	3-CAOT-1227	2
13	BEARING - 6203-ZZ - SHIELDED	3-CABR-1001	1
14	ISOLATOR - STATOR	3-CMBP-1341	1
15	STATOR - 16 AWG 10 TURNS	3-CMBP-1019-01	1
	STATOR - 16 AWG 17 TURNS	3-CMBP-1019-02	
	STATOR - 18 AWG 34 TURNS	3-CMBP-1019-03	
16	ROTOR - HP	3-CMBP-1313	1
17	SCREW - TAPTITE - 8/32 X 1"	3-HDBT-9000	2
18	CIRCUIT & RECTIFIER ASSEMBLY - 12V	3-CMBP-1021-12	1
	CIRCUIT & RECTIFIER ASSEMBLY - 24V	3-CMBP-1021-24	
	CIRCUIT & RECTIFIER ASSEMBLY - 48V	3-CMBP-1021-48	
19	WIRE HARNESS - POTENTIOMETER	3-CMBP-1033-01	1
20	O-RING	3-CAOT-1002	1
21	MACHINED - BODY - AIR	3-CMBP-1000-01	1
22	BEARING - 6007 2RS	3-CABR-1000	1
23	SNAP RING - INTERNAL - 69MM - ZINC	3-CAOT-1067	1
24	SNAP RING - 32MM STAINLESS STEEL	3-CAOT-1219	1
25	YAW ASSEMBLY	2-ARYW-101-01	1

AIR Wind Turbine Limited Warranty

What is Covered

Primus Wind Power, Inc. ("Primus Wind Power") warrants the AIR Wind Turbine against defects in factory-supplied materials and/or factory workmanship under normal authorized use consistent with the Wind Turbine's Owner's Manual, except for the limitations set forth in this Limited Warranty. Installation of AIR Breeze Wind Turbine constitutes acceptance of the terms and conditions of this Warranty.

How Long Coverage Lasts

This Limited Warranty begins on the following dates, whichever occurs first: (i) date of installation of the Wind Turbine, or (ii) ninety (90) days after the date the original end-user purchaser ("Customer") purchased the Wind Turbine. The customer is encouraged to return the warranty registration document included with this Limited Warranty within sixty (60) days of the start of the Warranty Period. While submission of the warranty registration document does not reduce your eligibility to receive warranty service, you will be requested to provide proof of ownership satisfactory to Primus Wind Power prior to receiving warranty services. You may also visit www.primuswindpower.com/warranty to register your wind turbine online.

Limited Warranty will be provided for up to Five Years from whichever occurs first: (i) date of installation of the Wind Turbine, or (ii) ninety (90) days after the date the Customer purchased the Wind Turbine, or (iii) up to one year after the product is no longer manufactured. This Limited Warranty applies to the wind turbine only provided the owner follows the maintenance procedures outlined in the owner's manual. Should the product prove to be irreparable, Primus Wind Power reserves the right to substitute an equivalent product if available. This Limited Warranty extends to the original Customer and may not be transferred if the wind turbine is sold.

How to Register a Claim Against Warranty

If a defect arises with regard to any Wind Turbine part and a valid claim is received within the Warranty Period, Customer's sole and exclusive remedy and the entire liability of Primus Wind Power, its dealers, suppliers and affiliates under this Limited Warranty is, at Primus Wind Power's sole option, either (i) to repair free of charge the defective part, or (ii) exchange free of charge the defective part with a new or remanufactured part or wind turbine that is new or equivalent to new in performance and reliability and is at least functionally equivalent to the original wind turbine part. Repaired or exchanged wind turbine parts will be warranted for the remainder of the Warranty Period.

If you experience any problem with your AIR Wind Turbine, please contact an authorized service dealer or Primus Wind Power directly. Retain all information and documents until the problem is resolved. Your authorized service dealer can provide you with a solution and start the claims process. For best possible service, we strongly recommend registration of your product with the warranty registration materials provided with your AIR Breeze Wind Turbine. You MUST demonstrate ownership with a copy of the original receipt indicating that you are the primary owner of the wind turbine.

To find a Primus Wind Power authorized service dealer near you or to report your claim to technical support, call Primus Wind Power at (303) 342-5820 Monday-Friday 8:00AM – 5:00 PM Mountain standard time.

Warranty claims notification must include a description of the defect, the serial number of the Wind Turbine at issue, and the original purchase date in addition to the name, address, and telephone number of the party requesting warranty service under this Limited Warranty. After Primus Wind Power is notified, Primus Wind Power representatives will make all reasonable efforts via phone and email to ascertain the nature of the problem to determine whether any part is defective for purposes of coverage under this Limited Warranty. Other than normal communication carrier charges, there is no charge for such diagnosis. Any repair or replacement will be provided only after Primus Wind Power's diagnosis and its agreement to the defective condition. Certain diagnostic checks may be required to be performed by the end-user or designee at Primus Wind Power representatives' request. All claims for defect shall be deemed waived unless made in writing and delivered to your Wind Turbine dealer during the Warranty Period and not later than thirty (30) days after discovery of the defect. If Primus Wind Power representatives determine that the Wind Turbine requires service and that Customer's service request constitutes a valid claim under this Warranty, Primus Wind Power will provide warranty service, at Primus Wind Power's sole option, either (i) through an authorized dealer, with service to be performed at the servicer's location; (ii) by sending replacement Wind Turbine or parts to the Customer or (iii) by providing the Customer with a Return Merchandise Authorization ("RMA") number to authorize the Customer to ship the defective Wind Turbine or Wind Turbine parts to Primus Wind Power for service. Any Wind Turbine part(s) requiring warranty repair shall be transported at the expense and risk of the party requiring warranty service, including but not limited to proper packaging of the part(s). Primus Wind Power will return to sender any Wind Turbine and/or part(s) that do not have a valid RMA number. Primus Wind Power will use all reasonable efforts to repair/replace the defective Wind Turbine and/or part(s). Repaired or replaced wind turbines and replacement parts will be delivered to the Customer at Primus Wind Power's expense. If a warranty claim is invalid for any reason, Customer may be charged at Primus Wind Power's and/or the authorized service dealer's then current rate for repair services performed. In such event, the Customer will be informed of the repair charges for prior approval, and, upon approval, will be charged for the approved repairs and return freight. If the Customer refuses to approve repair charges, return freight charges may apply. When a Wind Turbine part is replaced for a new or remanufactured part, such new or remanufactured part becomes Customer's property and the replaced part becomes Primus Wind Power's property. Customer property remaining at Primus Wind Power's repair facilities for more than ninety (90) days without required Customer approval of return freight charges, becomes the property of Primus Wind Power.

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AIR Wind Turbine Limited Warranty (continued)

Exclusions and Limitations

Primus Wind Power does not warrant that the operation of the Wind Turbine will be uninterrupted, nor does this Limited Warranty guarantee specific performance or energy production under any conditions.

This Limited Warranty does not apply to claims arising from installation of your AIR Breeze Wind Turbine at improper or deficient site locations as described in the Wind Turbine's Owner's Manual. This Limited Warranty does not cover any part that was not manufactured by Primus Wind Power, nor does it cover the costs of any repairs or adjustments to your Wind Turbine that might be needed because of the use of non-Primus Wind Power parts, components, equipment, or materials. This Limited Warranty does not apply to: (i) consumable parts; (ii) cosmetic damage, including scratches or dents unless such damage compromises the product's function; (iii) damage caused by overload, surges, use with any unsuitable power source, voltage irregularities or utility system failures that enter the Wind Turbine through the output side; (iv) damage caused by acts of God (including flood, fire, earthquake, lightning, hail damage, flying debris, wind speeds in excess of 120 mph, tornadoes, hurricanes or other cyclonic windstorms), misuse, negligence, accident, abuse, or vandalism; (v) damage due to a failure to service and maintain, and/or operate the Wind Turbine in accordance with its Owner's Manual or provided instructions; (vi) a Wind Turbine or any of its parts that has been modified to alter functionality or capability without the written permission of Primus Wind Power; (vii) any Wind Turbine part whose serial number has been removed or defaced; (viii) damage or loss to any items or products not manufactured by Primus Wind Power that are connected to, powered by, or otherwise attached to, the Wind Turbine; (ix) any expenses incurred from travel to and from the repair location, troubleshooting, diagnostic and repair services, equipment expenses, or; (x) damage due to improper installation of the Wind Turbine that is not in accordance to the owner's manual or, (xi) use of the wind turbine in wind regimes with an annual average of 18 mph (8 m/s) or greater.

Disclaimer of Warranty

This Limited Warranty gives you specific legal rights, and you may also have other rights which vary from state to state. TO THE EXTENT PERMITTED BY LAW, THIS EXPRESS LIMITED WARRANTY AND THE REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, REMEDIES AND CONDITIONS, WHETHER ORAL, WRITTEN, STATUTORY, EXPRESS OR IMPLIED. AS PERMITTED BY APPLICABLE LAW, Primus Wind Power DISCLAIMS ANY AND ALL STATUTORY OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, NON-INFRINGEMENT AND WARRANTIES AGAINST HIDDEN OR LATENT DEFECTS. IF Primus Wind Power CANNOT LAWFULLY DISCLAIM STATUTORY OR IMPLIED WARRANTIES THEN, TO THE EXTENT PERMITTED BY LAW, ALL SUCH WARRANTIES SHALL BE LIMITED IN DURATION TO THE DURATION OF THIS EXPRESS LIMITED WARRANTY. Primus Wind Power does not grant

to any person or entity (including its field representatives, dealers or distributors) the authority to create for it any obligation or liability in connection with your Wind Turbine.

Limitation of Liability

EXCEPT AS PROVIDED IN THIS EXPRESS LIMITED WARRANTY AND TO THE MAXIMUM EXTENT PERMITTED BY LAW, UNDER NO CIRCUMSTANCES WILL Primus Wind Power, OR ITS AFFILIATES, SUPPLIERS, DEALERS, DIRECTORS, OFFICERS, EMPLOYEES, OR AGENTS (THE "RELEASED PARTIES") BE LIABLE OR RESPONSIBLE FOR, EVEN IF SUCH RELEASED PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE, ANY DIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY BREACH OF WARRANTY OR CONDITION, OR UNDER ANY OTHER LEGAL THEORY OR FORM OF ACTION (WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE), INCLUDING, BUT NOT LIMITED TO, ANY LOSS OF USE, INTERRUPTION OF OR LOSS OF BUSINESS, LOSS OF ACTUAL OR ANTICIPATED PROFITS (INCLUDING LOSS OF PROFITS ON CONTRACTS), LOSS OF REVENUE, LOSS OF THE USE OF MONEY, LOSS OF ANTICIPATED SAVINGS, LOSS OF OPPORTUNITY, LOSS OF GOODWILL, LOSS OF REPUTATION, LOSS OF, DAMAGE TO OR CORRUPTION OF DATA, OR ANY INDIRECT OR CONSEQUENTIAL DAMAGES HOWEVER CAUSED, INCLUDING THE REPLACEMENT OF EQUIPMENT AND PROPERTY, BODILY INJURY OR DEATH. (Note: some states do not allow the exclusion or limitation of incidental or consequential damages, so these limitations may not apply to you.) The total cumulative liability to Customer, from all causes of action and all theories of liability, will be limited to and will not exceed the purchase price of the Wind Turbine paid by Customer.

Product Changes

Primus Wind Power reserves the right to make changes, improvements or additions to its products in the future without incurring obligations to make such changes, improvements, or additions to its products previously manufactured. Occasionally, a product change, improvement or addition will be made that either prevents future failure of a product or part or eliminates a safety hazard. Primus Wind Power will then issue a field change order to correct this problem. Installation of the mandatory field change order must be done within thirty (30) days of field change order issuance or this Limited Warranty will be void should failure occur as a result of not installing said parts. Primus Wind Power reserves the right to change the terms of this Limited Warranty in the future without incurring any obligations to make the changed terms applicable to products previously manufactured.

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AIR Wind Turbine Limited Warranty (continued)

Additional Terms that Govern this Limited Warranty

Each of us (i) agrees that all actions and proceedings relating directly or indirectly to this Limited Warranty shall be litigated in state or federal courts located in Jefferson County, Colorado; (ii) consents to the jurisdiction and venue of any such court and consents to service of process in any such action or proceeding by personal delivery or any other method permitted by law; and (iii) waives any and all rights either of us may have to object to the jurisdiction of any such court, or to transfer or change the venue of any such action or proceeding. WE FURTHER EACH WAIVE THE RIGHT TO TRIAL BY JURY IN ANY ACTION OR PROCEEDING BASED UPON, ARISING OUT OF, OR IN ANY WAY RELATING TO, THESE TERMS AND CONDITIONS. We further agree that this Limited Warranty may not be extended, altered or waived except in writing signed by an authorized officer of Primus Wind Power. ANY ACTION FOR BREACH HEREUNDER MUST BE COMMENCED WITHIN ONE YEAR AFTER THE CAUSE OF ACTION HAS ACCRUED. Primus Wind Power shall be entitled to recover legal fees, costs and expenses in defending and enforcing this Limited Warranty against Customer and others. This Limited Warranty shall be construed and enforced in accordance with the laws of the State of Colorado without regard to conflicts of laws.

primuswindpower

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