

Skystream 3.7

Maintenance, Troubleshooting and Service Guidelines

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1. Skystream 3.7 Recommended Maintenance

Skystream 3.7 has a 20 year design life but there are a number of recommended maintenance procedures that should be performed at regular intervals throughout its life.

Every six months

- Inspect blades visually once every six months (with binoculars if possible) and after high wind events with flying debris. Inspect for cracks and chips particularly along the edges of the blades. Any damage is cause for replacing the blades.

Annually

(see log in Appendix E for recording annual checks)

TURBINE INSPECTION

- Remove yaw shield and check the tightness of the eight (8) yaw bolts with a torque wrench. All yaw bolts should be torqued to 60 lb-ft (80 N-m). NOTE: Bolts shall not be loosened; only checked that they are at least the specified torque.
- Check vibration isolators for signs of stress, cracking or any abnormal wear.
- Verify yaw bearing snap ring is properly seated and yaw bearing seal is sound, by using a mirror underneath the bearing. Remove nose cone and lift up on root of rotor/blade shaft to check for play in yaw bearing. Any play in excess of **xxx** in a vertical direction is cause for concern. If there is concern about the yaw bearing, move the turbine through the entire 360 degree range of yaw motion. It should move smoothly. If it is rough or "notchy" this is an indication the yaw bearing is worn. Wipe any grease that may have seeped from yaw bearing (a small amount of lubricant is normal). Consult Technical Support if there is a large amount of leakage.
- Check ground lead coming from the yaw terminals of the turbine (the turbine must be grounded to the tower as depicted in Figure 1).

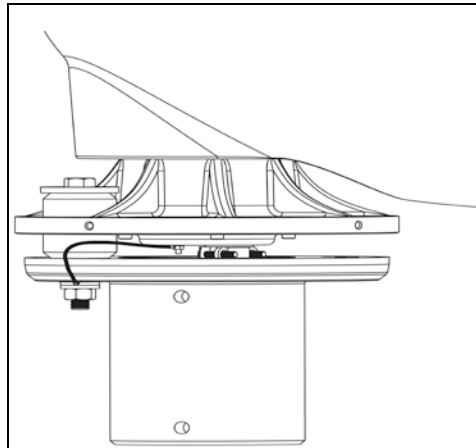


Figure 1

- Verify Skystream is grounded to the tower by measuring resistance between the nacelle (use an unpainted bolt head in the case of marine units) and the tower flange. The resistance must be < 1 ohm.
- Reinstall the yaw shield and secure the fasteners.
- Check that the hatch cover bolts are tight. Bolts should be tightened to 60 in lb (7 N-M). NOTE: Bolts shall not be loosened; only checked that they are at least the specified torque.

- Check the RF antenna for tightness on nacelle fitting. Fingertight is sufficient.
- Remove the nose cone. Inspect the rotor blades for possible cracking, chipping, flaking or other signs of abnormal stress particularly along the edges of the blades. Very small cosmetic damage is not of concern, but any damage that changes the shape of the blade in any way is cause for shutting turbine down until blade set can be replaced.
- Check "tip to tip" distance (chord length) of each blade set to confirm it is within 1/2 inch (1.3cm) tolerance.
- Blade bolts should be torqued to 50 lb-ft (68 N-m). Follow sequence indicated in Figure 2. NOTE: Bolts shall not be loosened; only checked that they are at least the specified torque.

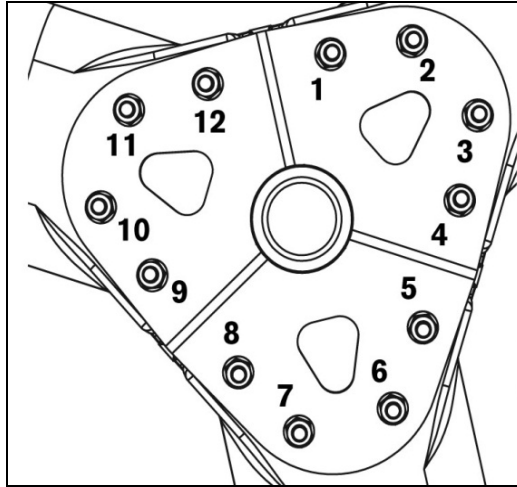


Figure 2

- Clean the rotor blades with a mild soap and water and a soft cloth. Remove as much buildup of any dirt and debris as possible from the blades.
- Reinstall the nose cone and secure the fasteners.
- Visually inspect the face, nacelle and the rest of Skystream and note any potential damage or problem.
- Face bolts should be torqued to 17 lb-ft (23 N-m). NOTE: Bolts shall not be loosened; only checked that they are at least the specified torque.

TOWER INSPECTION

- **MONOPOLE TOWER:** Visually inspect the tower for any potential damage, making sure to check the tower welds at the tower top flange and tower bottom flange. Check turbine for tower level after inspection.
- **MONOPOLE TOWER:** Check the system for proper grounding at the tower site.
- **GUYED TOWER:** Check all accessible tower supports and guy wires for correct tension and bolts and nuts for correct torque (see Tower Manual), guy wire integrity and turnbuckle tension. Check bolts on tower adaptor.

ELECTRICAL SYSTEM

- Check all system electrical connections for connection integrity (if turbine is removed from tower). Check integrity of lightning protection system and replace any damaged components

After twenty years

- After 20 years of service the blades **MUST** be replaced – even if there is no apparent damage. The blades should be replaced as a set. Do not attempt to replace individual blades. All blade mounting hardware – bolts, nuts and washers – should be replaced at the same time. Do **NOT** attempt to reuse the blade fasteners.

2. Troubleshooting Procedures

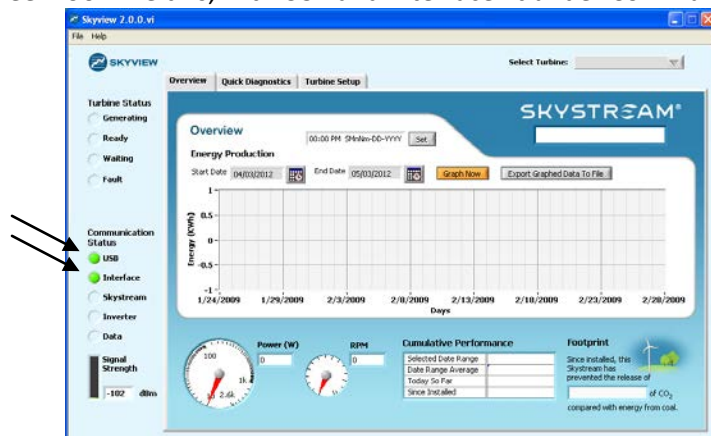
Identify main complaint:

Is the turbine:

- A) spinning but not communicating?
- B) not spinning in sufficient wind but IS communicating?
- C) not seeking the wind?
- D) not spinning and not communicating?
- E) shutting down intermittently?
- F) spinning but overall production not as expected?
- G) louder than expected?
- H) vibrating/head nodding, or spinning unevenly?

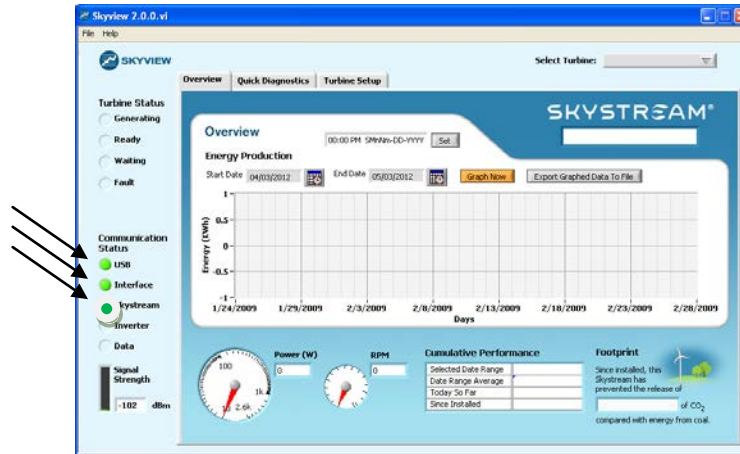
A) Turbine spinning but not communicating/communication not available

- What is the communication history of the turbine?
 - Never communicated?
 - If the turbine was manufactured prior to current comm. model (pre-1010-4839), it is possible it was never enabled with xBee comm / Skyview 2.0 system. (Some inverters were upgraded/replaced over the years so this is not a hard/fast identification path.)
 - If the turbine was manufactured shortly after the advent of Skyview 2.0, communication package was sold as an option. It's possible it was not purchased.
 - Previously communicated but now unable, or Skyview opening with error messages?
 - Is this a new computer? Skyview 2.0 is compatible with all current Microsoft OS – through Windows 8.1. However, MS has made it difficult to utilize unsigned drivers. See Appendix A for instructions on installing drivers for Skyview interface in Windows 7, Windows 8 and Windows 8.1
 - Does your Skyview screen look like this, with USB and Interface lit under Communication Status?



If so, see Appendix B for Communication Tips and Tricks:

- Does your Skyview screen look like this (with USB, Interface and Skystream lit, but not Inverter or Data)?



- Shut power to turbine off for 10-15 minutes, turn it on.
 - Problem may be baud speed mis-match or serial number mis-match. Contact WIND Skystream Tech Support to obtain *zserfix.exe* utility and instructions to use it.
 - Alternately, the xBee firmware might need to be updated (this is only the case in a very few turbines manufactured with the incorrect firmware version between November 2011 and April 2012). Contact WIND Skystream Tech Support for help identifying and assisting with update if necessary.

B) Turbine not spinning in sufficient wind but IS communicating

This can be described as “never spins in light winds”, “spins slowly in heavy winds”, “never spins quickly despite wind conditions”. This is an indication the brake is engaged. As it is an electromechanical brake (not mechanical), the turbine’s blades can spin up to 5 RPM in heavy winds with the brake engaged.

- Power cycle the turbine - turn power to turbine off for 30 minutes.
- Measure incoming voltage at closest available location to base of turbine. Confirm appropriate voltage levels coming from utility connection (120v hot to neutral and 240v hot-to-hot for US residential installations).
- What does Skyview show? (Screen shots of Quick Diagnostics and Advanced Diagnostics are v. helpful.)
 - If Skyview shows “Ready” and Advanced Diagnostics does not show any unusual lights (Grid Disconnect, Low Windspeed and Anemometer lights are NORMAL for any Skystream at rest) prepare to use the Troubleshooting Kit and the Troubleshooting Guide provided by SWWP (WIND has the kit available for sale). The culprit is likely the relay driver on the inverter, the latching relay, the ribbon cable, one of the primary relays on the relay board, or the alternator itself. The Troubleshooting Guide helps to ascertain which of these is at fault. See Appendix D. Troubleshooting Kit will be required.
 - If Skyview shows “Ready” and “Fault” at the same time - check Advanced Diagnostics tab for “Braking” light under “Turbine Status” section. If Braking and Ready are on at the same time, this is an indication of an alternator issue, which is often associated with a primary short in the stator wires caused by rubbing on the rotor hub nut. Do the following:
- Gain access to the turbine.

- Follow inverter/hatch cover removal instructions (Appendix G) with power to turbine off. Observe all safety precautions as indicated.
- Inspect interior condition of nacelle. It should be clean and free of corrosion, carbon dust, etc.
- Inspect the orange, black and red wires running from alternator to inverter plug (largest black connector). If there is a primary wire visually damaged, repair/splice the wire
 - If there was a primary wire short, the Skystream's inverter may well be locked. This is almost definitely the case if braking and ready were showing at the same time in Skyview. The only way to ascertain this is to review the *stat a* table in *skzcmd.exe*. Contact WIND Skystream Tech Support for assistance.
 - If there is no primary wire visibly damaged, test the condition of the alternator by disconnecting the seven wires from the relay board and spin the rotor by hand. It should turn freely and smoothly, at least 1.5 RPMs with a good tug of the arm. If it feels rough, bumpy or difficult to turn, the problem is most likely a shorted alternator and the entire face assembly will need to be replaced.
- If Skyview shows "Fault" Find the source of the fault by accessing the Quick Diagnostics tab in Skyview and determining if there are any fields shown in red.
 - Fault will usually show in the voltage or frequency fields near the bottom of the screen.
 - How long has the fault condition existed?
 - Have the line voltages been checked with a hand-held meter at the service panel to the house as well as the disconnect location for the turbine (if one exists)? If so, what are the line voltage and frequency readings at those locations?
 - Normal voltage and frequency readings at service panel/disconnect and fault is in Frequency Field (0 Frequency): this is likely an inverter failure: **Inverter must be replaced.** See Appendix G for inverter removal/replacement procedures and contact WIND Skystream Tech Support to order replacement inverter. Serial number, grid configuration and site elevation (above sea level) will be needed.
 - Normal voltage and frequency readings at service panel/disconnect and fault is in Voltage Field(s). If voltage is 0 or VERY high/low OR fluctuating wildly this is likely a brush issue (small wire connecting brush lug to brush head is partially or completely severed). **This requires a brush replacement.** See Appendix H for brush replacement instructions and contact WIND Tech Support to order brush assembly.
- If no fault is showing in Quick Diagnostics, check Advanced Diagnostics (select "Advanced Diagnostics" from the File menu in the upper left corner of Skyview screen, then click on the Advanced Diagnostics tab when it appears).
 - If "Bad CRC" is lit in the right side part of Advanced Diagnostics, this is an indication that the set points in the inverter have become corrupted. This can be corrected by uploading a fresh version of the proper set points to the inverter via the Skyview Interface and a special software utility that can be provided by Skystream Technical Support. Please contact XZERES Skystream Tech Support.
- If this is a NEW installation and there are normal voltage and freq. readings at service panel/disconnect and fault is in Voltage Field(s) but readings are stable and showing normal L1 and low (90v range) L2 OR high (140v range) L1 and normal L2, you likely have a grid mis-match. **Run gridfix.exe utility. Contact WIND Tech Support for the utility if necessary.**

C) Turbine not seeking the wind:

- Is the turbine always facing the same position despite variable wind directions?
- Does the turbine settle back in the same position after spinning in sufficient wind?

The tower top flange is either out of level, there is a mechanical obstruction, or the yaw bearing is not functioning correctly.

1. Check tower level (follow instructions in Appendix E).
2. Check for mechanical obstruction with binoculars or from tower top.
3. Verify yaw bearing snap ring is properly seated and yaw bearing seal is sound, by using a mirror underneath the bearing.
4. Remove nose cone and lift up on root of rotor/blade shaft to check for play in yaw bearing. Any play in excess of **xxx** in a vertical direction is cause for concern.

If there is concern about the yaw bearing, move the turbine through the entire 360 degree range of yaw motion. It should move smoothly. If it is rough or "notchy" this is an indication the yaw bearing is worn. Wipe any grease that may have seeped from yaw bearing (a small amount of lubricant is normal). **Consult Technical Support if there is a large amount of leakage or if the bearing is not functioning correctly/damaged.** See Appendix I for Nacelle, Yaw Replacement Instructions.

D) Turbine not spinning and no communication-see “Troubleshooting without Skyview” process

E) Turbine is not Skyview-capable or Skyview interface & software not available-“see Troubleshooting without Skyview” process

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- failure mode. Troubleshooting Kit will be required.

F) Turbine shutting down intermittently

- Is Skyview available?
 - What fault does Skyview show when the shut downs occur? This should show in the “Last Event” field of “Quick Diagnostics” tab or LastEvCode field of “Advanced Diagnostics” tab. Note: Skyview must be open when the event occurs.
 - Check event code in Turbine Events list (see Appendix
 - Set data log to run and capture shut downs. Send data log to WIND Skystream Tech Support.
- **If Skyview is not available, suspect brush issue.** See Appendix H for brush replacement instructions and contact WIND Tech Support to order brush assembly.

G) Turbine spinning but overall production not as expected

- What is the average wind speed at the installation site?
- What were production expectations and where did these come from?
- Is there communication via Skyview?
 - **If so, get screen shot of Overview and graph/export kWh report for life of installation, send to XZERES Tech Support at Skystream service**

H) Turbine louder than expected

- What does it sound like?
 - Whine?
 - Siren?
 - **Record an audio file and send to WIND Skystream Tech Support**
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I) Turbine wobbles or tower/turbine vibrate more than expected

Describe the behavior of the turbine or tower/turbine?

- **Blades wobbling** – could be out of balance or installed with irregular distance between tips
 - Inspect blades carefully for any debonding, cracks or water ingress.
 - Measure tip to tip distances (chord length). Distances must be within ½ inch of each other.
 - **Turbine/Tower Vibration:**
 - What is the tower height and type?
 - **Get a video of the behavior if possible and send to WIND Skystream Tech Support**
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3. Turbine Removal and Replacement/Re-installation

Wind strongly recommends Skystream be installed/removed/replaced by trained professionals.

1. Choose a calm day to remove, replace or re-install Skystream - no wind at ground level.
2. A minimum of 2 adults is required to safely lift or move Skystream. Use proper equipment such as hydraulic hoists to lift Skystream.
3. Always wear appropriate protective personal equipment such as closed toe work shoes, hard hat, work gloves, and safety glasses when working on or installing Skystream.
4. This wind generator complies with international safety standards, and therefore the design or its installation must never be compromised.
5. Only open the inverter cover if instructed to do so by Wind; doing so without factory authorization will void the warranty.
6. Take precautions.
 - Disconnect power to Skystream prior to servicing – observe “Lock-out” and “Tag-out” procedures.
 - Verify the turbine is OFF by attempting to turn the blade shaft. It should be very difficult to turn by hand.
 - Never use unauthorized fasteners. Use fasteners supplied with Skystream. Contact your dealer for authorized replacement fasteners.
 - Observe fastener torque requirements.
 - Do not attempt to modify Skystream in any fashion – internally or externally.
 - Do not install blades other than those supplied with Skystream. Use only genuine replacement blades supplied by Wind.
7. Removal of Skystream is most easily accomplished with Skystream on the ground as would be the case when utilizing a tilt-up tower.

A) Remove the antenna from the hatch cover

1. Unscrew the antenna using only the metal collar at the base of the antenna.
2. Set aside.

B) Remove the nosecone

1. Unscrew the three M6-1.0 socket head screws.
2. Set the nosecone aside.

C) Remove the blades

1. If reusing the blades, it is recommended to remove them as an assembly, keeping them connected to the blade hub. The blade assembly consists of the blade plate, the blades and the blade hub.
2. Unscrew the Rotor Hub Nut (M42-4.5 class 8.8) to release the blade assembly, then spin the entire assembly off the rotor shaft in a counter-clockwise direction. Note: Additional leverage may be required. Apply a “cheater bar” to hub nut wrench if necessary.
3. Taking great care not to bump or scrape the blades, set the assembly aside.

D) Un-bolt Skystream from the Tower

1. Remove the yaw shield halves by unscrewing four M5 socket head screws with 8mm socket wrench.
 2. Disconnect the turbine ground wire that connects the turbine and the tower.
 3. Remove nuts on vibration isolator bolts from below.
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4. Remove the vibration isolator bolts and snubbing washers from above.
 5. Remove the vibration isolator halves. Note the orientation of the isolator halves for re-installation. Orientation is very important. If vibration isolators seem compromised, consider replacing them.
 6. Lift the turbine slightly and remove the strain relief cover by removing four screws.
 7. Release the transmission wires from the terminal block assembly; the turbine is now disconnected.
 8. Lift the turbine off the tower.
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Appendix A – Skyview Communication Tips and Tricks

1. Confirm the antenna is still attached on top of the Skystream.
2. Ensure the USB Radio Receiver is working. There should be at least one light on.
3. Under the *Turbine Setup* tab, check if any entries appear under *Other Turbines Found*. If you find another entry confirm you have entered your serial number correctly.
 - If it was incorrect, delete the old entry and re-enter the correct serial number. Perform step 5.
 - If it is correct, repeat step 5 first. If you have not established communication, call Wind while you are on site. This number may or may not be related to your communications problem. Note: If you cannot call Wind on site you should still continue with the communication troubleshooting steps.
4. Press the *Find Turbines* button, wait 60 seconds.
5. Go to *File* and select *Disconnect from USB Converter*. Wait 5 seconds. Go back to *File* and select *Connect to USB Converter*. Wait 60 seconds.
6. Move the USB cable to another port on your computer. Repeat step 5.
7. Change the line of sight. Move the USB radio receiver next to a window, or move closer to the turbine (no closer than 30 feet), or step back at least 30 feet and repeat step 5.
 - If it is very difficult or impossible to attain a favorable line of sight to the turbine, consider purchasing WINDS' Extended Range Antenna Kit for Skyview which comprises an external antenna that may be mounted on the side or roof of a building, a 30-60' co-ax cable and a modified Skyview interface (with SMA connector for co-ax cable connection). Contact WIND Tech Support for more information or to order the kit.
8. Confirm the USB Radio Receiver is still intact: ensure the top Xbee Pro Series 2 board is not separating or becoming "unseated" from the bottom board. If separating, open the box and carefully press the boards back together. Repeat step 5.
9. Perform a **Forced Join**. Unplug the USB radio receiver, close Skyview, and shut off power to the turbine for 10 minutes. After 10 minutes plug the USB back into the computer, open Skyview and during the 60 second countdown power the turbine up.

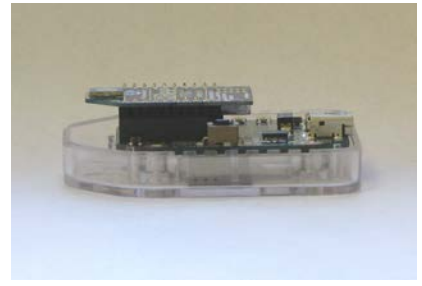
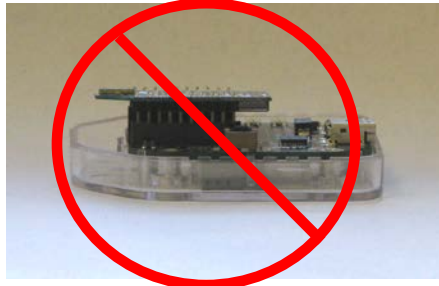
!! It is essential the turbine is powered up during the 60 second countdown, not before or after!!

!! Be advised once you open Skyview it will immediately begin the 60 second countdown!!

If communication is still unavailable, **contact WIND Skystream Tech Support for assistance.**

Appendix B - Down Tower xBee boards separated

1. Prior to approximately 2010, the two xBee boards in the down tower receiver could become separated.



If this has occurred, gently re-seat the boards by pushing them back together while observing anti-static protection.