NEON PREVENTIVE MAINTENANCE PROCEDURE: BAROMETRIC PRESSURE SENSOR

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See configuration management system for approval history.

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Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	04/25/2018	ECO-05501	Initial release
B	08/02/2021	ECO-06656	Removing offensive terminologies and updating NEON branding.
C	12/01/2022	ECO-06923	Minor formatting fixes

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1 DESCRIPTION

1.1 Purpose

The National Ecological Observatory Network (NEON) employs terrestrial and aquatic sensors to collect measurements from water, air, wind, soil, and sun across the United States (to include Alaska, Hawaii and Puerto Rico). Regular maintenance of these sensors and their infrastructure is necessary for the continued operation of the observatory and identify problems before they escalate.

This document details the procedures necessary for the preventive maintenance of the **Barometric Pressure Sensor**.

1.2 Scope

Preventive Maintenance is the planned maintenance of infrastructure and equipment with the goal of improving equipment life by preventing excess depreciation and impairment. This maintenance includes, but is not limited to, inspecting, adjusting, cleaning, clearing, lubricating, repairing, and replacing, as appropriate. The procedures in this document are strictly preventive.

This document specifically addresses the preventive procedures to maintain the **Barometric Pressure Sensor** for all applicable NEON terrestrial and aquatic sites. This covers the instrumentation, subsystem and infrastructure.

The procedures in this document are strictly preventive.

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

The following applicable documents (AD) contain mandatory requirements and/or supplementary information that are directly applicable to the topic and/or procedures herein. Visit the NEON Document Warehouse for electronic copies of these documents.

AD [01]	NEON.DOC.004300	NEON Environmental, Health, Safety and Security (EHSS) Policy, Program and Management Plan
AD [02]	NEON.DOC.004301	NEON Environmental, Health, Safety and Security (EHSS) Environmental Protection Manual
AD [03]	NEON.DOC.004316	Operations Field Safety and Security Plan
AD [04]	NEON.DOC.050005	Field Operations Job Instruction Training Plan
AD [05]	NEON.DOC.004257	NEON Standard Operating Procedure (SOP): Decontamination of Sensors, Field Equipment and Field Vehicles
AD [06]	NEON.DOC.002768	TIS Subsystem Architecture, Site Configuration and Subsystem Demand by Site - SCMB Baseline
AD [07]	NEON.DOC.002767	AIS Subsystem Architecture, Site Configuration and Subsystem Demand by Site - SCMB Baseline
AD [08]	NEON.DOC.001427	TIS Communications Interconnect Map TIS Hut, Rack DAS and PDS Interconnect
AD [09]	NEON.DOC.001436	TIS Comm Interconnect Mapping
AD [10]	NEON.DOC.001972	AIS Comm Interconnect Mapping
AD [11]	NEON.DOC.000230	NEON Sensor Command, Control and Configuration – Barometric Pressure
AD [12]	NEON.DOC.000653	NEON Algorithm Theoretical Basis Document – Barometric Pressure

2.2 Reference Documents

The Reference Documents (RD) listed below may provide complimentary information to support this procedure. Visit the NEON Document Warehouse for electronic copies of these documents.

RD [01]	NEON.DOC.000008	NEON Acronym List
RD [02]	NEON.DOC.000243	NEON Glossary of Terms
RD [03]	NEON.DOC.000705	NEON Bolt Torque Specifications
RD [04]	NEON.DOC.000769	Electrostatic Discharge Prevention Procedure
RD [07]	NEON.DOC.004821	NEON Preventive Maintenance Procedure: Aquatic Meteorological (Met) Station
RD [08]	NEON.DOC.001637	Aquatic Met Station Installation Procedure
RD [09]	NEON.DOC.004613	NEON Preventive Maintenance Procedure: AIS Buoy
RD [09]	NEON.DOC.004638	AIS Verification Checklist
RD [10]	NEON.DOC.004637	TIS Verification Checklist

RD [11]	NEON.DOC.000492	NEON Installation Procedure: Barometric Pressure
RD [12]	NEON.DOC.004608	AIS Buoy Verification Procedures
RD [13]	NEON.DOC.004455	Barometric Pressure & Humidity Subsystem Verification Procedure
RD [14]	NEON.DOC.000734	Procedure, Barometric Pressure Assembly
RD [15]	NEON.DOC.000804	Site Flora and Fauna Maintenance Plan

2.3 External References

The External References (ER) listed below may contain supplementary information relevant to maintaining specific standards and/or commercial products pertaining to the Aspirated Air Temperature. These documents are external to the NEON project and Battelle Ecology. If an issue with a product requires the involvement of the manufacturer, NEON Headquarters (HQ) will contact the manufacturer or provide Field Operations (FOPS) the authority to contact via the NEON Issue Management System.

ER [01]	MSDSOnline (NEON Project Access) https://msdsmanagement.msdsonline.com/ec04e43d-e72d-4174-9369-c81635eb9493/ebinder/?nas=True
ER [02]	Vaisala PTB330 Digital Barometer User's Guide in English https://www.vaisala.com/sites/default/files/documents/PTB330_User_Guide_in_English.pdf
ER [03]	Vaisala PTB330 Digital Barometer Datasheet https://www.vaisala.com/sites/default/files/documents/PTB330-Datasheet-B210708EN-F.pdf
ER [04]	Vaisala BAROCAP Sensor for Measuring Pressure https://www.vaisala.com/sites/default/files/documents/CEN-TIA-BAROCAP-Technology-description-B210845EN-B.pdf

2.4 Acronyms

Acronym	Description
A/R	As Required
AATS	Aspirated Air Temperature Shield
AIS	Aquatic Instrument Systems
Comm	Communications
CnC	Command and Control
CVAL	Calibration, Validation and Audit Laboratory
ESD	Electrostatic Discharge
FLNT	Flint River, Domain 03
FOPS	Field Operations
GWW	Ground Water Wells
HQ	Headquarters
IP	Ingress Protection
IP65	Ingress Protection where "65" is the specific rating[iii]
JSA	Job Safety Analysis
LC	Location Controller

LED	Light Emitting Diode
LENO	Lenoir Landing, Domain 08
LOGWAR	Logistics Warehouse
LOTO	Lock Out/Tag Out
ML	Measurement Level
MLx	Measurement Level where “x” is the measurement level
NIWO	Niwot Ridge Mountain Research Station, Domain 13
OKSR	Oksrukuyik Creek, Domain 18
PoE	Power Over Ethernet
PRIN	Pringle Creek, Domain 07
PRPO	Prairie Pothole, Domain 09
QR	Quick Response
SDS	Safety Data Sheet
TEP	Terminal Emulator Program
TIS	Terrestrial Instrument Systems
V	Volt
WREF	Wind River Experimental Forest, Domain 16

2.5 Terminology

The use of common names for NEON instrumentation and subsystems vary across departments and domains. Equipment, tools, and instrumentation have one technically accurate name, and at times one or more “common” names describing the same item.

This section aims to clarify and associate “common” names with the technical names herein.

SYNONYMOUS AND COMMON NAME(S)	NEON TECHNICAL REFERENCE NAME
Baro, Barometer, PTB330, Barometric Pressure Sensor, Vaisala Pressure Sensor	Barometric Pressure

3 SAFETY AND TRAINING

Personnel working at a NEON site must be compliant with safe fieldwork practices as outlined in AD [01] and AD [04].

The Field Operations Manager and the Lead Field Technician have primary authority to stop work activities based on unsafe field conditions; however, all employees have the responsibility and right to stop their work in unsafe conditions. All technicians must complete required safety training and protocol-specific training for safety and implementation of this protocol as required in AD [04].

Refer to the site-specific EHSS plan(s) and procedure-specific Safety Data Sheet (SDS) via the NEON Project's account on MSDSOnline or via the NEON Safety document portal for electronic copies. Conduct the appropriate Job Safety Analysis (JSA) before conducting any preventive maintenance.

Preventive maintenance of TIS and AIS Infrastructure may require the use of a special equipment to access the sensor subsystem assemblies. Follow Domain site-specific EHS plans via the Network Drive and NEON safety training procedures when conducting maintenance activities. Conduct a Job safety Analysis (JSA) prior to accessing the sensor subsystems onsite. Reference the Safety Office SharePoint portal for JSA templates and additional hazard identification information.

In the event the current method to conduct the procedures herein are no longer safe for use due to unforeseen or unknown site dynamics, consult with the NEON Safety Office via the NEON Project's Issue Management and Reporting System (i.e., JIRA or ServiceNow) for alternative methods to conduct TIS and AIS preventive/corrective maintenance and Sensor Refresh procedures.

3.1 Hazard Communication Safety Data Sheets (SDS)

Safety Data Sheets (SDS)s can always be accessed via the NEON Project's account on MSDSOnline.

If in the field and have internet connectivity, access to MSDSOnline can also be accessed via the following Quick Response (QR) code.

Neon Inc.

Scan to access an MSDS

4 SENSOR OVERVIEW

4.1 Associated Equipment

4.2 External Components

- Vaisala PTB330 Digital Barometer with One Pressure Sensor
  - ***CD05890000*** *Subsystem, Barometric Pressure, Standard*
  - ***CD05890010*** *Subsystem, Barometric Pressure, Heavy/Extreme*
  - ***CD05890020*** *Subsystem, Barometric Pressure, Wind River*
  - ***HA05890000*** *Subsystem, Barometric Pressure, Aquatic Met Station*
  - ***0348400000*** *Sensor, Buoy, Barometric Pressure*
- Concord Grape G4, 24V
  - **CB14043600** *Assembly, Grape Concord G4 24V, 2digi 6anlg*[i]
- Power/Ethernet Cables (vary per site location and classification (i.e., TIS/AIS))

4.2.1 Other Components

- Mounting Assemblies
  - TIS: Two External Sun Shields with a Mount on the Tower
    - ***0318060000*** *Shield Sun A Barometer Sensor*
    - ***0318080000*** *Shield Sun B Barometer Sensor*
    - ***0318050000*** *Mount Barometer Sensor*
  - AIS: Pole Installation Kit with Rain Shield on the Aquatic Met Station
    - ***HJ06740000*** *Assembly, Barometer with Rain shield*
    - ***HJ06680000*** *Assembly, Side Grape Mount, 1.5 Inch IPS Round Clamp*
  - Grounding Cable

4.3 Description

The Vaisala PTB330 Digital Barometer (hereafter referred to as the Barometric Pressure Sensor) is a single BAROCAP[ii] sensor enclosed in IP65[iii] rated aluminum enclosure. The enclosure itself has a Light Emitting Diode (LED) indicator, one external pressure inlet port, a power and signal cable, and ports for additional sensor expansion (see **Figure 1**).

[i] Applicable to each AIS and TIS assembly with exception of the AIS Buoy. The AIS Buoy does not use Grape data loggers; it uses Campbell Scientific (CR-1000) data loggers and radios transmit the data to a Grape data logger onshore at either the Aquatic Met Station or Stream AIS Device Post.

[ii] BAROCAP is the Vaisala registered trademark name for their silicon-based capacitive sensor for absolute pressure measurements. See also ER [04].

[iii] Protected from total dust ingress and from low-pressure water jets from any direction.

Barometric Pressure Sensors are operational at both terrestrial tower and aquatic sites. For TIS sites, the sensor mounts to the TIS Towers (***CD05890000*** *Subsystem, Barometric Pressure, Standard* in **Figure 5**) to include the TIS Tower in the Wind River Experimental Forest (WREF)[iv] in Domain 16 (**CD05890020** *Subsystem, Barometric Pressure, Wind River* in **Figure 6**) and TIS Towers in extreme cold weather locations (***CD05890010*** *Subsystem, Barometric Pressure, Heavy/Extreme*). The mounting assemblies for the TIS Towers use two external sun shields to cover the top and front of the sensor, and a mount with galvanized U-bolts to secure it to the tower infrastructure.

For AIS sites, the sensor mounts on the Aquatic Metrological (Met) Stations (***HA05890000*** *Subsystem, Barometric Pressure, Aquatic Met Station*) and the AIS Buoys (***0348400000*** *Sensor, Buoy, Barometric Pressure*) at both Lake and River locations. The mounting assemblies vary on AIS sites. The Aquatic Met Station uses a rain shield with pole mounting kit (**Figure 7**) and the AIS Buoy uses a custom mount to secure the sensor to the T-Frame underneath the yellow fiberglass covers and PVC electronic canisters (**Figure 8**).

PRO TIP: Look up each assembly drawing in the NEON Drawing Warehouse using the Agile Number in ***BOLD lettering*** *in the description above.*

[iv] The NEON Project acquired the WREF Tower from the University of Washington (http://www.sefs.uw.edu/centersPrograms/windriver.shtml). It is our tallest tower, although it is not a NEON-custom built tower.

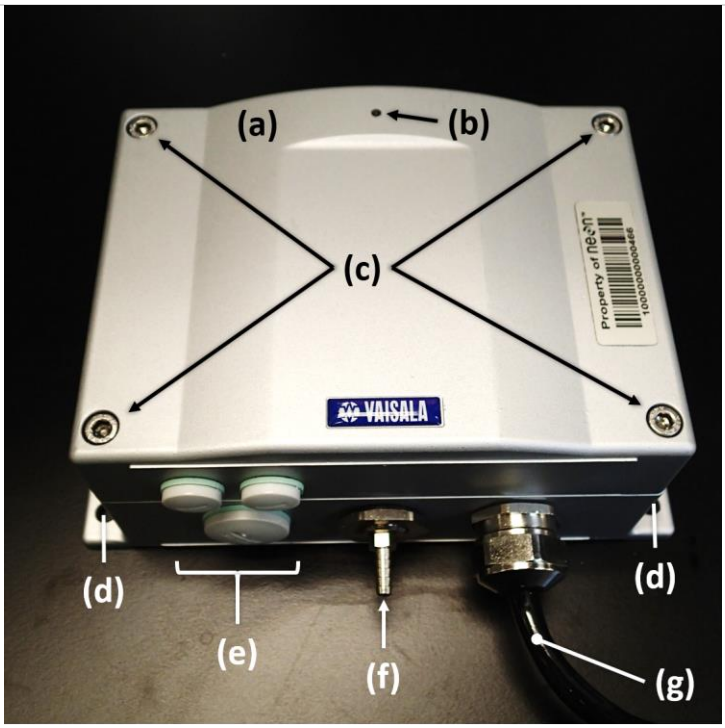


Figure 1. Picture and description of the Barometric Pressure Sensor.

a) Aluminum Enclosure
b) LED Indicator
c) Enclosure Screws
d) Mounting Holes
e) Expansion Ports
f) $^{1}/_{8}$" Barbed Pressure Inlet Port
g) Power and Signal Cable

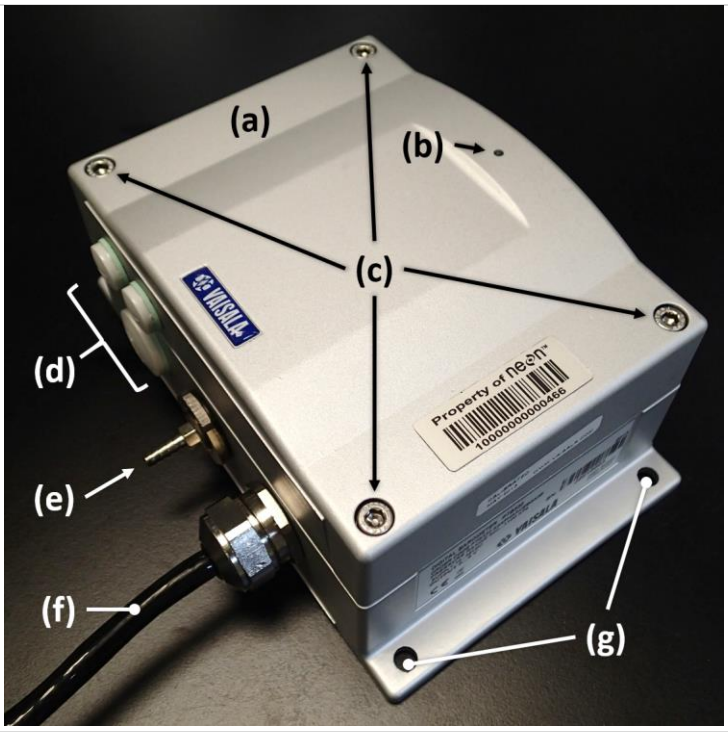


Figure 2. Alternate view and description of the Barometric Pressure Sensor.

a) Aluminum Enclosure
b) LED Indicator
c) Enclosure Screws
d) Expansion Ports
e) $^{1}/_{8}$" Barbed Pressure Inlet Port
f) Power and Signal Cable
g) Mounting Holes

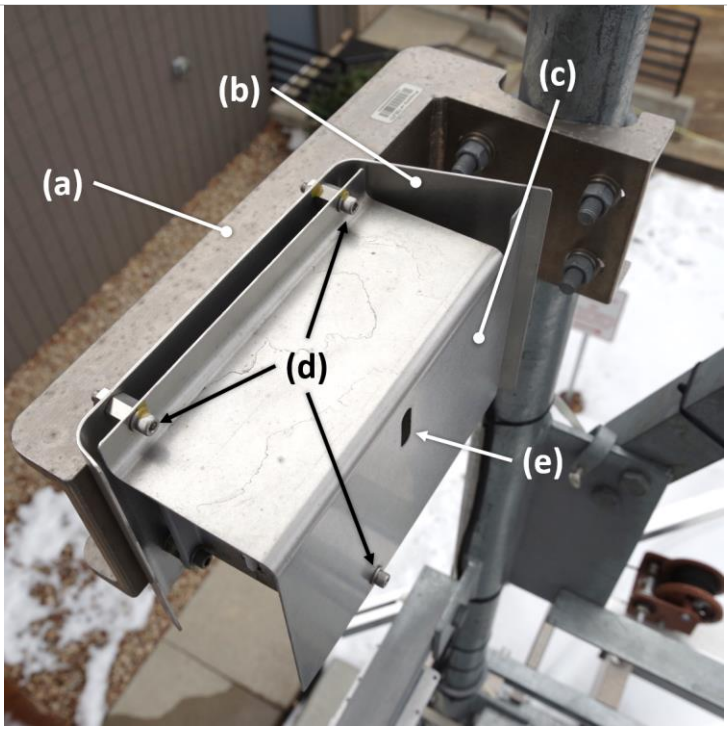


Figure 3. The Barometric Pressure Sensor with sun shields mounted on the TIS tower.

a) Mounting Assembly
b) Rear Sun Shield
c) Front Sun Shield
d) Front Sun Shield Mounting Bolts
e) View Port for LED Indicator

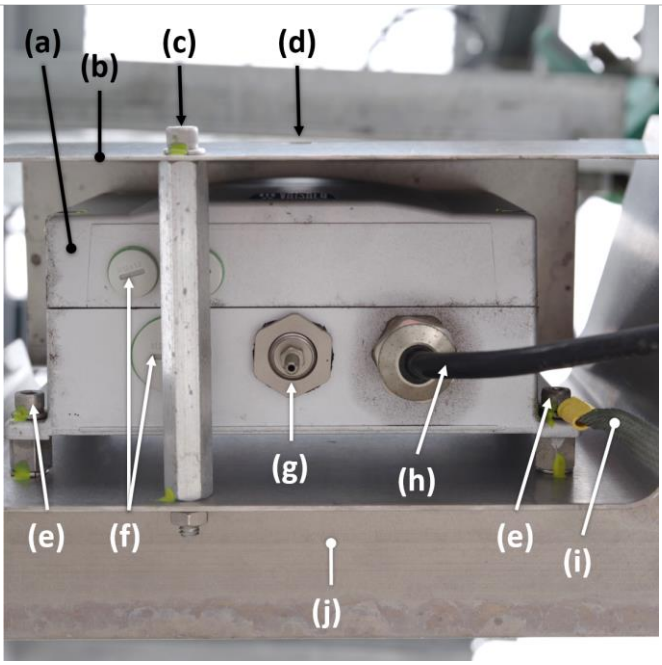


Figure 4. Underside view of a TIS tower mounted Barometric Pressure Sensor.

a) Barometric Pressure Sensor
b) Front Sun Shield
c) Front Sun Shield Mounting Bolt
d) View Port for LED Indicator
e) Barometric Pressure Sensor Mounting Bolt
f) Expansion Ports
g) $^{1}/_{8}$" Barbed Pressure Inlet Port
h) Power and Signal Cable
i) Grounding Cable
j) Mounting Assembly

Figure 5. TIS Tower mounted Barometric Pressure Sensor with both Sun Shields and tower leg U-bolt mount, and Concord Grape subsystem with railing mount.

NEON location: D08 LENO

Figure 6. Barometric Pressure Sensor with both sun shields and subsystem mount for its Grape, which mount together to the Wind River Tower leg.

NEON location: D16 WREF

Figure 7. Barometric Pressure Sensor with rain shield, which mounts to the tripod mast on the Aquatic Met Station. Grape subsystem mounts to the mast as well under a sun/rain shield.

NEON location: D07 PRIN

Figure 8. For AIS Buoy lake/river sites, the Barometric Pressure sensor mounts on the T-Frame under the Met and Profile PVC Canisters. (Yellow fiberglass covers protect these components when the AIS Buoy is on the lake/river.)

NEON Location: D09 PRPO

4.4 Sensor Specific Handling Precautions

4.5 Operation

A silicon micromechanical sensor measures atmospheric pressure changes. A dimensional change in the single-crystal silicon membrane deforms to pressure changes that alters the sensor's capacitance. A relationship between the sensor's capacitance and absolute pressure determines the atmospheric pressure. Refer to ER [04] for further information.

The LED on the cover of the Barometric Pressure Sensor is continuously lit during normal operation when receiving power.

5 INSPECTION AND PREVENTIVE MAINTENANCE

Begin preventive maintenance by first reviewing Section 5.1, Preventative Maintenance Procedural Sequence, to understand the order of the procedure.

5.1 Preventative Maintenance Procedural Sequence

1. Check LED indicator.
2. Inspect the $^{1}/_{8}$" pressure inlet port.
3. Inspect and clean exterior surfaces.
4. Inspect cables and connectors.
5. Inspect mounting hardware.

5.2 Preventive Maintenance Schedule

Table 1. Preventive Maintenance Frequency and Schedule.

Maintenance	Bi-weekly	Quarterly	Annual	As Needed	Type
Barometric Pressure Sensor					
Remote Monitoring	X			X	P
Visual Inspection of LED Indicator	X			X	P
Visual Inspection of Sensor	X			X	P
Inspect Pressure Inlet Port	X			X	P
Clean Pressure Inlet Port				X	R
Sensor Body Cleaning		*X*		X	P/R

NOTE: The biweekly and annual inspections should be carried out regardless of whether they coincide or not. P = Preventive, R = Repair, X = Indicates preventive maintenance task time interval may increase due to environmental (season/weather) or unforeseen/unanticipated site factors.

5.3 Equipment

Table 2 lists a summary of the preventive maintenance equipment necessary to conduct the procedures herein. Equipment recommendations and applicability may adjust over time as the implementation of NEON sensors and subsystems mature.

Table 2. Tools, Consumables, and Resource Lists for Preventive Maintenance.

Item No.	Description	Quantity
Tools		
1	Hex or Allen Key Set (Imperial)	1

Item No.	Description	Quantity
2	Hex or Allen Key Set (Metric)	1
3	Small Wire Brush	1
4	Soft Bristle Brush (Various Sizes)	A/R
Consumable items		
1	Formula 409, Multi-surface Cleaner (32 oz. spray bottle)	A/R
2	Distilled or Deionized water (Squirt/Spray Bottle)	A/R
3	Lint-free Cloths or Microfiber Towels	A/R
4	Powder-free Nitrile Gloves	A/R
5	Trash bag(s)	A/R
6	Rags or roll of paper towels	A/R
37230	Loctite QuickStix Silver Anti-Seize LB 8060 (for TIS Infrastructure)	1 (A/R)
80337	SAF-T-LOK SAFTEZE Food/Drug Grade Anti-Seize (for use on AIS stainless steel Infrastructure)	1 (A/R)
Resources		
1	Technician	2
Reference **Table 3** and **Table** 4 for mounting hardware descriptions and part numbers.		

5.4 Subsystem Location and Access

The Barometric Pressure Sensor is located on TIS Towers, AIS Met Stations, and AIS Buoys.

- **TIS Towers:** The location on the TIS Towers is on one leg of the tower at approximately 5 m (16.4 ft.) above the mounting base flange the tower[v] (see for e.g. **Figure 5** and **Figure 6**). This includes the Wind River TIS Tower.
- **Aquatic Met Station:** The Mast (see for e.g. **Figure 7**) or RD [08].
- **AIS Buoy:** Underneath the PVC Canisters on the Buoy T-Frame (reference RD [09] for specific location).

5.4.1 Mounting Hardware

Table 3. TIS Mounting Hardware with part numbers and descriptions for the sun shield.

	Part #	Description
a)	0307150000	Nut hex ¼-20 Machine SS
	0305200000	Washer Split Lock .25” ID X .49” OD ¼ SS
b)	0317600000	Standoff M/F ½” Hex X ½” ¼-20 SS
	0305200000	Washer Split Lock .25” ID X .49” OD ¼ SS

[v] NEON Science Requirement: NEON.TIS.1395 – Static atmospheric pressure shall be measured at the same height across all tower sites of 4.95 m (+/- 20 cm) measured from the origin of tower coordinate system reference point projected horizontally.

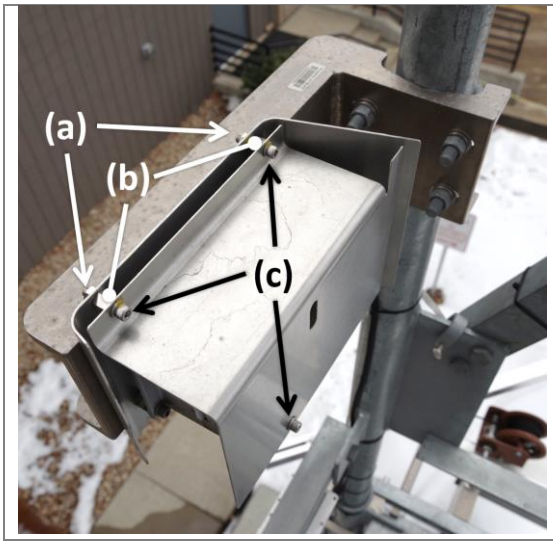
	c)	0390160005	Screw Socket Head ¼-20 SS .5”
		0305200000	Washer Split Lock .25” ID X .49” OD ¼ SS

Table 4. TIS Mounting Hardware with part numbers and descriptions.

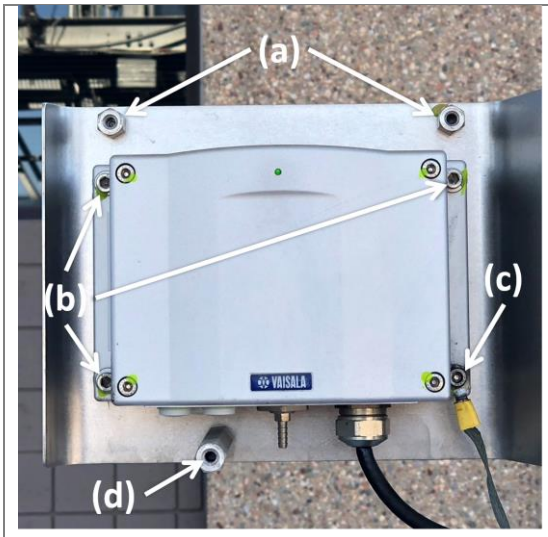
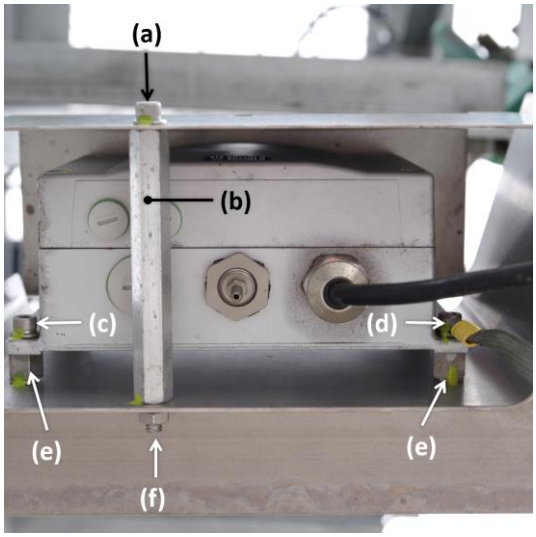
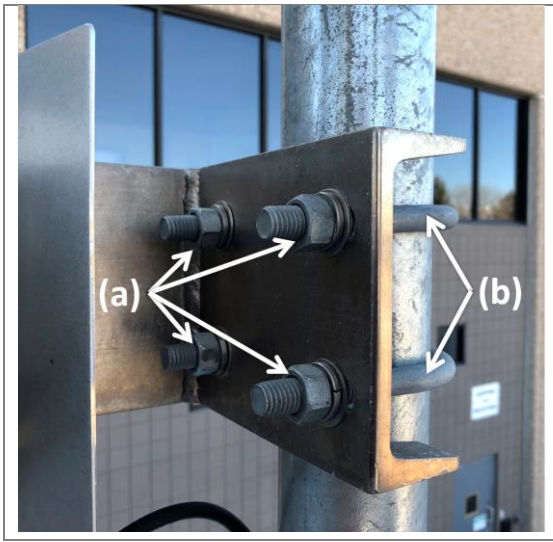
		Part #	Description
	a)	0317600000	Standoff M/F ½” Hex X ½” ¼-20 SS
	b)	0390160005	Screw Socket Head ¼-20 SS .5”
		0305200000	Washer Split Lock .25” ID X .49” OD ¼ SS
	c)	0390160005	Screw Socket Head ¼-20 SS .5”
		0306870000	Washer Tooth Internal Lock .25 ID X .48 OD ¼” SS
	d)	0318440000	Standoff ½” Hex M/F ¼-20 4” Long Aluminum

Table 5. Alternate view of the TIS Mounting Hardware with part numbers and descriptions.



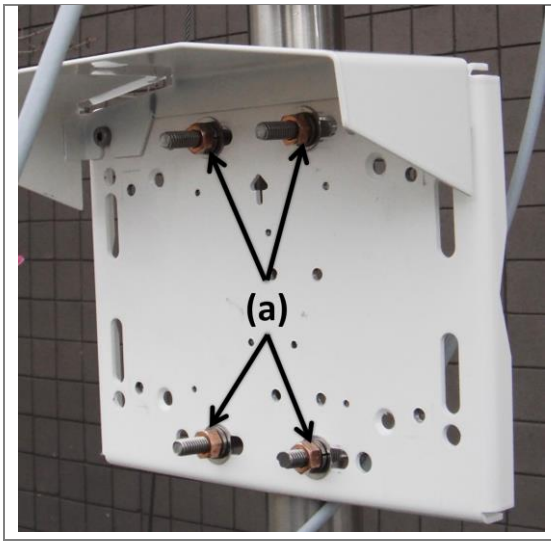
	Part #	Description
a)	0390160005	Screw Socket Head ¼-20 SS .5”
	0305200000	Washer Split Lock .25” ID X .49” OD ¼ SS
b)	0318440000	Standoff ½” Hex M/F ¼-20 4” Long Aluminum
c)	0390160005	Screw Socket Head ¼-20 SS .5”
	0305200000	Washer Split Lock .25” ID X .49” OD ¼ SS
d)	0390160005	Screw Socket Head ¼-20 SS .5”
	0306870000	Washer Tooth Internal Lock .25 ID X .48 OD ¼” SS
e)	0390160005	Screw Socket Head ¼-20 SS .5”
	0305200000	Washer Split Lock .25” ID X .49” OD ¼ SS
f)	0307150000	Nut hex ¼-20 Machine SS
	0305200000	Washer Split Lock .25” ID X .49” OD ¼ SS

Table 6. TIS Mounting Hardware with part numbers and descriptions for the mounting assembly.



	Part #	Description
a)	0306120000	U-Bolt Round 3” ID x 4.5” L ½-13 Galvanized
	0309480001	Washer Flat .531 ID X 1.0 OD ½” SS
	0306350000	Washer Split Lock 05” ID X .87” OS ½” SS
b)	0306120000	U-Bolt Round 3” ID x 4.5” L ½-13 Galvanized

Table 7. Aquatic Met Station Rain Shield and Pole Mounting Hardware with part numbers and descriptions**.**



	Part #	Description
a)	0344640000	U-Bolt, Round, 2” ID X 2-$^{11}/_{16}$” L, $^{5}/_{16}$-18, SS
	0306750000	Washer Split Lock .32 ID X .59 OD # $^{5}/_{16}$" SS
	0306630000	Washer Flat .344 ID X .75 OD # $^{5}/_{16}$" SS

NOTE: Mounting of the Barometric Pressure Sensor to the rainguard uses the same hardware listed in **Table** 4 *(b) and (c).*

5.5 Maintenance Procedure

5.5.1 Check LED Indicator

The LED Indicator is continuously lit under normal operating conditions.

Step 1. Visually inspect the LED Indicator

a) **On** – Normal operation
b) **Off** – Possible power issue.
c) **Blinking** – Error mode. Submit a trouble ticket.

5.5.2 Inspect and clean the $^{1}/_{8}$” Pressure Inlet Port

The $^{1}/_{8}$” Pressure Inlet Port should be clear of obstructions of blockages.

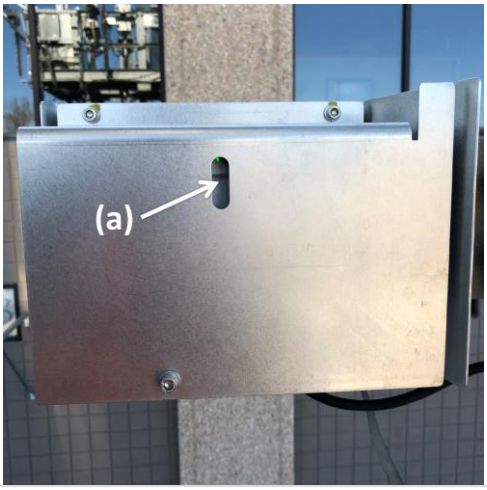
Step 1. Visually inspect the $^{1}/_{8}$" Pressure Inlet Port for any debris or blockage.

a) Remove any debris or insect nests that may have accumulated around the Pressure Inlet Port.

NOTE: Do not use compressed air, or spray any liquids or cleansers into the port. Damage to the internal pressure sensor will occur

5.5.3 Inspect and Clean Exterior Surfaces

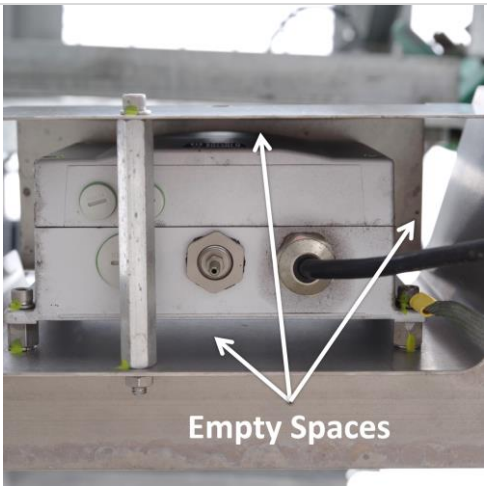
The exterior surfaces of the sun shields, and the sensor enclosure should be clear of debris, as outlined in Section 5.2 Preventive Maintenance Schedule.



Step 1. (TIS Only) Visually inspect the sun shield and view port.

a) Use a cotton swab to keep the view port clear.
b) Remove any debris or insect nests that may have accumulated on the sun shield.

Step 2. (TIS Only) Using a multi-surface cleaner and a lint-free cloth or microfiber towel, clean the outside of the sun shield.



Step 3. (TIS Only) Visually inspect the space between the sun shields and the sensor enclosure for any debris or insect nests.

a) Remove any other debris that may have accumulated in these empty spaces.

Step 4. (TIS Only) Using a $^{3}/_{16}$" Allen key, loosen the three screws holding on the front sun shield.

	**Step 5.** Using a multi-surface cleaner and a lint-free cloth or microfiber towel, clean the outside of the Barometric Pressure Sensor.
	**Step 6.** (TIS Only) Replace the sun shield and tighten the screws.

5.5.4 Specific Conditions Cleaning Procedures (SCCP)

5.5.4.1 SCCP – Winterization

There are no specific preventive maintenance procedures for winterization. This unit should operate throughout the winter.

5.5.4.2 SCCP – Severe Storms/Hurricanes

In anticipation of severe storms or hurricanes it is determined necessary to remove sensors from the TIS Towers or AIS Met Stations, remove the Barometric Pressure Sensor. Reference RD [15], Site Flora and Fauna Maintenance Plan.

5.5.4.3 SCCP – Rain

The Barometric Pressure Sensor will operate normally under this condition.

1. Follow standard preventive maintenance procedures.

There are no specific preventive maintenance procedures for rain or other wet deposition or precipitation events. This unit should operate normally under these conditions.

5.5.4.4 SCCP – Dew, Fog, Mist

The Barometric Pressure Sensor will operate normally under this condition.

1. Follow standard preventive maintenance procedures.

5.5.4.5 SCCP - Frost

The Barometric Pressure Sensor will operate normally under this condition.

1. Follow standard preventive maintenance procedures.

5.5.4.6 SCCP – Snow

The Barometric Pressure Sensor will operate normally under this condition.

1. First attempt to remove excess snow with a soft bristle brush and a back and forth sweeping motion.
2. Follow standard preventive maintenance procedures.

5.5.4.7 SCCP – Ice

The Barometric Pressure Sensor will operate normally under this condition. Ice may accumulate on the housing and mounting assembly. The thickness of the ice is OK as long as it does not completely block the pressure inlet portUnder severe icing conditions, ice may accumulate and completely block the $^{1}/_{8}$" Barbed Pressure Inlet Port. In the case of ice blockage, conduct the following procedure.

1. Place a catch basin, or towel underneath the Barometric Pressure Sensor to catch any overflow.
2. Using a spray or squirt bottle, apply 95% ethanol on to the external areas with ice. Allow the ethanol to melt the ice.
    a. Repeat as necessary until ice is removed on the external surface of the barbed inlet port. Do not spray anything into the inlet port itself.
3. Saturate a cotton swab with 95% ethanol.
    a. Place the saturated cotton swab over the inlet port. Allow the ethanol to melt the ice.
        i. Repeat as necessary until ice is removed.

4. Follow standard preventive maintenance procedures.

5.5.4.8 SCCP - Salt Deposits

The Barometric Pressure Sensor will operate normally under this condition.

Salt deposits can accumulate on the Barometric Pressure Sensor surfaces. These deposits can be seen as a thin white film or white spots or accumulations. The cleaning procedure in Section 5.5.3 should remove light salt deposits, though heavier buildup may require the use of a solvent (e.g. 0.1 M acetic acid) to dissolve the deposits.

1. Follow the cleaning procedure in Section 5.5.3.
2. If the salt deposits remain, or are caked on, use of 0.1 M acetic acid may be required.
    a. Place a catch basin, or towel underneath the AAT to catch any overflow.
    b. Using a spray or squirt bottle, apply 0.1M acetic acid on to the areas with salt deposits. Allow the acetic acid to dissolve the salt deposits.
        i. Gentle scrubbing motion with a lint-free cloth, microfiber towel, or cotton swab may be used to help facilitate salt deposit removal.
    c. Repeat as necessary until salt deposits are removed.
3. Follow the cleaning procedure in Section 5.5.3.

5.5.4.9 SCCP - Insect Nests

The Barometric Pressure Sensor will operate normally under this condition. However, spiders or other insects may form nests on, in, or around the $^{1}/_{8}$" Barbed Pressure Inlet Port, and may block or obscure the air intake. Consult with the NEON Safety Office in the event the issue is out of the ordinary from procedures addressed in AD [01]/Site-specific EHS plans.

1. Use a brush or cotton swab (depending on nest size) to remove any insect nests or spider webbing on, in, or around any part of the Barometric Pressure Sensor.
2. Follow the cleaning procedure in Section 5.5.3.

5.5.4.10 SCCP - Bird and Other Droppings

The Barometric Pressure Sensor will operate normally under this condition. However, it would be to your benefit to clean the unit of bird or other droppings as allowing it to cake on will just make your life much worse when it comes to decontaminate it for sensor refresh.

1. Place small container or catch basin underneath the sensor to catch any excess liquid runoff.

2. Using a spray or squirt bottle, apply multi-surface cleaner to the areas with bird droppings, allowing it to "soak in" and loosen the debris.

3. Continue spraying with distilled or DI water, attempting to loosen and remove the debris with the water.

4. If droppings remain, use a cotton swab or microfiber towel to aid in loosening and removing the debris. Use only gentle pressure and continue spraying with water.

    - The liquid should be allowed to do the cleaning, not mechanical force.

5. Once the debris is removed, follow the cleaning procedure in Section 5.5.3.

5.5.4.11 SCCP – Wildlife

The Barometric Pressure Sensor will operate normally under this condition. However, the flat surface of the sun shield may attract wildlife, particularly birds and lizards, and sometimes even snakes.

1. Use common sense on whether it would be safe, easy, and/or appropriate to try to ward off any wildlife on the Barometric Pressure Sensor.

2. Consult with local agencies and authorities regarding nesting birds.

5.5.5 Cables and Connectors

The cables and connectors should be intact without any breaks or cracks, and the cables should be securely fastened to the support arm.

1. Visually inspect cables and connectors for damage from the elements (sun, wind, water), animals, and insects.

    a. Replace missing, broken, or brittle cable ties.

5.5.6 Mounting Nuts and Bolts

The mounting nuts and bolts should be clean of corrosion that would prevent easy removal of the radiation shield or component sections.

1. Visually inspect nuts and bolts.

    a. If light corrosion is present

        i. Clean with a small wire brush.

    b. If heavy corrosion is present,

        i. Clean with a small wire brush

ii. Remove the nut or bolt.

iii. Apply the appropriate anti-seize compound (see **Table 2**) to the threads, and replace the nut or bolt.

6 REMOVAL AND REPLACEMENT (SUBSYSTEM ONLY)

6.1 Equipment

Table 8 contains a list of equipment to conduct sensor refresh at TIS and AIS sites for specific instrumentation and/or subsystem components that require calibrations and validations. This also includes unique equipment necessary for removal and replacement procedures. Equipment recommendations and applicability may adjust over time as the implementation of NEON sensors and subsystems mature.

Table 8. Removal and Replacement Equipment List.

P/N	MX/NEON	Description	Quantity
Tools			
4620	MX103120	3M Antistatic Wristband (ESD Requirement)	1
NEON, IT		NEON Laptop (for AIS only to connect to Aquatics Portal)	1
GENERIC		Ethernet Cable (for AIS only to connect to Aquatics Portal)	1
GENERIC		3/16” Allen Wrench (to remove mounts to Grapes/Sensors on	1
GENERIC		Hex Wrench Set (with Torx Bits – optional) (to remove sensor)	1
GENERIC		Phillips-Head Screwdriver (to Access Power Box Breakers)	1
Safety		Site-Specific PPE	A/R
Safety		LOTO Equipment (required over 50 Volts)	A/R
GENERIC		Flush cutters/Scissors (to remove zip ties)	1
Consumable Items			
3M	*See below*	ESD Bags for Sensor Refresh	1
	MX105865	3M Bag, ESD Shielded, 8 inch x 11 inch, Cushioned	A/R
	MX105931	3M Bag, ESD, Static Shield, 6 x 8 Inches, Zip Closure, Non-Cushioned	A/R
	MX105864	3M Bag, ESD Shield, 6 Inch X 7 Inch, Cushioned	A/R
	MX105866	3M Bag, ESD Shielded, 14 Inch X 15 Inch Cushioned	A/R
	MX105935	3M Bag, ESD, Static, 15 x 18 Inches, Zip-Closure Top	A/R
	MX110345	3M Bag, ESD Static Shield, 12 inch x 12 inch, Zip Closure	A/R
GENERIC		Microfiber/Lint-free cloth	1-2
1HAB2	MX104219	Grainger Red Inspection Tag, Paper, Rejected, PK1000	A/R
Various	CB08180000	Kit, Grape Dust Caps	4-6
S-16061FO		ULINE Stake Flags - 2 1⁄2 x 3 1⁄2", Fluorescent Orange or Fiberglass Snow Stakes	A/R
GENERIC		Multi-colored Zip-ties or Electrical Tape (to label Heater Ports)	4 Colors
GENERIC		Black Zip-Ties (to re-dress cables post- Sensor Refresh)	1 Pack
80337	0355220000	SAF-T-LOK SAFTEZE Food/Drug Grade Anti-Seize (for AIS sites)	1

		Temperature Range: Lubricant -65 to 450°F | Anti-Seize -65°F to 2600°F[vi]	
37230		Loctite QuickStix Silver Anti-Seize LB 8060 (for TIS Infrastructure)	1
Resources			
GENERIC	MX106639	Sturdy Container and/or Backpack (Transport sensors from site location)	1
NEON		NEON Combination code (to access Aquatics Portal)	1

Note: When working on power systems, use tools with insulated handles. Always shutdown the power prior to removing or replacing any components. Never hot swap Grape connections!

6.2 Removal and Replacement Procedure

The FOPS Domain Manager is responsible for managing the removal and replacement of the sensors on site for preventive maintenance and/or sensor swaps and manages field calibration and validation of sensors, as appropriate. The NEON project Calibration, Validation and Audit Laboratory (CVAL) is responsible for the calibration and validation of select sensors and manages Domain sensor refresh (swap) schedules.

To minimize data downtime and optimize the availability of sound data, coordinate instrumentation and subsystem annual calibration, validation and preventive maintenance requirements to occur within the same timeframe. See **Table 9** for sensor refresh requirements for the sensor and subsystem infrastructure for the Barometric Pressure Sensors at TIS and AIS sites.

Table 9. Barometric Pressure Sensor Refresh Requirements.

	LOCATION		TIMEFRAME			
	CVAL	*FIELD*	*BIWEEKLY*	*ANNUAL*	*NA*	COMMENTS
Concord (24V) Grape	X			X		Employ ESD protocols.
Vaisala Barometric Pressure Sensor	X			X		Employ ESD protocols.

6.2.1 TIS Tower Removal/Replacement

Table 10 provides guidance to remove and replace a Barometric Pressure sensor from a TIS Tower. Conduct this procedure to remove/replace the sensor to conduct maintenance, protect equipment from severe weather systems or to swap calibrated sensor equipment.

[vi] SAF-T-LOK International Corporation, SAF-T-EZE FOOD/ DRUG GRADE ANTI-SEIZE Technical Data Sheet, 0355220000 Hardware in Agile accessed January 01, 2018.

Table 10. Barometric Pressure Sensor Removal/Replacement | TIS Tower.

STEP 1 | Power down the Measurement Level where the sensor resides (ML Power Box). *Reference Appendix 8.1* - How to Power Down a Tower Measurement Level (ML).

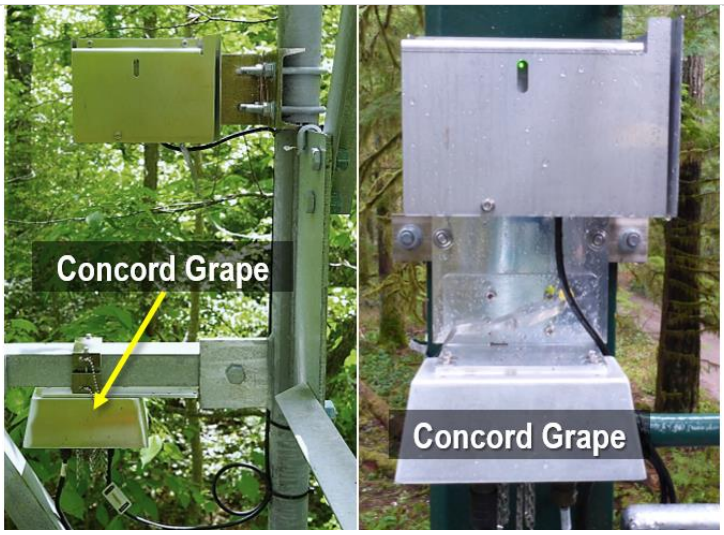


Figure 9. Subsystem - Concord Grape (24V) (D08 LENO/D16 WREF).

STEP 2 | Disconnect Eth-to-Comm (RJF) and sensor (12-10) connections from Concord (24V) Grape per AD [09]. For TIS Sites, the Grape resides below the sensor (**Figure 9**).

Cut zip ties, as appropriate.

Remove Grape for Sensor Refresh; *reference Section 6.2.4 for Grape removal guidance.*

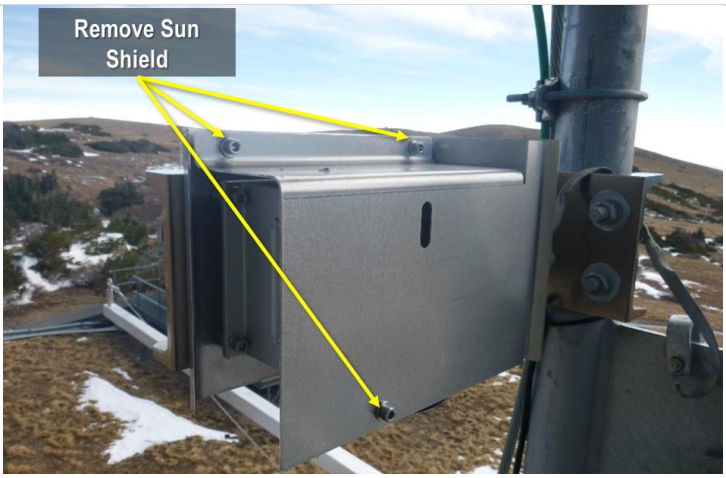


Figure 10. Remove Sun Shield (D13 NIWO).

STEP 3 | Use $^{3}/_{16}$" hex or Allen key to remove the three screws (see **Table 3**) securing the Sun Shield (**Figure 10**). The removal process is the same for D16 WREF TIS tower.

Note: Reference RD [14] for additional guidance on the assembly of this sensor with mount for the tower.

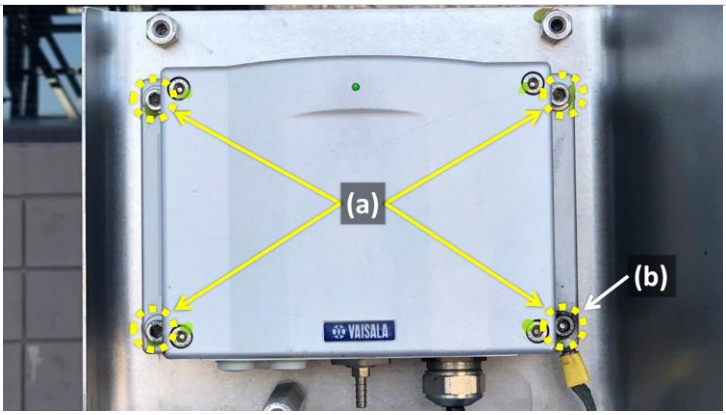


Figure 11. Remove Sensor (D13 NIWO).

STEP 4 | Use $^{3}/_{16}$" hex or Allen key and remove the four screws (a) securing the sensor to the mount plate (**Figure 11**).

Removing this screw (b) will disconnect the ground strap from the assembly.

STEP 5 | Reinstall "refreshed" sensor and secure mounting plate with the same four screws that were removed in the previous step. Ensure the grounding strap is reconnected/secured to the hardware during the reinstallation.

STEP 6 | Reinstall the sun shield.

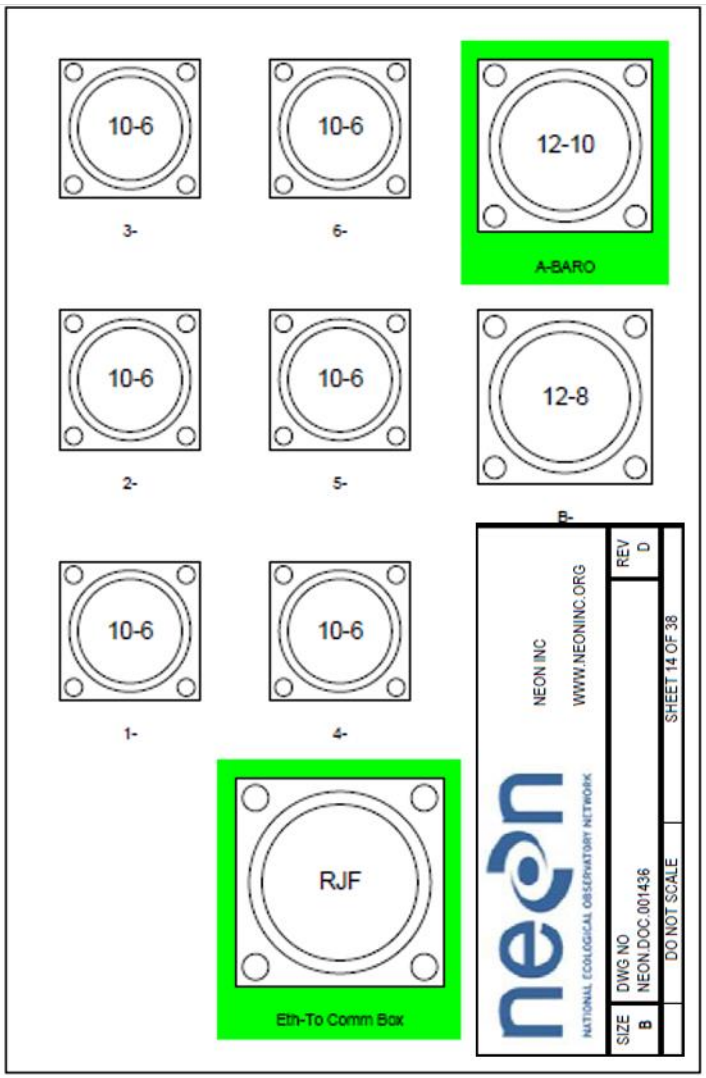


Figure 12. "Grape Tower Baro" Port Mapping (Source: AD [09]).

STEP 7 | Connect sensor (12-10) and Eth-to-Comm (RJF) connections to Concord (24V) Grape in accordance with **Figure 12** per AD [09].

Remove Grape for Sensor Refresh; *reference Section 6.2.4 for Grape removal guidance.*

Note: AD [09] supersedes Figure 12 in the event the TIS Grape Mapping Interconnect is updated for these assemblies.

STEP 8 | Per RD [11], dress the cable down the tower leg, then in the 45° angle iron toward the comm box at the base of the tower. Use zip ties to make a loop below the comm box to control the excess cable length and serve as a drip loop.

STEP 9 | Reapply power to the Measurement Level power box. Verify LED status indicator on sensor lights up when power is restored to the Tower ML.

6.2.2 AIS Aquatic Met Station Removal/Replacement

Table 11 provides guidance to remove and replace a Barometric Pressure sensor from an AIS Aquatic Met Station. Conduct this procedure to remove/replace the sensor to conduct maintenance, protect equipment from severe weather systems or to swap calibrated sensor equipment.

Table 11. Barometric Pressure Sensor Removal/Replacement | Aquatic Met Station.

STEP 1 | Power down the Aquatic Met Station via its power box. *Reference Appendix 8.2 How to Power Down an Aquatic Met Station.*

Figure 13. Subsystem - Concord Grape (24V) (D03 FLNT).

STEP 2 | Disconnect Eth-to-Comm (RJF) and sensor (12-10) connections from Concord (24V) Grape per AD [10]. The Barometer Pressure sensor shares a Concord Grape with the HMP-155 sensor (**Figure 13**).

Cut zip ties, as appropriate.

Remove Grape for Sensor Refresh; *reference Section 6.2.4 for Grape removal guidance.*

STEP 3 | Use a $^{3}/_{16}$" hex or Allen key to remove four hex screws securing sensor to mounting plate (**Figure 14**).

Figure 14. Remove the 4 Screws Securing the Sensor to the Mounting Plate on the Aquatic Met Station (D03 FLNT).

Figure 15. Pole Mount Plate with U-bolts (Source: RD [08]).

STEP 4 | For the Aquatic Met Station, the sensor mounts to the infrastructure using a pole mount with two U-bolts and rain shield (**Figure 15**).

*See also **Table 7** for mounting hardware and part numbers.*

Figure 16. Install Sensor onto Mount Plate (Source: D03 FLNT).

STEP 5 | Per RD [08], reinstall the "refreshed" sensor onto the mount plate with four hex screws and lock washers using a $^{3}/_{16}$" hex or Allen key to 22 in-lb.

Reconnect the grounding cable per **Figure 16**.

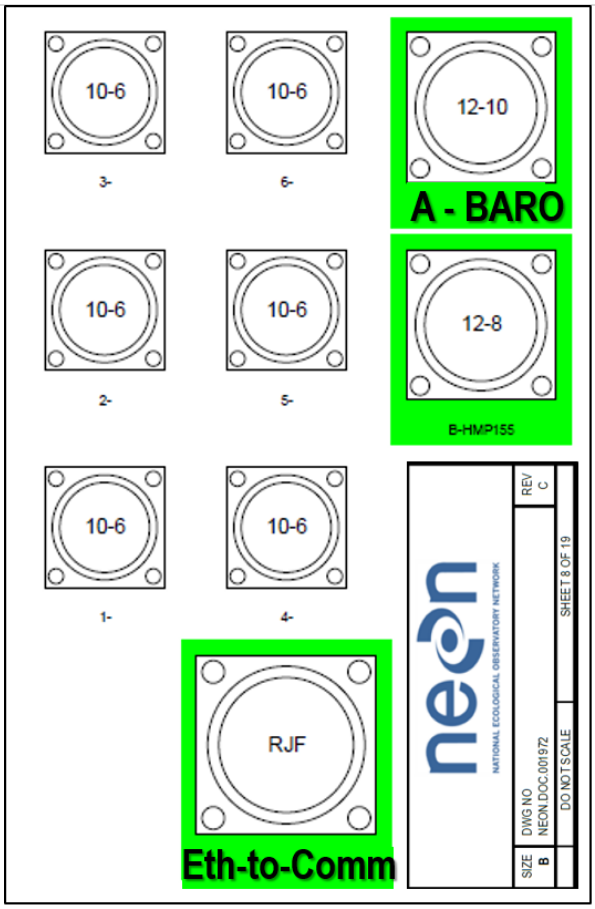


Figure 17. Grape Met Baro (Source: AD [10]).

STEP 6 | Connect Eth-to-Comm (RJF) and sensor (12-10) connections from Concord (24V) Grape per AD [10]. Cut zip ties, as appropriate.

Remove Grape for Sensor Refresh; *reference Section 6.2.4 for Grape removal guidance.*

Note: AD [10] supersedes **Figure 17** *in the event the TIS Grape Mapping Interconnect is updated for these assemblies.*

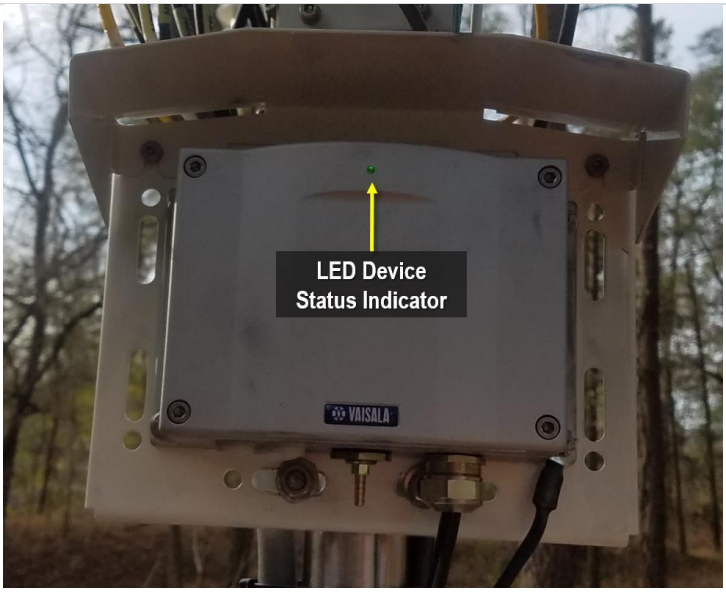


Figure 18. LED Status Indicator (D03 FLNT).

STEP 7 | Restore power to the Aquatic Met Station. *Reference Appendix 8.2 How to Power Down an Aquatic Met Station.*

Check LED on sensor to verify it lights up (**Figure 18**).

6.2.3 AIS Buoy Removal/Replacement

Table 12 provides guidance to remove and replace a Barometric Pressure sensor from an AIS Buoy.

Table 12. Barometric Pressure Sensor Removal/Replacement | AIS Buoy.

Figure 19. Unlatch to Remove Fiberglass T-Frame Covers (D09 PRPO).

STEP 1 | Unlatch (**Figure 19**) and slide off the T-Frame cover where the Profiler Canister resides. ***The handles for the fiberglass T-Frame cover are not for lifting purposes; they guide the housing on and off the track.***

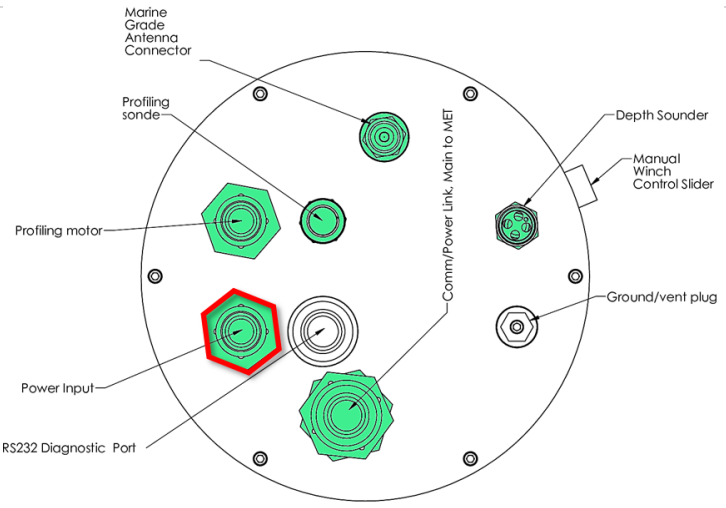


Figure 20. Profile Canister Port Mapping (Source: AD [10]).

STEP 2 | For annual Sensor Refresh, Power down the buoy by disconnecting the bolts from the battery or unplug the Power Input cord from the profiler canister. (Power Input port is in red in **Figure 20**)

Reference AD [10] for the complete AIS Buoy Canister port mapping.

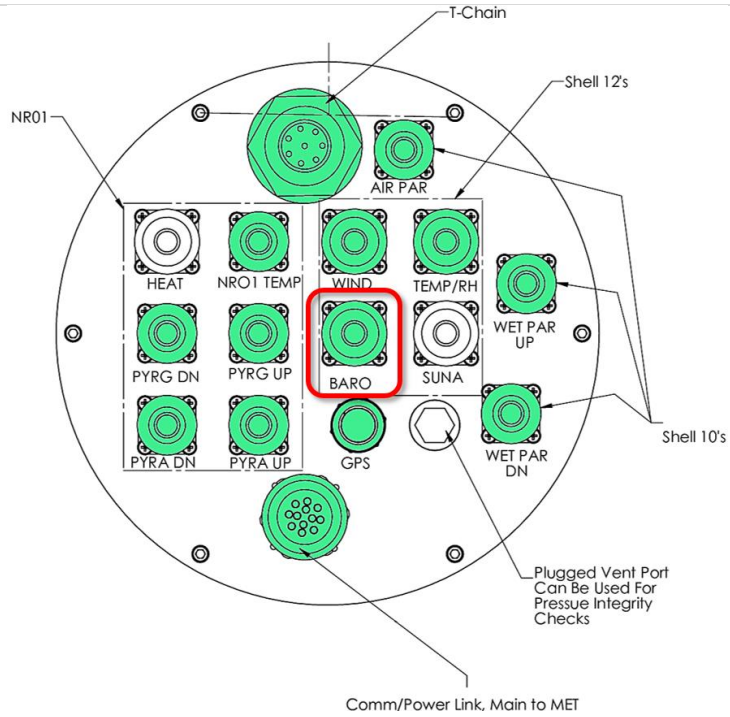


Figure 21. Met Canister Port Mapping (Source: AD [10]).

STEP 3 | Disconnect Barometric Pressure sensor power cord from Met Canister. **Figure 21** identifies the port in red.

Reference AD [10] for the complete AIS Buoy Canister port mapping.

Note: Grapes are not part of the AIS Buoy sensor assemblies. Power derives from an onboard DC system (solar and battery combo) created by YSI, Inc.

Figure 22. Remove Sensor via Mounting Hardware.

STEP 4 | Use a nut driver to remove the four nuts securing the sensor to the mounting plate.

Figure 22 one of the four nuts requiring removal to remove sensor from mount plate.

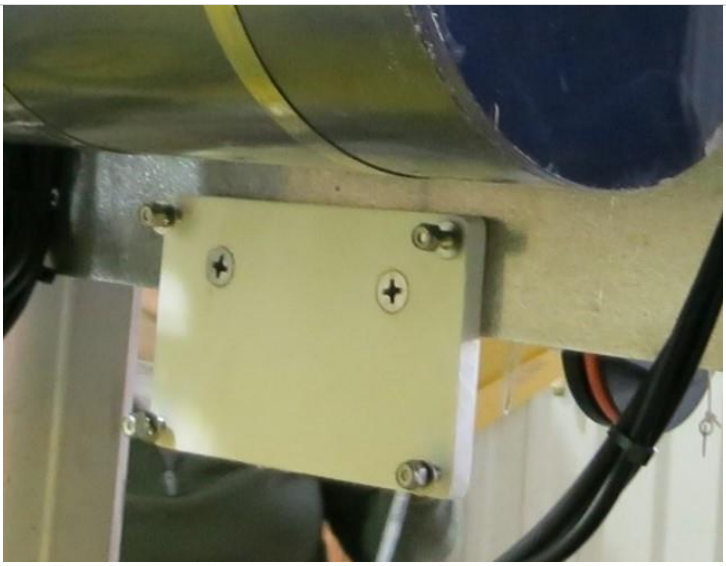


Figure 23. Mount with Mounting Hardware (D09 PRPO).

STEP 5 | The hardware remains with the mount plate when the sensor is not present (**Figure 23**).

Note: Only the nuts come off. This mount does not require lock washers.

Figure 24. Reinstall Sensor on AIS Buoy (D09 PRLA).

STEP 6 | Reinstall the "refreshed" sensor. Use a nut driver and secure the Barometric Pressure sensor to the mount plate by threading on the four nuts (**Figure 24**).

Note: When reinstalling, verify height is within 1.5cm of Site As-Built documentation (four studs on the wall of the T-Frame guarantees accurate reinstallation) per RD [12].

STEP 7 | Connect Barometric Pressure sensor power cord to Met Canister. **Figure 21** identifies the port in red above. *Reference AD [10] for the complete AIS Buoy Canister port mapping.* Check LED status indicator on Vaisala Barometric Pressure sensor to see if it lights up after restoring power to the sensor/AIS Buoy.

STEP 8 | Guide the T-frame cover over the tracks to close it and secure it via its latches.

6.2.4 Grape Removal/Replacement Procedure

1. Employ ESD protocols when handling Grapes. Reference RD [04].
2. Power down the site at the TIS Tower ML or AIS Device Post.
    a. *Reference Appendix 8.1* - How to Power Down a Tower Measurement Level (ML)

b. *Reference Appendix 8.2 - How to Power Down an Aquatic Met Station.*

3. On the Grape, disconnect the armored Ethernet cable connecting to the RJF/Eth to Comm connection.

4. Disconnect sensor connection(s).

5. Remove the Concord (24V) Grape from Grape Shield. Remove the four screws that affix the Grape to the Grape Shield using a hex wrench. If there is a need to remove the Grape Shield(s) from the Aquatic Met Station, remove the Grape Shield Unistrut mount/clamp using a $^{3}/_{16}$" hex wrench.

PRO TIP: It is easier to reinstall the Grape in the Grape Sheild when the mount is removed from the infrastructure.

6. Install dust caps on open Amphenol connectors of old Grape.

7. Reinstall new Grape to the Grape Shield by threading the four screws that affix the Grape to the Grape Shield using a hex wrench.

8. Remove dust caps on sensor connectors and Eth-To-Comm connector. Re-connect sensor and armored Ethernet cable in accordance with AD [09] or AD [10].

9. Re-energize site power.

    a. Reconnect heater ports, first. Ensure they connect to the correct ports per AD [09] or AD [10]. These port connections must be in accordance with AD [09] for TIS sites and AD [1] for AIS sites for Location Controller (LC) Command and Control (CnC) programming.

    b. Apply site power from the AIS Device Post power box breakers or TIS tower ML power box breakers.

10. Re-energize the site and verify Grape function. Connect locally to verify function: Use the LC in the Instrument Hut at TIS sites or the Aquatics Portal Power over Ethernet (PoE) Switch with a laptop and Ethernet cable at AIS sites. Use a Terminal Emulator Program (TEP), such as PuTTY or MobaXterm, to execute the commands in **Table 13**.

PuTTy Login Username: **user** | Password: **resuresu**

Table 13. Grape Verification TEP Commands (PuTTY).

TEP Commands	Description
`vd | grep 7CE0440015FD`	This displays the data from the grape (**grep**) with the MAC Address (e.g., using "7CE0440015FD"). Enter either in decimal or hexadecimal format. Use "**grep –i**" to ignore case.

TEP Commands	Description
`vd -s [sensor eeprom id]`	To view data from a sensor. For example "root@D23-HQTW-LC1:~# vd -s 3171982"
`vd -s [sensor eeprom id] -r [stream number]`	To view data from a sensor and specific data stream.

6.3 Cleaning & Packaging of Returned Sensor

Field Operations staff clean, package, and ship the sensors back to the CVAL at the NEON project HQ (Battelle Ecology) for annual sensor swap/calibration requirements. For this procedure, the items requiring CVAL calibration are the Concord (24V) Grape and the Barometric Pressure sensor. Reference **Table 8** for the equipment, tools and consumables necessary for conducting the NEON HQ, CVAL Sensor Refresh procedures.

As a reminder, please maintain ESD (antistatic) packaging and handling during inter- and intra-site transport, reception, and storage of Grapes.

Note: if the Barometric Pressure Sensor is defective, submit a trouble ticket and affix a red tag with the trouble ticket number on it. See Section 7 for additional guidance).

Please conduct decontamination (see AD [05]) on the sensors/subsystems returning to NEON HQ.

For the cleaning and packaging of Grapes and Sensors post-removal, conduct the following steps:

1. Check mounting holes for spiders and spider webs. Remove biologics and carefully clean connectors with a lint-free cloth.

2. Cap cables/connectors, as applicable, on each device. Cap all Amphenol connectors on the Grape.

3. Conduct decontamination on the exterior per AD [05]. Remove any additional biologics from the devices.

4. Place each device (**Figure 25**) in an ESD bag and shipping container.

5. Update asset records via the NEON's project Asset Management and Logistic Tracking System (e.g., MAXIMO). NEON HQ, Logistics Warehouse (LOGWAR) receives the Grapes for refresh and distributes to CVAL.

Figure 25. Use ESD Packaging to Return Sensor to CVAL Post-Decontamination.

Note: In general, to minimize errors for CI, all devices leaving a CFGLOC must move to SITE first, then TRANSIT/DxxSUPPORT.

6. Provide an electronic packing list to CVAL with the Box number and Asset Tag number (14-digit Property Tag ID ("Property of") number) of each item. CVAL uses this information to verify items via LOGWAR/general HQ distribution of shipments.

7. Prepare a Bill of Lading.

Note: For any Non-CVAL initiated sensor returns, please notify CVAL of the return.

Package sensor items via original packaging, as requested or outlined via the Issue Management System and return to the NEON project HQ using the following address:

BATTELLE ECOLOGY, **ATTN: CVAL**
1685 38TH STREET, SUITE 100
BOULDER, CO 80301

Only include sensors/subsystems for refresh. Additional equipment must ship separately as they may require attention from other NEON HQ departments. Sensor refresh shipments go direct to CVAL. If sensors are shipping to HQ to address a trouble ticket, per guidance via the Issue Management System, return to the NEON project HQ using the following address:

BATTELLE ECOLOGY, **ATTN: REPAIR LAB**
1685 38TH STREET, SUITE 100

BOULDER, CO 80301

6.4 Sensor Refresh Record Management of Assets

In addition to the physical movement of devices, the sensor refresh process requires dedicated and accurate record management of asset movement and location.

6.4.1 NEON Asset Management and Logistic Tracking System Requirements

Technicians must update the instrumentation records via the NEON's project Asset Management and Logistic Tracking System (MAXIMO). NEON HQ must maintain accurate record keeping on the location, date, and time offline of an instrument to ensure NEON HQ, Computer Infrastructure, Data Products, and CVAL are aware to apply the correct algorithms, calibrations, and processing factors. Ensure the CFG location reflects the current site of the sensor. All devices leaving a CFGLOC must move to SITE first, then TRANSIT/DxxSUPPORT.

7 ISSUE REPORTING OUTPUTS

FOPS must report issues encountered while conducting preventive maintenance in the NEON project Issue Management/Reporting System. To ensure a quick response and remedy to an issue, please include as much information and detail, as possible. This includes, but is not limited, to the following:

- Domain and Site name
- Date and Time
- Technician Full Name
- Issue Narrative (detailed narrative of the issue, specific location of issue on tower infrastructure, relevant 2nd/3rd order effects to infrastructure, possible cause [e.g., weather event, obstruction, human activity])
- Multiple Photographs (to capture vantage points/perspectives for remote diagnostic)
- Provide Part Number/Manufacturer Information, EPROM ID, Asset Tags, IP Address, MAC Address, etc.
- Provide Diagnostic Information (from firmware, if applicable), such as error codes, values, etc. Provide screenshots.

Table 14. Metadata Output Checklist.

Issue Reporting Datasheet		
Datasheet field	**Entry**	
NEON Site Code		
Maintenance Date		
Maintenance Technician		
Preventive Maintenance	**Issue Noted**	**Issue Summary**
Cables & Connectors - Condition Check	☐	
Sensor - Condition Check	☐	
Sensor - Configuration Check	☐	
Sensor – Clean	☐	
Sensor - Other Specific Checks	☐	
Environmental Information	☐	
Notes		

For Barometric Pressure Sensor corrective actions, ensure proper tracking of the asset via the NEON issue management and tracking system (e.g., JIRA) to establish a chain of custody of the asset between Engineering Repair Laboratory and CVAL.

Conduct the following tasks to ensure the proper management of the asset between sites:

1. For each issue where NEON, HQ is replacing a defective instrument/subsystem at a TIS site, please create a sub-task in the NEON Issue Management and Reporting System for the defective asset from the reported issue. Resolution of an issue does not occur with the installation of a replacement, but with the root cause analysis of the issue deriving from the defective asset. FOPS may resolve the ticket upon installation of the replacement if a sub-task exists for the defective asset for NEON HQ to conduct root cause analysis[vii].

2. Ship all defective equipment/assets with a red "Rejected" tag. **Figure 26** displays the minimum information requirements for each tag.

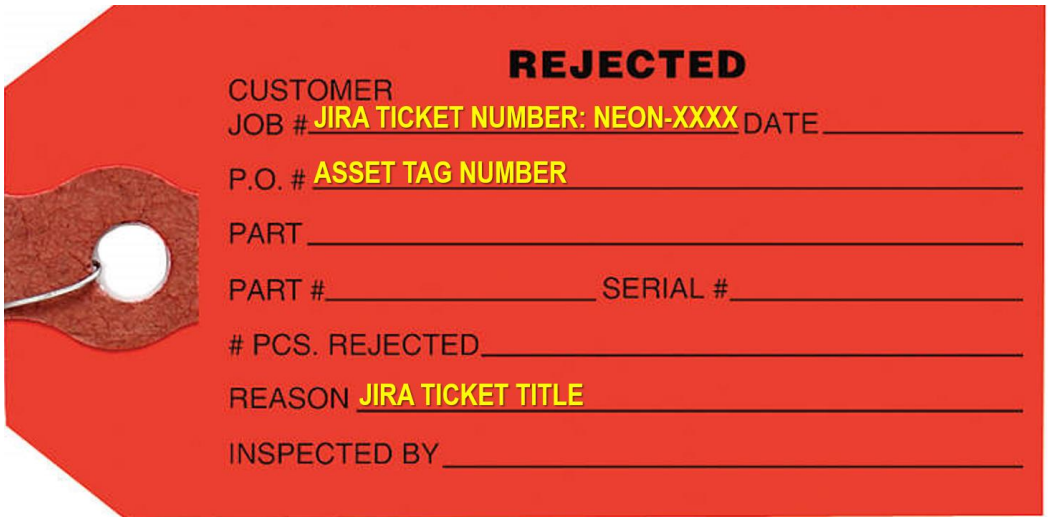


Figure 26. Red Rejected Tag for Defective Assets (MX104219).

[vii] JIRA-5848 is a good example for reference.

8 APPENDIX

8.1 How to Power Down a Tower Measurement Level (ML)

Power down the Measurement Level (ML) power box via the adjacent Communications (Comm) box providing power to tower ML.

NOTE: When working on power systems, use tools with insulated handles.

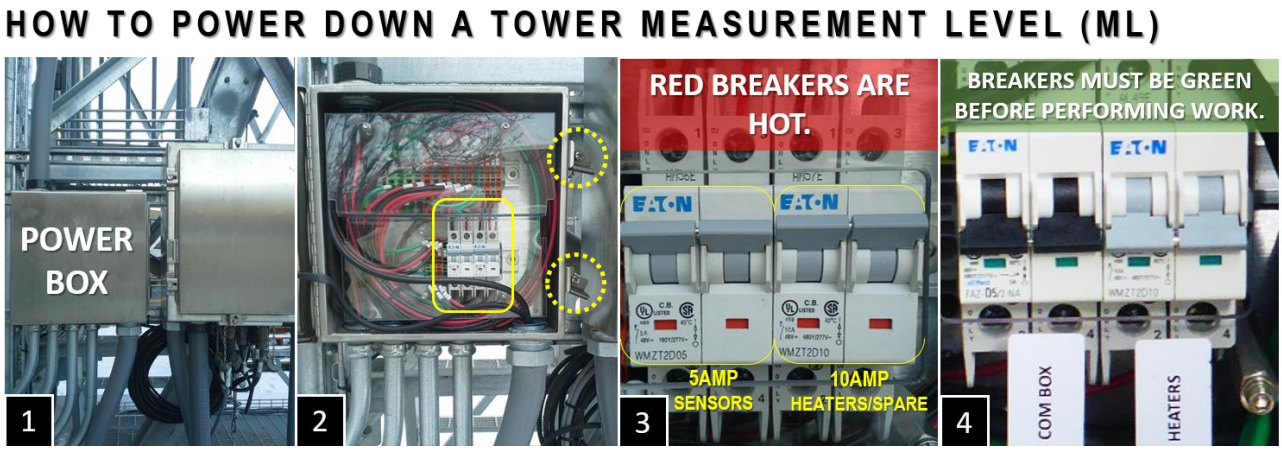


Figure 27. How to Power Down a Tower ML.

To power down a Tower ML to conduct preventive maintenance and/or to swap sensors and subsystems, conduct the following steps in accordance with **Figure 27**.

1. Locate the ML power box.

    a. ***Connections may reside on multiple levels if ports are unavailable. Please ensure this procedure occurs for all applicable power boxes for the ML.*** *For example, short towers combine ML 1 and 2 for power and communications; therefore, the sensors on ML1 connect to the Comm and power box on ML2.*

2. Open the power box using a Phillips-head screwdriver on the two clasps on the right. **Figure 27** identifies the location of the two clasps and the location of the breakers in image number 2.

3. Locate the breakers. A 5 Amp breaker is on the left and A 10 Amp breaker is on the right.

    a. The 5 Amp breaker turns the power on/off to the sensors (via their Comm box).

    b. The 10 Amp breaker turns the power on/off for sites employing heaters. If a site does not employ a heater, then it is a spare breaker.

    c. Red breakers indicate the power is ON – live voltage.

4. Flip the breakers down on the 5 Amp and the 10 Amp breakers to de-energize the ML.

    a. <u>The color on the breaker is green, signifying the power is OFF.</u>

b. If the site is unheated or Technicians are conducting maintenance on unheated sensor assemblies, proceed with the Preventive Maintenance, Sensor Refresh and/or Corrective Maintenance.

c. If Technicians are conducting maintenance on heated sensor assemblies or conducting Sensor Refresh for a heated site, Technicians must disconnect the sensor heaters at the ML Comm box in accordance with NEON Safety Office's TIS Electrical Safety Training. After disconnecting the (12-3) heater port(s), conduct LOTO procedures for equipment over 50V (such as these heaters), and proceed with the Preventive Maintenance, Sensor Refresh and/or Corrective Maintenance

Note: These heater ports are not interchangeable; FOPS must label each port to ensure they plug back into the correct port post-sensor swap. Heater port locations are critical for LC CnC Software to operate properly!

8.2 How to Power Down an Aquatic Met Station

Powering down the site enables Technicians to perform work with less hazards to themselves and to the equipment. It also mitigates requiring NEON Headquarters to conduct data quality analysis when Technicians are onsite close enough to the sensors to influence data collection. This procedure shuts down power at the Aquatic Met Station and the Groundwater Wells (GWW) data transmission, if the Grape and Base Radio for the GWWs connects to the Aquatic Met Station Comm box. This procedure allows Technicians to conduct work on the sensors on the infrastructure in the Aquatic Met Station. This does not shut down power at the GWWs. A DC system provides power to the GWW Aqua TROLL and remote radio.

1. Power down the site from the AIS Device Post power box via the breakers. Use **Figure 28** for this procedure.

    a. Open the Power Box using a Philips head screwdriver.

    b. Flip both breakers from RED to GREEN: 5 Amp Breakers for Sensors and 10 Amp Breakers for Heaters. Disregard the 10 Amp Breakers if they are spares/no-heaters present onsite.

    c. Conduct LOTO procedures (required for FOPS personnel on equipment over 50V).

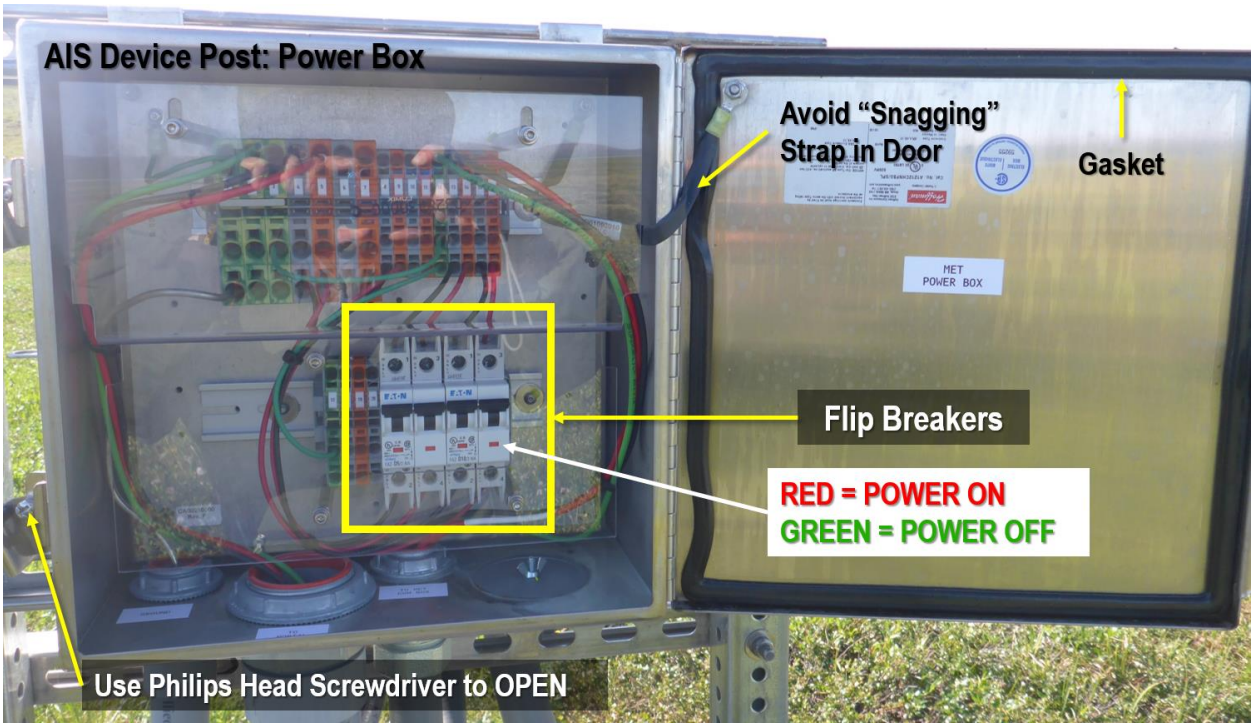


Figure 28. AIS Device Post: Power Box Components (Domain 18 OKSR AIS Aquatic Met Station).

2. **FOR HEATED SITES ONLY:** After disabling power from the Power Box, disconnect all Comm Box heater ports before servicing or replacing sensors for Sensor Refresh. *Use AD [10]to verify heater ports onsite where Comm Boxes are grouped together (i.e., sites that have the Secondary Precipitation share a Comm Box with the Aquatic Met Station).* Heater ports are the 12-3 connectors on the Comm box.

    a. The **Aquatic Met Station Comm Box** provides power to the Aspirated Air Temperature Shield (AATS) and 2D Wind heaters. The 2D wind heater port is in front of the AATS heater port in **Figure 29** per AD [10]. (*PRO TIP: The AATS cable is larger in diameter than the 2D wind cable. The 2D Wind heater transformer mounts directly to the AIS Device Post, which allows Technicians to visually verify the cable connection and port*).

Note: These heater ports are not interchangeable; FOPS must label each port to ensure they plug back into the correct port post-sensor swap. Heater port locations are critical for LC CnC Software to operate properly!

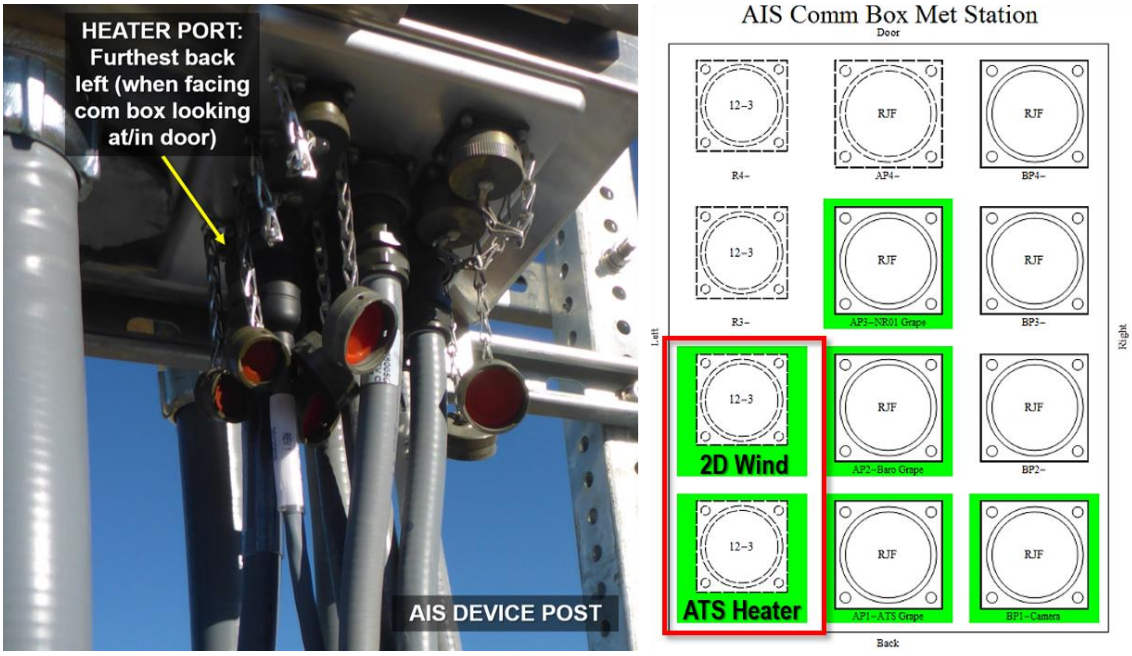


Figure 29. AIS Device Post: Comm Box Heater Ports for Aspirated Temperature Shield (ATS) and 2D Wind (Source: AD [10]).

*PRO TIP: How to tell the difference between Heater ports and Grape ports are, as follows: Heater ports consist of four 12-3 ports total onsite and use 3-pin connectors (***Figure 29***). Inside the Comm box at a TIS or AIS site, wires run directly to the ports (hardwired in the Comm box). Comm ports consist of seven or eight ports and have RJF/Ethernet connectors. Inside the Com box at TIS or AIS site, Ethernet pass-thru connectors, typically with white 1-ft Ethernet jumper cables, connect to the PoE Switch.*

If there is a need to remove a sole sensor assembly onsite, then power down the sensor assembly from its Grape. Remove the armored Ethernet cable from the Merlot or Concord Grape RJF/Eth-To-Comm connector before disconnecting or connecting sensor connections. Removing sensor connections without removing the RJF/Eth-To-Comm cable is best practice to avoid accidental hot swapping when the power is ON. *Reference AD [10] for Aquatic Met Station Grape mapping.* Follow ESD procedures in RD [04].