180426

ETX900-TSO

Manual with Instructions for Continued Airworthiness

FAA ACTION
West Certification Branch

☐ Approve ☐ Concur ☐ CFRs
☐ Reject ☒ Accept ☐ EASA CS
☐ Acknowledge ☐ CARs

TSO/Project #s: WTS Item #25-DOC-52036-07

Comments: FAA Acceptance of EarthX ETX900-TSO Manual with Instructions for Continued Airworthiness Revision G Dated 2/15/2025. The Airworthiness Limitations Section (ALS) was not changed.

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for WCB Manager JEFFREY A KISTLER Digitally signed by JEFFREY A KISTLER Date: 2025.05.01 10:52:44 -06'00'

Revision Log

Rev	Description	Date	Approved By:
New	Created New	5/12/2018	R.Nicoson/B.Olsen
A	AML STC Release	Draft	R.Nicoson
B	Incorporate FAA AEG comments.	7/31/2020	R.Nicoson FAA Approved 9/8/2020
C	Generic for all Part 23 Aircraft, Reference to SAFM/AFMS	9/11/2021	R.Nicoson/B.Olsen
D	Remove Reference to SAFM/AFMS	5/13/2022	R.Nicoson/B.Olsen
E	Revised per comments from WCB for ETX680-24-TSO STC (Ref 773-24-00018)	5/20/2024	R.Nicoson
F	Updated per AEG comments (WTS Ref. 776-24-00719)	1/3/2025	R.Nicoson
G	Updated per 2/15/2024 AEG comment	2/15/2025	R.Nicoson

ICON KEY

1. Valuable information

Caution

Warning

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Airworthiness Limitations

The Airworthiness Limitations section is FAA approved and specifies maintenance required under Secs. 43.16 and 91.403 of Title 14 of the Code of Federal Regulations unless an alternative program has been FAA approved.

There are no new (or additional) airworthiness limitations associated with this equipment and/or installation.

FAA APPROVAL:

Introduction

This manual covers the installation, inspection, maintenance (charging) and replacement aspects for the ETX900-TSO battery installed on 14 CFR Part 23 aircraft. The installation of the rechargeable lithium battery defined herein meets the guidance of AC 20-184. In accordance with Federal Aviation Administration (FAA) Advisory Circular (AC) 23.1309-1E and FAA Technical Standard Order (TSO) TSO-C179b, the Failure Condition Classification (FCC) for this TSO Battery is "Major" - unless other installations deem the analysis lessor or greater, dependent on the function(s) in the installation.

Although many internal and external safety features have been designed per TSO-C179b and AC 20-184, failure to follow all application use, installation, charging, and storage instructions may result in battery damage and could lead to fire!

Abbreviations

The following table describes the terminology used in this document.

AC	Advisory Circular / Alternating Current
Ah	Amp-Hour is a unit of measure of charge that can be stored in a battery.
AFMS	Airplane Flight Manual Supplement
AML	Approved Model List
BMS	The Battery Management System refers to the collection of electronics responsible for monitoring and protecting the battery cells.
Cell	A single encased electrochemical unit (one positive and one negative electrode) which exhibits a voltage differential across two terminals.
CFR	Code of Federal Regulations
DAL	Design Assurance Level (DAL), as defined by the RTCA
DC	Direct Current
FCC	Failure Condition Classification
GPU	Ground Power Unit
HMR	Hazardous Materials Regulations
IAW	In Accordance With
ICA	Instructions for Continued Airworthiness
LED	Light Emitting Diode
LRU	Line Replaceable Unit
OEM	Original Equipment Manufacturer
OVPD	Over-Voltage Protection Device
RTCA	Radio Technical Commission for Aeronautics
SDS	Safety Data Sheet
STC	Supplemental Type Certificate
TSO	Technical Standards Order

ICA Revisions

When a revision to the Instruction for Continued Airworthiness (ICA) is necessary, the STC holder will coordinate its approval with the FAA. Approved revisions to the ICA will be available from the documentation section of the EarthX Website: https://earthxbatteries.com/.

Description

EarthX Lithium batteries are a maintenance free replacement for the 12-volt lead-acid or lithium batteries. The battery operation is automatic (no operator control). The battery is part of the main aircraft electrical system with the alternator being the primary power source and the battery being the secondary power source; the battery function in the aircraft is unchanged. This battery includes a thermal run-away containment system. The containment system includes a vent tube designed to carry vapor or smoke to the exterior of the aircraft in the extremely improbable event of a thermal run-away condition. There are no emissions during normal operation. Both tubes exiting the battery are for outflow, and both are required. The battery can be operated at high G loads (see specification section).

Specification

Voltage	13.2 V
Capacity (1C, 1hour rate at 23 °C)	15.6Ah @ 1C rate
Peak Power (Ipp), 23/-18 °C	800 / 390 amps
Rated Power (Ipr), 23/-18 °C	600 / 365 amps
Weight	5.4lb
Maximum Altitude	25,000 Ft
Operational and Crash Safety G Load	20G

Dimensions

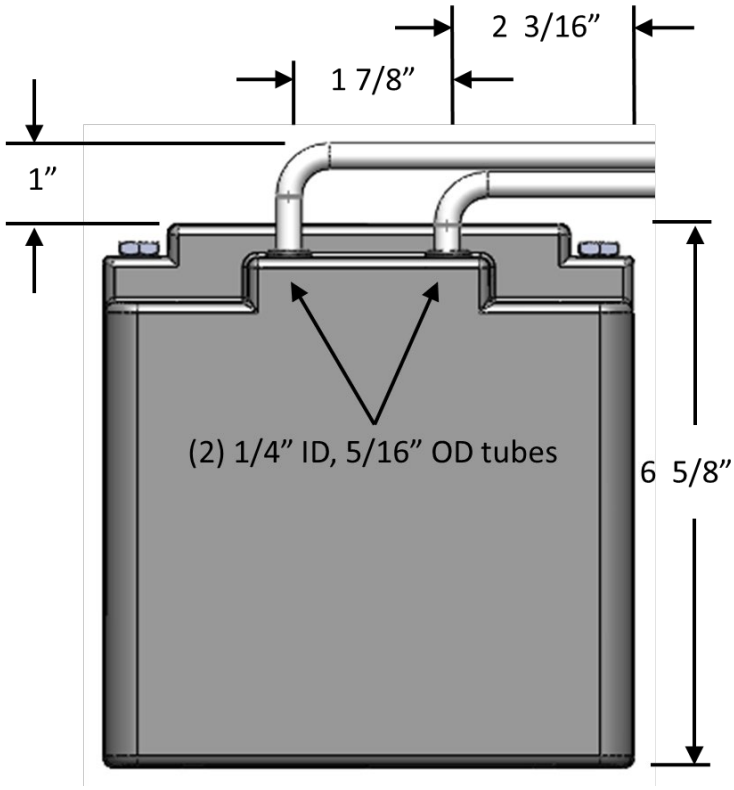


Figure 1 Battery Dimensions - Back View

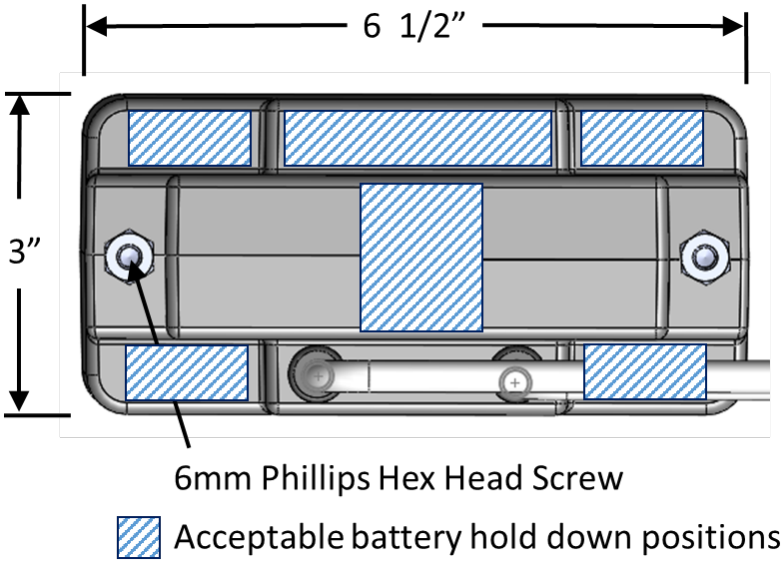


Figure 2 Battery Dimensions - Top View

Initial Installation

The initial installation of the EarthX battery requires the installation of battery vent tubing, and a Fault/Status LED in addition to the battery. See the Appendix for the aircraft specific initial installation process.

This article meets the minimum requirements of technical standard order (TSO) C179b. The article may be installed only according to 14 CFR part 43 on aircraft eligible IAW the Approved Model List for STC SA01005DE.

Installation Limitations

Automatic over-voltage protection is required on the aircraft charging system. Do not install battery if the aircraft does NOT have over-voltage protection. See the Approved Model List (AML) STC document for all limitations.

Maintenance Removal and Reinstallation

Remove all metal objects from your person before handling the battery and use insulated tools for installation.

The power terminals are ALWAYS live. Do not short across the terminals. Use caution when handling the battery inside the aircraft around metallic structures.

Battery Removal

1. Access the battery compartment.
2. Disconnect the battery cables (remove the negative cable first).
3. Remove the tie down hardware, store for reuse.
4. Note the routing and placement of wires, cables, vent tube and foam insert (if installed). A typical battery box installation with a foam insert is shown below.

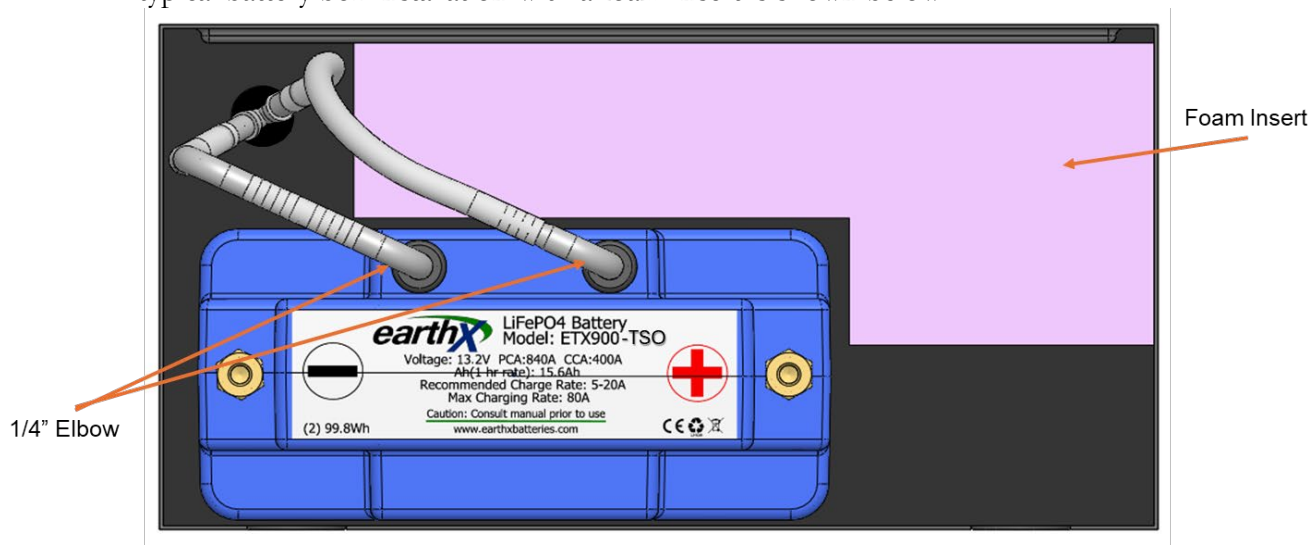


Figure 3 Battery Box Installation Example

5. Disconnect the vent tube at the battery. Remove the vent tube, by removing the vent tube "barbed" elbows from the old battery. Pull up on the elbows while making a circular motion.

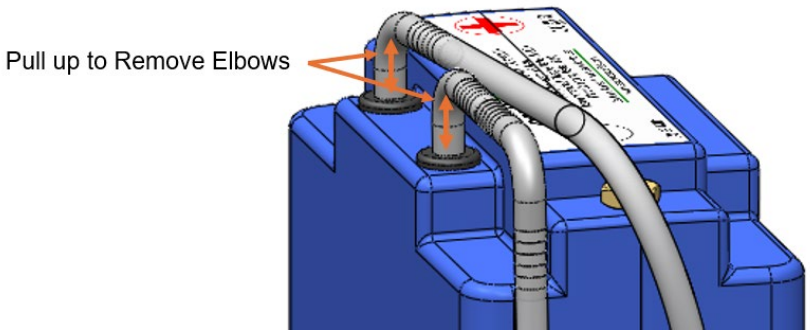


Figure 4 Vent Tube Removal

6. Disconnect the battery fault/status monitoring plug.
7. Remove the battery from the battery box or battery tray.

Battery Re-installation

It is recommended you check the voltage before installing. If the voltage is below 13.2V, charge the battery before installing. Follow these steps to install the battery (reinstallation or after service). Qualified personnel should inspect the box, connections, and venting provisions for corrosion, loose fasteners or damage. Check positive battery cable for cuts or wear marks in the insulation. Replace or repair parts as required. Refer to the Appendix for battery mounting and install kits for specific aircraft models.

1. Reinstall the battery in the battery box or battery tray.
2. Connect the positive (red) cable first. Make sure the Phillips screw is securely fastened (45in-lbs), but do not over-tighten. Next, connect the negative (black) cable. Do not connect the battery in reverse polarity (positive to negative or negative to positive).
3. Connect the existing vent tube and barbed fitting to the new battery's vent tube stubs (remove the protective caps that are installed at the factory over the vent tube stubs).
4. Reconnect the battery fault/status monitoring plug.
5. Re-install the battery hold down bracket or battery box cover and tighten securely.

Battery Vent Replacement

The vent system is made up of tubing, fittings, fasteners and grommets. Worn or permanently kinked tubing should be replaced. The tubing should also be replaced if a tube connection to a fitting is loose. See Table 1 below for replacement parts. Follow these steps to replace all or part of the battery vent as required.

1. To remove a section of tubing, cut the tube (longitudinally) at each end, at the tube fittings. Remove the section of tubing noting the route. If the tube is held by an Adel clamp, loosen the clamp and pull the tube through the clamp.
2. Cut a new piece of tubing the same exact same length as piece removed.
3. Re-install the new tubing in the same manner as the tube that was removed. The vent tube should include downward sloping and or vertical section, so condensate drains to the outside of the aircraft. The tubing minimum bend radius is 3", so elbows are required to make small radius bends. See the installation example below.

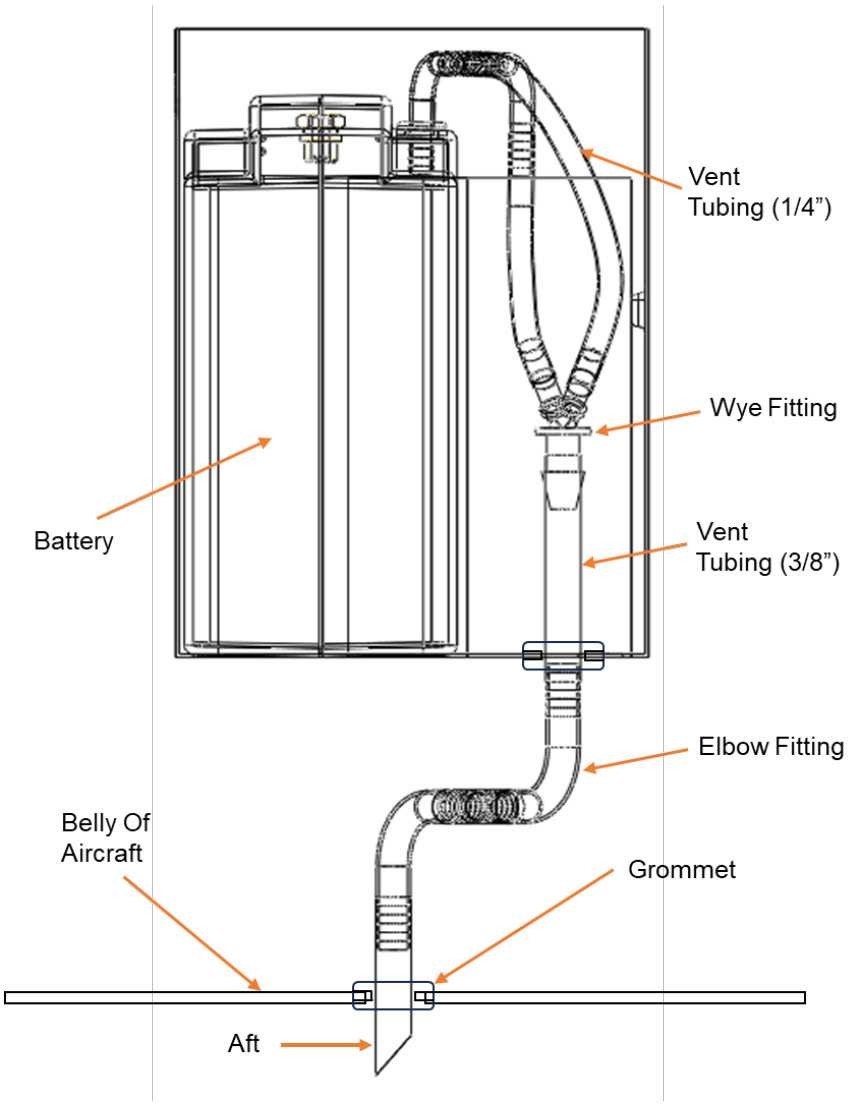


Figure 5 Firewall Forward Battery Vent Installation Example

4. If replacing the tube that exits the belly of the aircraft, leave at least 1" exposed on the outside of the aircraft and secure in place with RTV silicon. Cut the tube at an angle towards the aft of the aircraft.

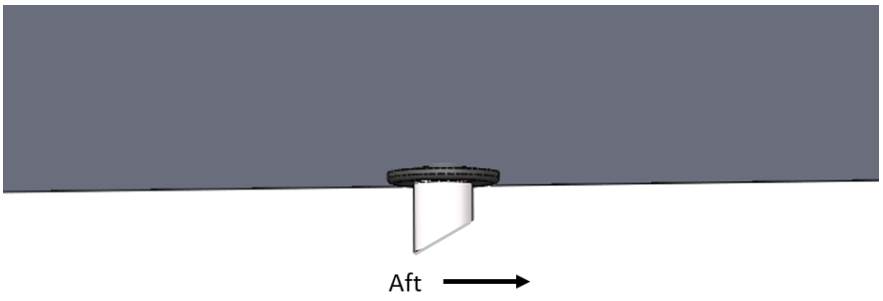


Figure 6 Fuselage Installed Battery Vent Tube Example

Part Number	Part Description
5239K13	1/4" Tubing
5239K15	3/8" Tubing
5670K17	90 Degree ¼" SS Elbows
5670K18	90 Degree 3/8" SS Elbows
5463K722	3/8" Wye Tube Fitting
L6-AL	90 Degree ¼" Close Elbows
9600K313	1/4"ID 3/8" OD, 1/16" Panel Grommet
9600K316	3/8"ID 9/16" OD, 1/16" Panel Grommet
9600K86	3/8"ID 9/16" OD, 1/8" Panel Grommet

Table 1 – Vent System Parts

Be careful not to crush or restrict flow through the tubing.

Only EarthX supplied tubing and tube fittings should be used.

Fault/Status Indicator LED Bulb or Fuse Replacement

To replace the LED bulb, remove the LED lens bezel by turning it counterclockwise, slide the bulb out of the housing, then replace it with a new bulb (12 volt, T1 3/4 Midget Flange type LED bulb).

To replace the fuse, push the ends of the fuse holder together and ¼ turn counterclockwise to open the fuse housing, then replace with a new fuse (¼ x 1 ¼", 1-amp, fast blow fuse).

Fault/Status Indicator Replacement

The installation or replacement of the EarthX Fault/Status LED Indicator (part# 11MM12) is detailed below.

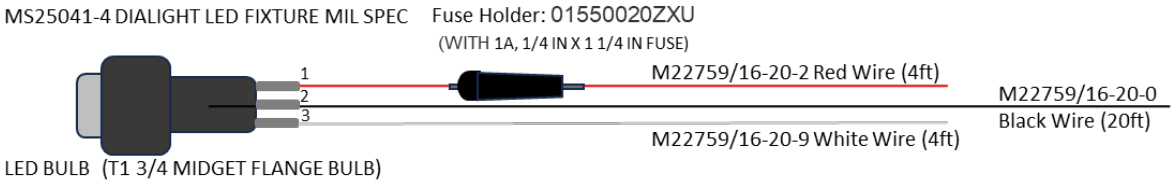


Figure 7 Fault / Status Indicator

1. Power OFF the aircraft to remove power.
2. Removed the trim panel if required.
3. Remove the LED lens bezel by turning it counterclockwise.
4. Remove the panel nut from the front of the LED housing and feed the LED housing through the hole.
5. At the LED housing, cut off the black wire.
6. Behind the instrument panel, disconnect the red wire (with inline fuse) from the circuit breaker.
7. Behind the instrument panel, disconnect the white wire from aircraft ground.

8. Secure the new Fault/Status Indicator in place on the panel in the same location as the old Fault/Status Indicator.
9. Unsolder the black wire from the new LED housing and solder the existing black to terminal 2 of the LED housing.
10. Behind the instrument panel, route the red wire (with inline fuse) to an instrument circuit breaker; crimp on (supplied) #6 ring lug to wire and secure to breaker.
11. Route the white wire to an available ground stud, crimp on (supplied) #6 ring lug and secure in place.

Return to Service Checks (Tests)

Follow these steps to check the battery operation prior to returning to service:

1. Verify the vent tube protruding from the aircraft can NOT be pushed up and into the interior of the aircraft with the force of an index finger.
2. Apply power to the aircraft via master switch, observe proper voltage, greater than 12.8V.
3. Verify the battery Fault/Status LED is off (no faults).
4. Press the LED "push-to-test lens" and observe the LED illuninates.
5. At the battery, jumper the fault/status discrete output to battery negative terminal using a test clip and verify panel LED indicator is "On".
6. Verify engine starts as normal.

Inspection

The supplemental Instructions for Continued Airworthiness (ICA) are required by 14 CFR part 23 for this Article (Part) installed on Aircraft (14 CFR 23.1529 for this application and TSO).

Battery Inspection Intervals

Battery:

Upon installation, record the next battery inspection due date based on the battery age as follows:

- 0-24 months: The battery and its mounting hardware must be inspected on or before 24 months from the installation date. Like aircraft annual maintenance, the period of 12 calendar months extends from any day of any month to the last day of the same month in the following year.
- 24+ Months: If the battery was inspected at Annual/100 hour Inspection, the due date for the next inspection is at the next Annual/100 hour inspection. If the battery was inspected at a time other than Annual/100 hour inspection, inspect the battery no later than 12 months/100 hours after the last inspection.

Charging Systems:

Annually: An annual inspection (check and/or test) is required for the voltage regulator and OVPD of the aircraft charging system for safe operation of the battery and aircraft electrical system.

Battery Inspection Instructions

The following inspections/tests shall be performed:

1) Visually inspect the battery for signs of damage; plastic case cracks, warped plastic or long side of the battery is swollen. Replace the battery if there are signs of damage.

2) Verify the battery fault/status monitoring LED is operational (not required for digital communications). To do this, use a wire jumper to connect the fault/status discrete output (which connects to the remote LED) to battery ground, and verify the LED is lit.
3) Fully charge the battery (see Battery Charging section below).
4) After fully charging the battery in the previous step, allow the battery to rest overnight (minimum of 12 hours) without any load applied to the battery. Verify the battery is "holding a charge" by confirming the voltage is greater than 13.3 volts.
5) Verify the battery capacity. A battery's current capacity as compared to its original capacity is an indication of the battery's remaining service life. A battery with greater than 80% of its original "rated" capacity is considered fit for continued service. If the battery capacity is less than 80%, then it must be replaced. Alternately, if the batteries tested capacity is capable of supporting the aircraft's emergency load for the required amount of time it is considered fit for continued service. It is recommended that the battery be replaced after 6 years of service. To test the battery capacity:

a. Fully charge the battery (see Battery Charging section below).
b. Turn on all electrical loads for flight operation and start a timer.
c. Measure and record the battery's discharge amps using a DC clamp-on current meter at the positive terminal of the battery.
d. Using the measured amps in the previous step and the battery's nameplate rated capacity (in Ah), calculate the time to discharge the battery 80%.

$$\text{Time to discharge 80\% (Hours)} = \frac{Rated\ Capacity\ in\ Ah * .8}{Measured\ Discharge\ Amps}$$

For Example, (16 Ah Rated Capacity, 5 amp measured discharge rate)

$$\text{Time to discharge 80\%} = \frac{16 * 0.8}{5} = 2.56 \text{ hours}$$

e. Terminate the test after the number of hours calculated in the previous step has expired or if the battery is over-discharged (shuts off discharge current). If the battery is still supplying power at the termination of the test, then the battery's capacity is greater than 80%. If the battery's capacity is greater than 80%, then the battery has passed the test.
f. Fully charge the battery.

6) Inspect battery cables for wear, loose terminal connectors, and terminal screws are properly secured (torque to 45in-lbs).
7) Inspect the vent tubes for blockage (plugged, pinched, or kinked) and loose connections.
8) Verify the battery box, and or battery restraint system is in good working order (no corrosion, loose fasteners, or signs of wear). Repair or replace the battery box or restraint as needed. If a foam insert is supplied, inspect the foam insert for signs of wear and that the battery movement with foam insert installed, is less than 1/8" side to side. Replace the foam insert if worn.
9) Record inspection results in the Aircraft Logbook(s).

Aircraft Charging System Inspection Instructions

The regulator and OVPD may physically be separate devices or in a single housing. Follow the regulator and/or OVPD manufacturer's ICA or maintenance instructions for periodic checks.

Maintenance

This is a maintenance free battery with no internal replaceable components. Charging is only required as needed (see Battery Charging section of this manual).

The following conditions indicate battery end-of-life, and the battery shall be replaced:

- Insufficient capacity per inspection requirements above
- Insufficient power to crank engine.
- On-going battery fault indication (refer to the "Troubleshooting" section)
- Will not hold a charge (<13.3 volts a week after charging the battery to full charge)

At battery end-of-life contact EarthX. The only approved replacement lithium battery is an EarthX battery of the same model number. The model number is displayed on the top label of the battery.

Configuration Control

The battery "Configuration Control" information is on the back side battery label (revision, TSO number, manufacturing date and serial number).

Figure 8 Battery TSO Configuration Label

Battery Charging

If at any time the aircraft will not start, or the battery seems low, or the voltage is less than 13.2 volts, charge it. To charge the battery, connect the battery charger to the battery and leave the charger "On" until the charge light is extinguished. The recommended and maximum charge rate is specified on the top label of the battery. Never exceed the maximum charging amps for your battery.

This table shows typical charging times using the Optimate series of chargers.

Charging Amps	Charging Time
5 amp (Optimate TM291/TM391)	3 hours
10 amp (Optimate TM275)	1.5 hours

Table 2 Charge Time

Lithium batteries have a very low self-discharge rate which means the battery, if disconnected from the aircraft, could "hold its charge" for over a year. However, some aircraft may have systems that use a small amount of power with the "Master switch" off. In those cases, we recommend disconnecting a battery cable from the battery during long term storage (greater than 6 months).

Only an approved battery charger shall be used, see EarthX website for compatible chargers.

If the battery has been over-discharged and "disconnected" (meaning automatic electronic disconnect commanded by the Battery Management System), the voltage at the battery terminal should be near zero volts if the battery still has a load on it. If the battery is disconnected from the load, it will automatically reconnect, and the terminal voltage should return to > 10 volts (remove the load by removing the positive or negative cables from the battery). In this case, simply connect the battery to a charger to restore charge (charge with 1-10 amps for 20-30 minutes). If the battery is holding a charge (voltage not decreasing over 10-minute period), the battery is ok to fully charge. If the battery voltage does not return to >10 volt after removing all loads, then (step 1) connect the Optimate charger cables to the battery (red clamp to positive and black clamp to negative), next (step 2) plug the charger power cord into AC outlet (or press the reset button on the charger). The charger should startup and go into the "Save" charging mode. If not contact EarthX technical support.

If using a Ground Power Unit (GPU), the current rating or current setting SHALL NOT be more than the max charge rate stated on the battery label or in this manual. It is recommended that a warning label is placed next to the GPU plug stating the max current allowed.

 **Never charge a faulty battery (a battery that will not accept a charge or hold a charge).**

 **Never use the de-sulfate setting on your charger.**

 **If the battery gets hot while charging, discontinue charging and use.**

 **Do not charge battery in temperatures above 140 degrees F (60C), or in direct sunlight.**

 **When charging a battery outside the aircraft, place it on a non-flammable surface, and remove any flammable items nearby.**

Troubleshooting

The battery is an integral part of the aircraft electrical system and as such to is useful to know the aircraft electrical system voltage and or current at the time of the battery fault.

The Voltage/Current column in the table below lists the voltage/current level or condition that could correspond with the battery fault. For example, over-voltage is an electrical system problem and may be reported and addressed with other aircraft equipment.

The table below is a summary of the battery's fault/status codes indicating a battery issue.

LED Light	Voltage	Possible Cause	Recommended Action

Slow Flashing (5s on/5s off)	Less than 12.8V	Battery over-discharged due to faulty charging system (alternator) not charging the battery.	Charge the battery. Verify aircraft charging system is functioning.
Slow Flashing (5s on/5s off) (> 1 hour)	12.8-14.5V	Weak or failing cell	Charge the battery with an approved charger and observe fault LED. If LED persists (another flight), charge the battery a second time. If the LED fault persists, for several consecutive flights, the battery should be replaced.
Slow Flashing (5s on/5s off)	Greater than 15.5V	Over-charging (due to faulty charging system regulator)	Verify aircraft charging system is functioning properly; could be faulty voltage regulator and or over-voltage protection device.
Solid Light	Any voltage	BMS electronics issue	Isolate the battery from the aircraft (disconnect positive or negative cable). If the fault is not extinguished, the battery should be replaced.
Solid Light that turns off after 3 minutes	Any voltage	Short Circuit protection was activated	Verify normal voltage (12.8-14.5V) at the battery terminals. Battery can be returned to service.
Short Flashing (2s on/2s off)	Any voltage	Battery temperature very high (> 85°C / 185°F) due to environment or excessive discharge.	If due to excessive discharge amperage, let the battery cool down prior to cranking or charging. If the environmental temperature is too high, engineer means to cool battery when in service.

Table 3 Battery Fault / Status Codes

For additional information go to https://earthxbatteries.com/ and review the FAQs.

Battery Storage and Handling

Upon receiving the battery check it for any physical damage, such as cracks, or a swollen case.

If storing the battery, it can be stored at temperatures between -40°C to +70°C. The recommended storage temperature is -10°C to 40°C. Our batteries have no liquid inside and will not freeze. Keep batteries in their original packaging or use appropriate containers to prevent short circuit of the terminals and physical damage.

If the aircraft is to be put in storage for an extended period (> 6 months), disconnect the battery cable to eliminate drain from the Aircraft's electrical system. A fully charged battery can be put in storage for up to a year without charging but should be charged and inspected annually.

Special care must be taken in the handling, shipping, and storage of rechargeable lithium batteries. As a result, installers, end users, and personnel involved in the maintenance and disposal of rechargeable lithium batteries require training in the special characteristics related to rechargeable lithium battery safety. Leaving battery output terminals or leads exposed may result in external short-circuiting of the battery during shipping, handling, testing and installation. Terminals of batteries shall be covered with non-conductive protective devices to avoid any possibility of shorting during handling, shipping, and storage.

Batteries can be recycled at any location accepting lithium-ion type batteries. Drain battery and or cover terminals with electrical insulating tape prior to recycling. For recycling information and where to recycle check this website (https://www.call2recycle.org/).

 **Do not incinerate or expose to open flames!**

 **The Safety Data Sheet (SDS) is available on EarthX's website.**

 **Always follow the manufacturers' recommended safety precautions and procedures.**

Weight and Balance

The installation of the ETX900-TSO battery is considered a permanent installation. The basic aircraft weight and balance should be updated inclusive of the added equipment when the installation is completed and documented on the aircraft Weight and Balance Record (WBR). The ETX900-TSO battery weighs 5.4 pounds.

Reference Documents

- ETX900-TSO FAA Approved Airplane Flight Manual Supplement (AFMS) for ETX900-TSO Battery

Regulations / Standards

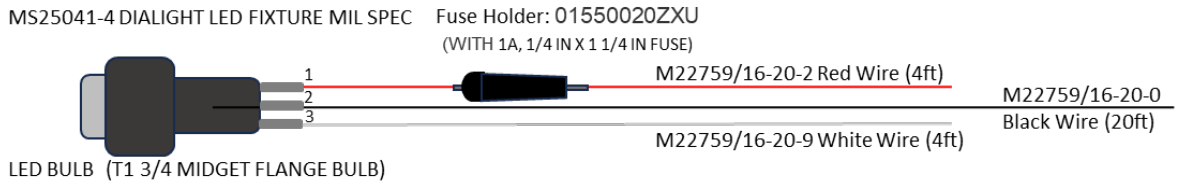
This battery is designed and tested to the following safety regulations as outlined in:

- FAA Technical Standard Order TSO-C179b
- FAA AC 20-184, Guidance on Testing and Installation of Rechargeable Lithium Battery and Battery Systems on Aircraft
- FAA AC 23.1309-1E, System Safety Analysis and Assessment for Part 23 Airplanes
- RTCA DO-160G, Environmental and Test Procedures for Airborne Equipment

- RTCA DO-254, Design Assurance Guidance for Airborne Electronic Hardware
- RTCA DO-311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems
- UN 38.3, – United Nations ST/SG/AC.10/11/Rev.6, Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Section 38.3, Lithium Metal and Lithium-Ion Batteries.

Appendix i: Fault/Status LED Initial Installation Common to all Aircraft

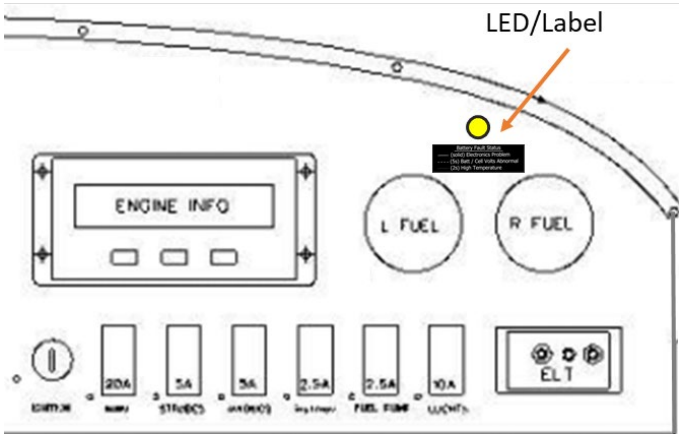
The installation of the EarthX Fault/Status LED Indicator (part# 11MM12) is detailed below. The LED is yellow or amber in color.



Fault / Status Indicator

Fault/Status Indicator (LED) Install Procedure

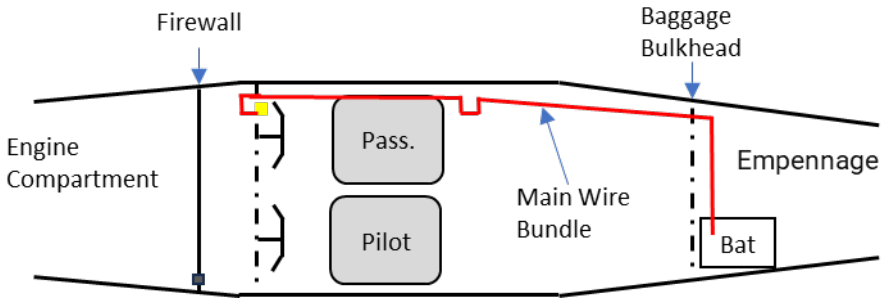
A suitable location for the Fault/Status Indicator will be determined by the installer. One example is shown below, but aircraft will vary. Find an open area that will not interfere with other equipment and in plain view of the pilot. LED must be visible in all operating conditions. Install the "Battery Fault Status" label near the LED. Follow shop best practice and/or AC 43.13 guidance.



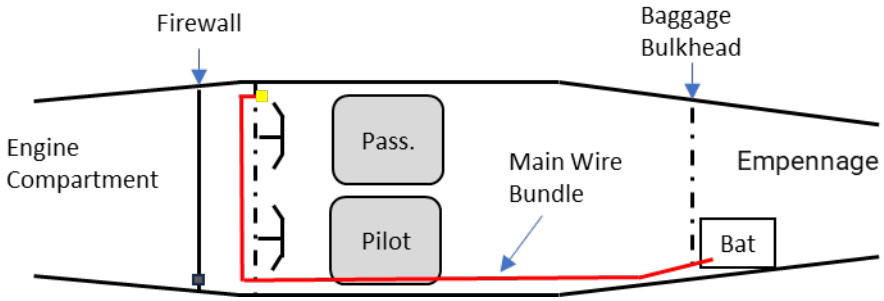
LED/Label Installation Example

1. Removed trim panel - drill a 7/16" hole in the panel.
2. Remove the panel nut from the front side of the LED housing and feed the LED housing through the hole from the back side of the panel.
3. Secure the LED in place with the panel nut removed in the previous step.
4. Secure the LED Placard (1" x 3") to the panel in close proximity to the LED (P/N: 200208).

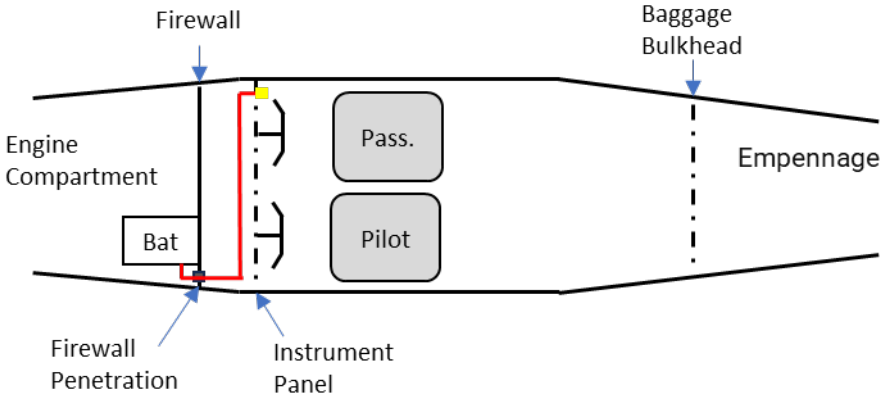
5. Route the black wire from the LED to the battery box through the main wire bundle, secure in place with zip ties. Follow shop best practices and AC 43.13 guidance. The routing is shown in the diagrams below.
6. Cut the black signal wire to length leaving a few inches of service loop at the battery.
7. Attach the "male" quick connect to the black wire. Then plug the male spade connector into the battery's black wire with a black female spade connector.
8. Behind the instrument panel, route the red wire (with inline fuse) to the instrument (or lights) circuit breaker (1 to 10 amp typical); crimp (supplied) #6 ring lug to wire and secure to breaker.
9. Route the white wire to an adequate or available ground stud, crimp on (supplied) #6 ring lug and secure in place.



Cessna 120/140/150/170/172/177/180/182/185 Wire Routing



Piper/Mooney/Beechcraft/Ercoupe/Luscombe/Rockwell/Navion/Bellanca Wire Routing



Firewall Forward (Cessna 172) Wire Routing

Appendix A: Cessna 177,180,182,185 Install

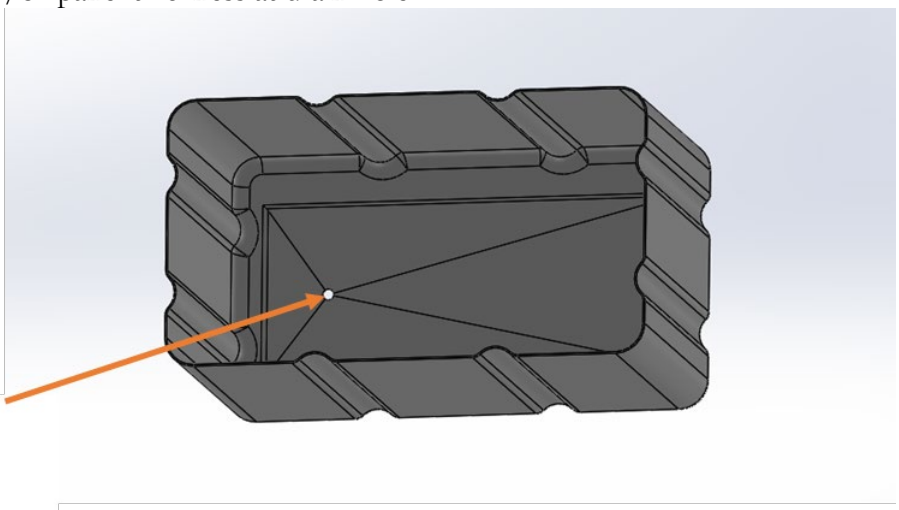
Install Parts Kit:
ETX900-TSO-35-KIT

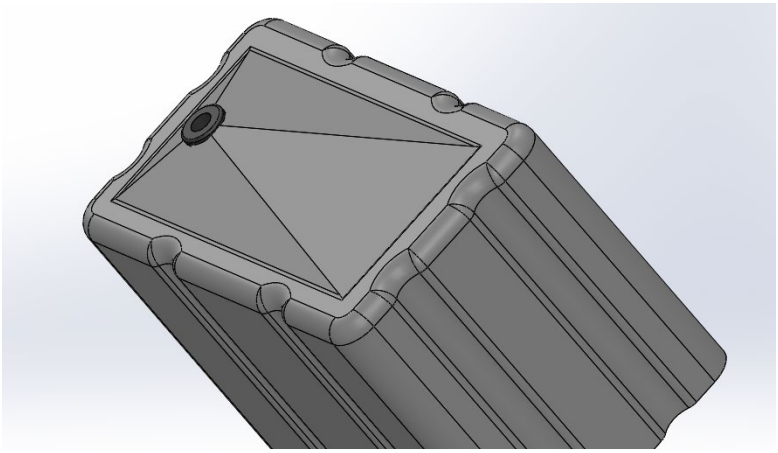
Note: For 177 models with a 25Ah battery option, the factory spacer is no longer used.

Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

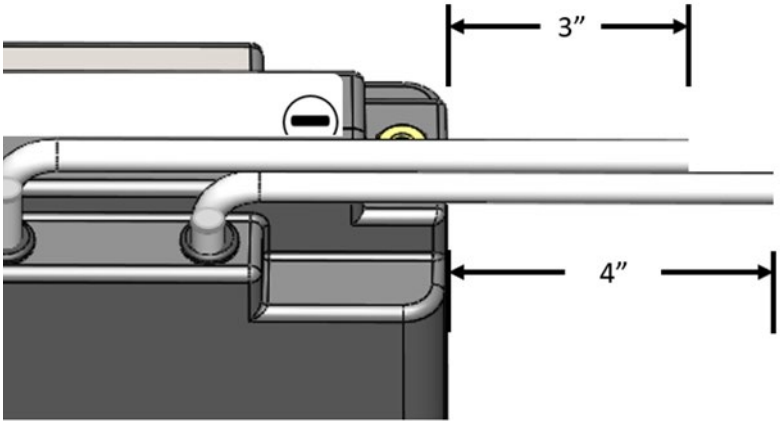
Battery and Vent Tubing

1. Drill a 9/16" hole in the bottom of the existing Cessna plastic battery box at the current drain hole. Follow guidelines of AC 43.13-2B, 11-19 and 11-22 (Installation Practices/Ventilating Systems). Install 9/16" grommet for 1/8" panel thickness at drain hole.

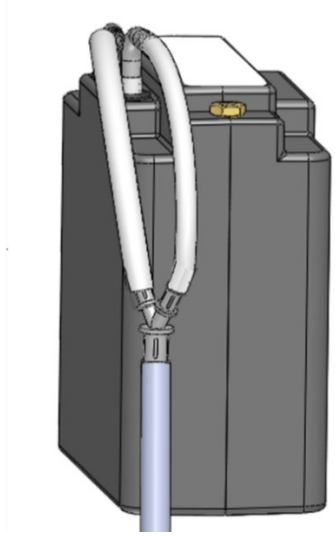




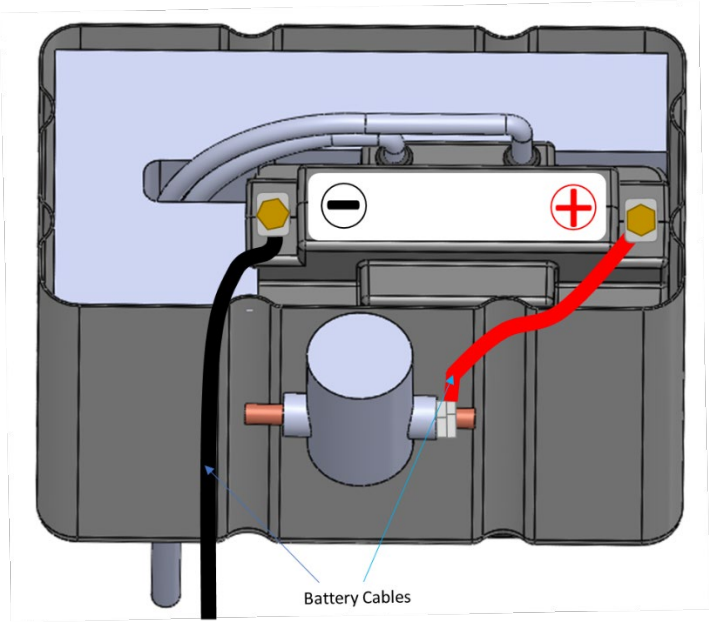
2. Install the supplied stainless-steel elbows to the battery vent tube stubs. It is helpful to heat the tubing to a couple hundred degrees F before pressing them into the tubes. Be sure the entire barbed part of the elbow is completely inserted into the tubing.
3. Connect the supplied ¼" ID tubing to the stainless elbows. Next, cut the ¼" tubes to a length of 3" and 4". Attach these pieces of ¼" tubing to elbows.



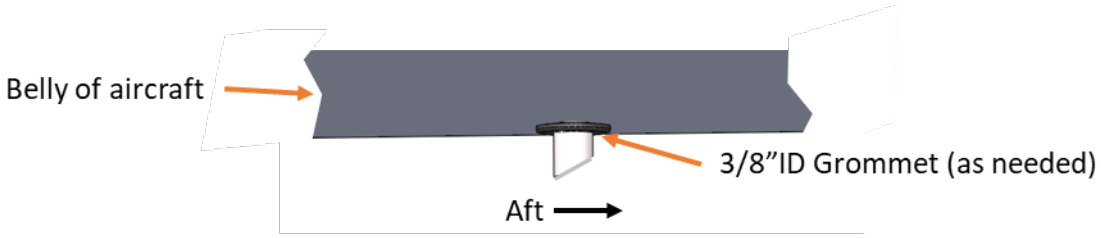
4. Connect the 3/8” wye fitting to the 3/8” tube supplied and then to ¼” tube from battery (do not kink the tubes). Next heat the ¼” tubes while bending them to create a 90-degree swiping bend with a 3” radius. (See image below).



5. Feed the 3/8” exhaust tube straight down and out the aircraft’s existing battery box drain hole, then thru the drain hole of the aircraft (do not cut tube length at this time).
6. Install another 9/16” grommet for 1/16” panel thickness at the aircraft exit hole. Silicon can be used around the grommet and or tubing to seal and secure it in place.
7. Insert L-Shaped foam insert (190531) into the 35Ah box around the battery. Make sure that the slot in the spacer is located over the drain hole and around the vent tubes. The foam insert (spacer) is used to hold the battery in a corner on the opposite end of the box from drain hole (up to +-1/8” of battery movement side to side or front to back is ok). The battery should be positioned on the side of the box closest to the battery cables.



8. With the battery box cover installed, push the vent tube up into the aircraft, then cut exhaust tube to length; at least 9/16" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft.



Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.

Appendix B: Piper PA-12, PA-18, PA-20, PA-22, PA-24, PA-28, PA-32; and Luscombe Install

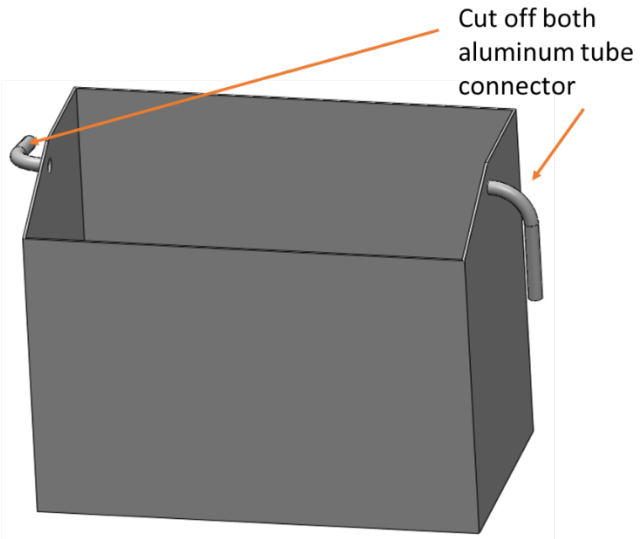
Install Parts Kit:
Models with 35Ah Battery (all PA-24, PA-28, PA-32 and Luscombe): ETX900-TSO-35-PA-KIT
Models with 25Ah Battery (all PA-12; early PA-18, PA-20, PA-22): ETX900-TSO-25-KIT

Note: the vent routing and battery position within the battery box is shown as a representative installation, but alternate tube routes and battery positions are also acceptable. Follow guidelines in the installation section of this manual and that of AC 43.13-2B, 11-19 and 11-22 (Installation Practices/Ventilating Systems).

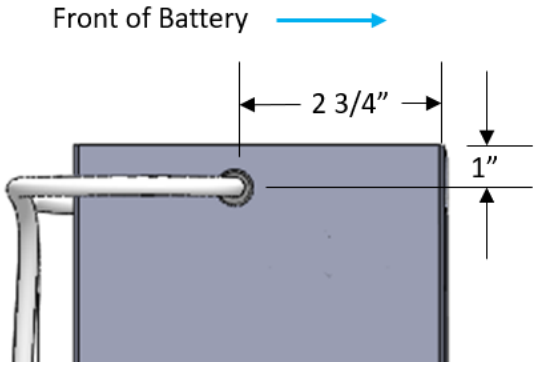
Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing

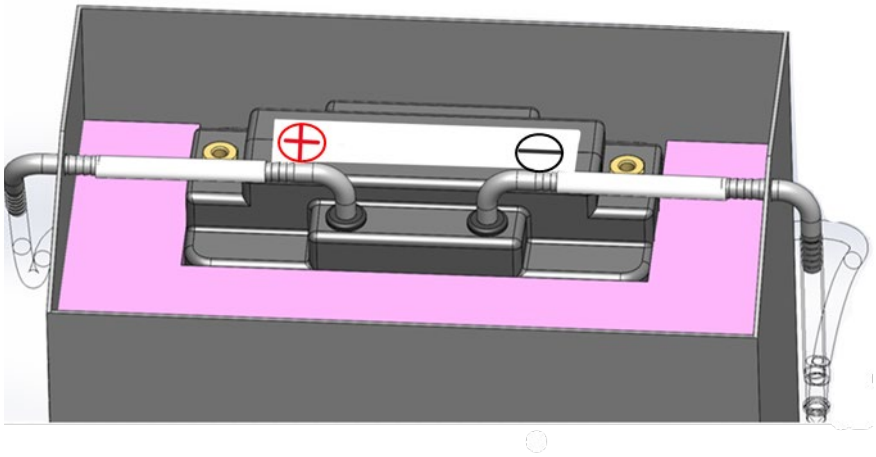
1. For boxes with existing vent tubes, remove aluminum vent tube connections from the top edge of the existing battery box (cut off, then drilled out; may not be present on every aircraft). Drill out vent tube penetration hole to 25/64". Install ¼" ID grommets into the new holes.



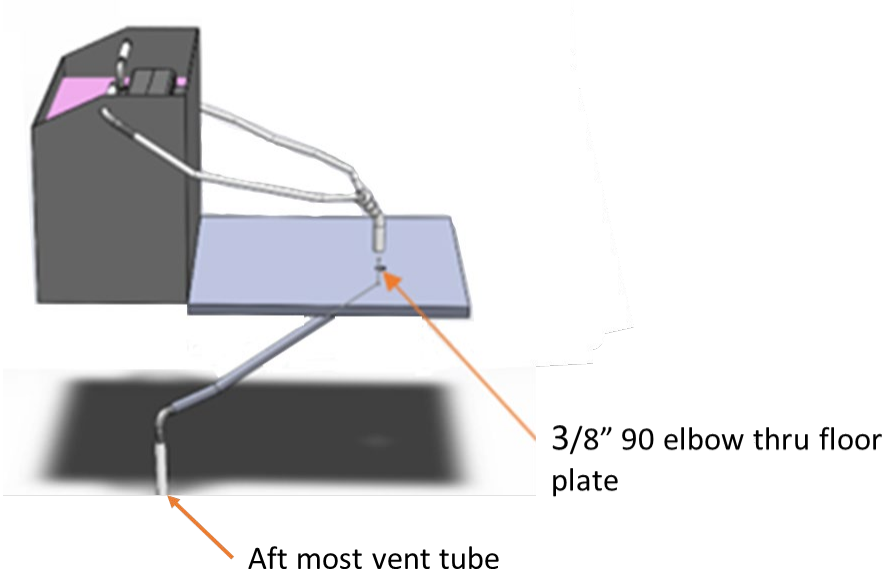
For boxes without an existing vent connection, drill a 25/64" hole though the top ends of the box (approximately 1" from the top of the box and 2 ¾" from front edge). Note, the lid, when installed, should not interfere with the vent tube.



2. The tubing from the bottom drain hole can be left as is (if installed).
3. Install the supplied stainless-steel elbows to the battery vent tube stubs. It is helpful to heat the tubing to a couple hundred degrees F before pressing them into the tubes. Be sure the entire barbed part of the elbow is completely inserted into the tubing. Note: close elbows (aluminum) and sweeping elbows (stainless steel) are supplied with the kit. Use the close elbows to reduce the overall vent tube height so the lid fits properly.
4. Cut two pieces of the supplied ¼” ID tubing to a length of 3.5 inches. Then, connect to each of the elbows already installed on the battery.
5. Place the U-Shaped foam into the battery box with the battery cutout closest to the battery cables.
6. Place the battery into the foam cutout. Ensure the battery is on the side of the battery box closest to the battery cables (see figure below).
7. Connect ¼” stainless elbows through the new battery box vent tube holes to the tubing already installed on the battery (one each side). Cut tubing as needed so stainless-steel elbow is positioned as shown in the figure below. Use ¼” ID tubing to connect the stainless elbows to the 3/8” wye fitting.

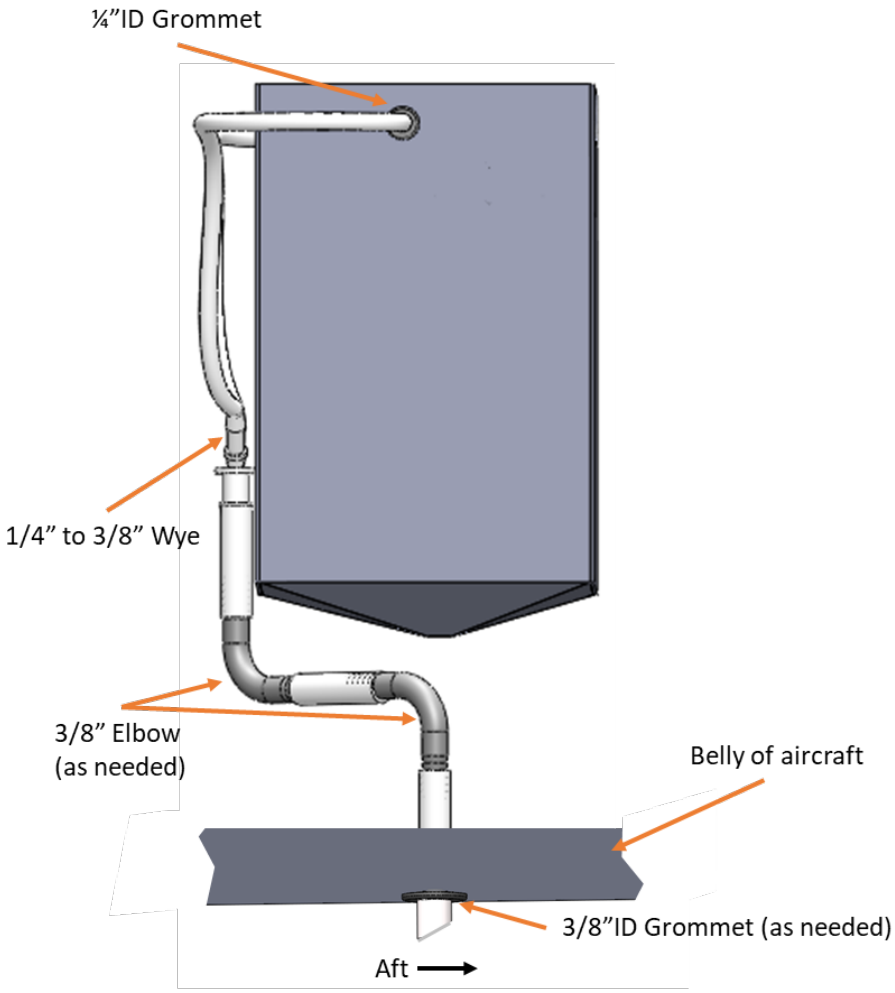


8. For Piper aircraft with a vent outlet port, use 3/8” tubing and fittings to route the vent line to the existing battery vent fitting (the fitting angled to the aft of the aircraft). Secure tube to the vent outlet port with the spring clamp (see example below).



Piper Aircraft Example

For aircraft without an outlet port (like the Luscombe), route 3/8” tube through the existing drain tube hole. Use RTV Silicon to secure tube at the grommet install at the aircraft vent exit hole. Then cut the exhaust tube to length; at least 9/16” should be exposed on the outside of the aircraft. Cut the tube at an angle with the angle towards the aft of the aircraft



Luscombe Aircraft Example

Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.

Appendix C: Mooney M20 Install

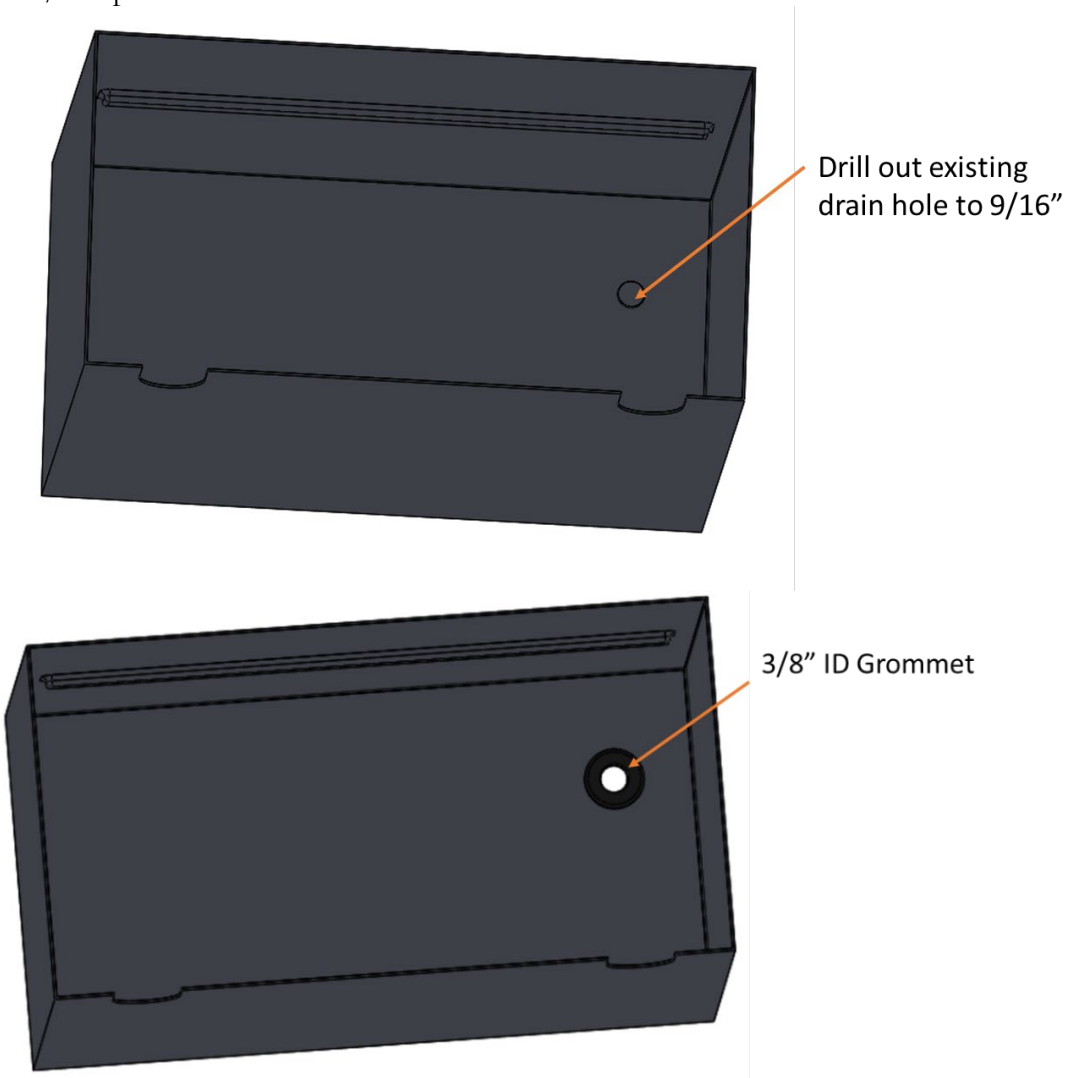
Install Parts Kit:
ETX900-TSO-35-M20-KIT

Note: some boxes may have the drain hole on the opposite side shown below, so vent lines will be routed toward the positive terminal side of the battery box.

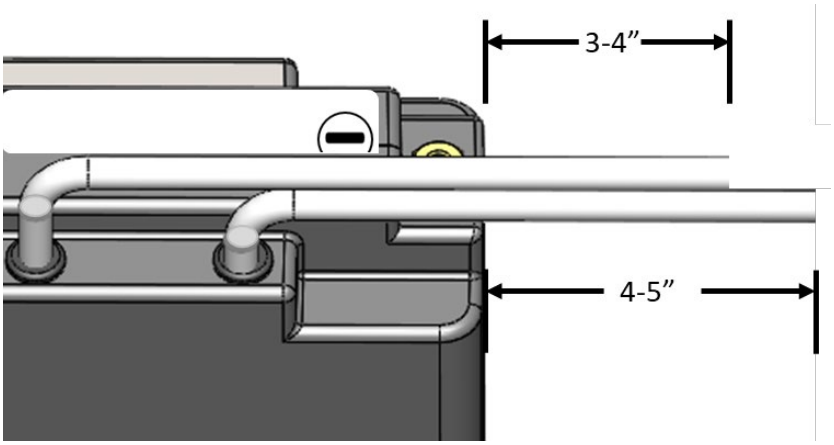
Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing

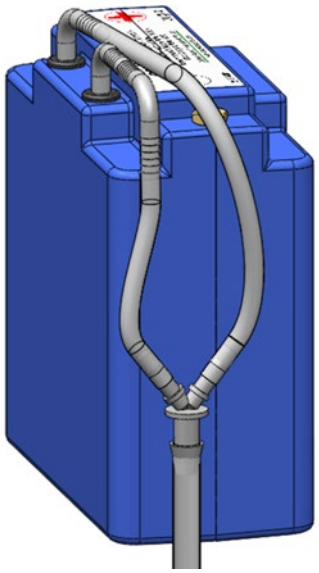
1. Drill a 9/16" hole in the bottom of the existing battery box at the current drain hole. Follow guidelines of AC 43.13-2B, 11-19 and 11-22 (Installation Practices/Ventilating Systems). Install 9/16" grommet for 1/16" panel thickness at drain hole.



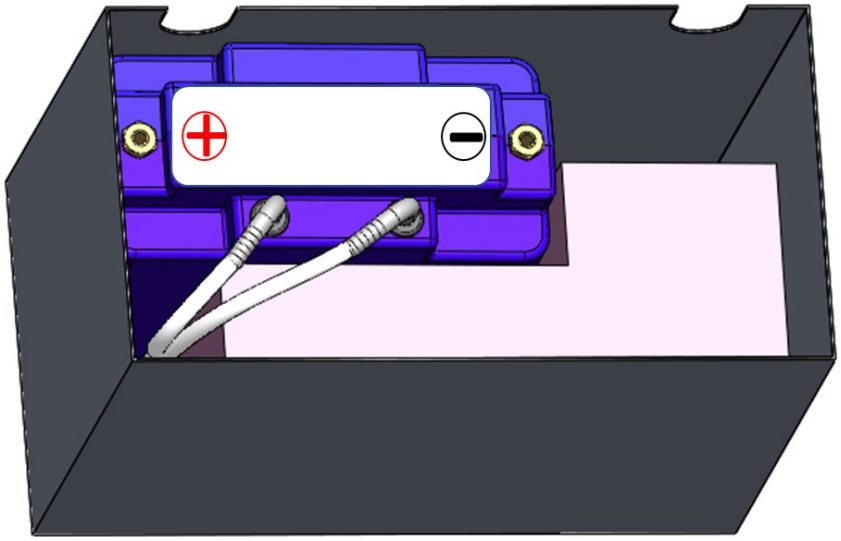
2. Install the supplied stainless-steel elbows to the battery vent tube stubs. It is helpful to heat the tubing to a couple hundred degrees F before pressing them into the tubes. Be sure the entire barbed part of the elbow is completely inserted into the tubing.
3. Connect the supplied ¼" ID tubing to the elbows and cut to the approximate lengths shown in the figure below.



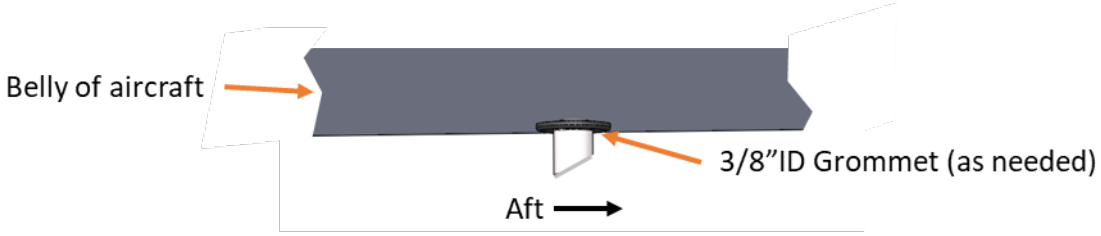
4. Connect the 3/8" wye fitting to the 3/8" tube supplied and then to ¼" tube from battery (do not kink the tubes). Next heat the ¼" tubes while bending them to create a 90-degree swiping bend with a 3" radius. (See image below).



5. Feed the 3/8" exhaust tube straight down and out the aircraft's existing battery box drain hole, then thru the drain hole of the aircraft (do not cut tube length at this time).
6. Install another 9/16" grommet for 1/16" panel thickness at the aircraft exit hole. Silicon can be used around the grommet and or tubing to seal and secure it in place.
7. Insert L-Shaped foam into the 35Ah box around the battery. Make sure that the spacer is located at the end of the box away from the vent tubes. The foam insert (spacer) is used to hold the battery in a corner on the same end of the box as the drain hole (up to +-1/8" of battery movement side to side or front to back is ok). The battery should be positioned on the side of the box closest to the battery cables.



8. With the battery box cover installed, push the vent tube up into the aircraft. Then cut exhaust tube to length; at least 9/16" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft.



9. Lastly, replace the battery negative cable with the one provided.

Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.

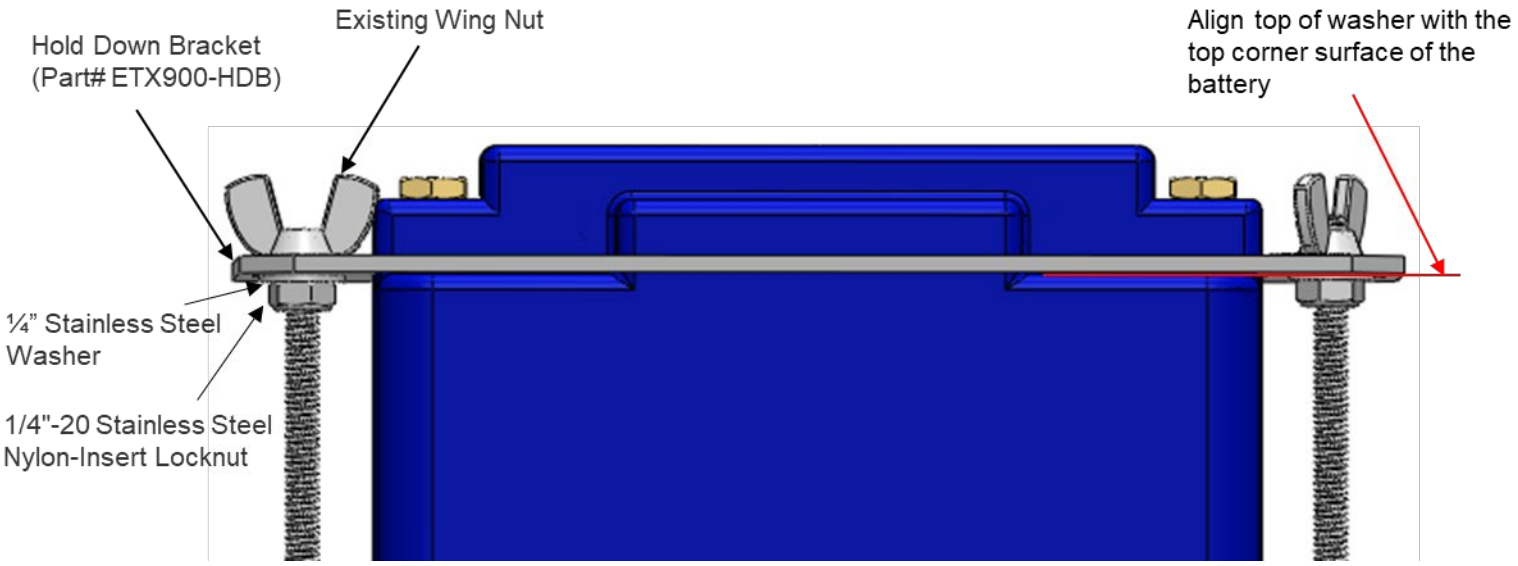
Appendix D: Aviat Husky and Pitts Install

Install Parts Kit:
ETX900-TSO-AVIAT-KIT

Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing

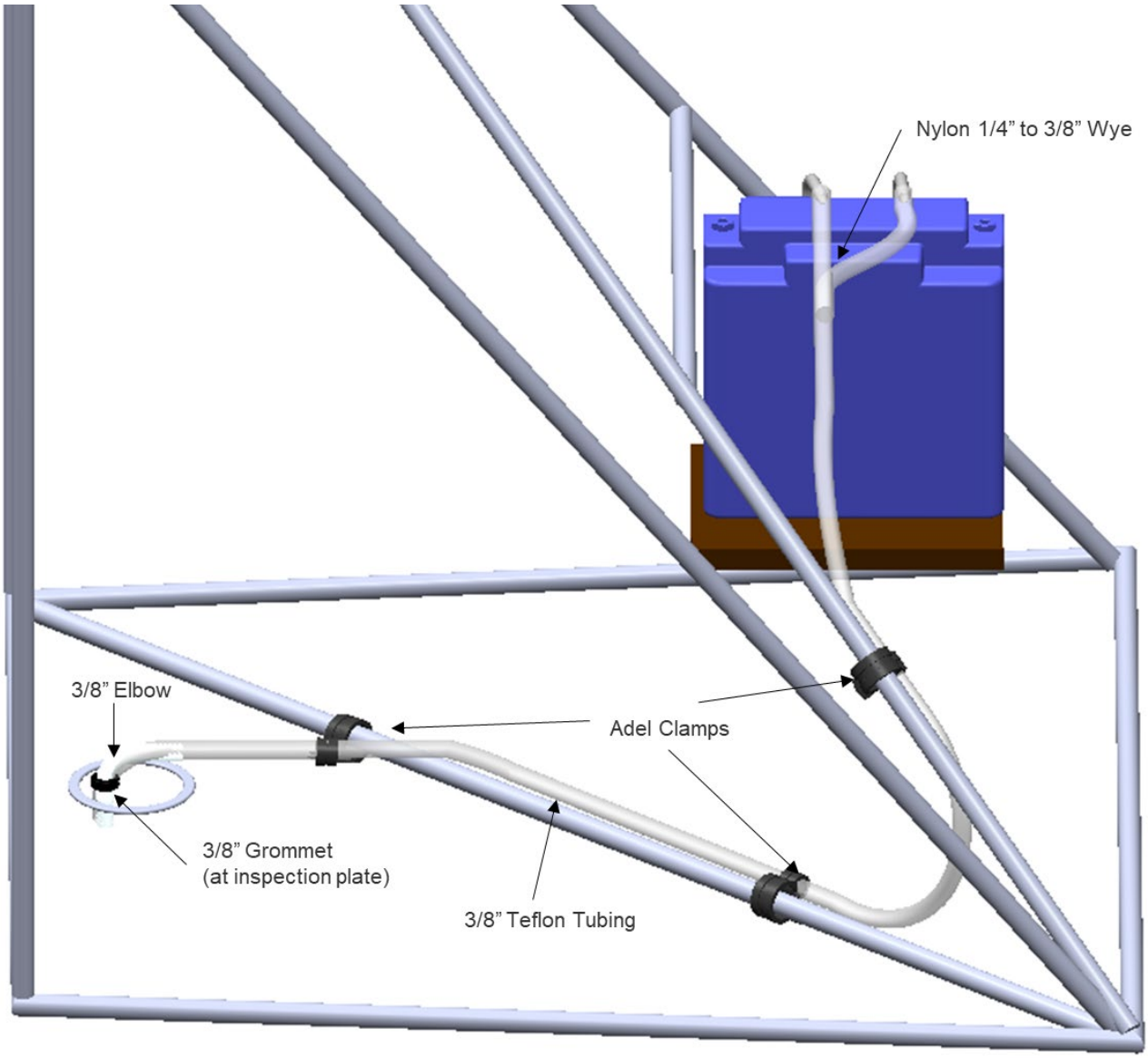
1. Thread lock nut onto exiting ¼-20 rod and then place a washer on top of the nut. Note, the lock nut is installed up-side-down (nylon lock side down).
2. Set the battery on the battery tray and place the hold down bracket on top of the battery feeding the threaded rod thru the ¼" holes in the bracket.
3. Using a straight edge, align the top of the washer with the top of the battery outside corners (pull the threaded rod upward while aligning, see figure below).
4. Install the wing nuts and hand tighten ensuring the threaded rod is perpendicular to the battery tray.



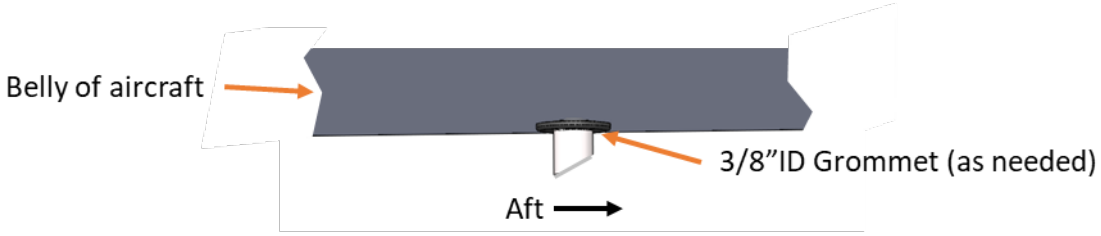
5. Verify the hold down bracket is firmly holding the battery (can't slide side to side). If not, tighten the lock nut another ½ turn. The wing nuts should not be overly tight as to bend (flex) the hold down bracket.
6. Install safety wire from hold down bracket to the wing nut.
7. Install the supplied stainless-steel elbows to the battery vent tube stubs. It is helpful to heat the tubing to a couple hundred degrees F before pressing them into the tubes. Be sure the entire barbed part of the elbow is completely inserted into the tubing.
8. Cut two pieces of the supplied ¼" ID tubing to a length of 6 inches. Then, connect to each of the stainless elbows already installed on the battery.

9. Attach each of the two loose ends of the ¼" ID tubing to the supplied 3/8" wye fitting.
10. Connect the 3/8" tubing to the wye fitting and route tubing to the aluminum belly of the aircraft under the seat (see representative routing below, slight variation between models). The 3/8" tubing will run from the battery down the

vertical tube frame (5/8" Adel clamp here) to the horizontal frame tube (be sure to stay clear of aileron push tubes). The 3/8" tubing will be secured to the frame tubing with Adel clamps.



11. Drill a 9/16" hole through the center of the inspection plate in the belly of the tail section. Install a 9/16" grommet in the plate. Install a 3/8" elbow onto the vent tubing at the inspection plate hole location. Then connect a short piece of 3/8" tubing to the elbow which will feed down thru the grommet to outside the aircraft (see figure above). Use RTV Silicon to secure tube at the inspection plate grommet if required. Then cut the exhaust tubes to length; at least 9/16" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft.



Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.

Appendix E: Cessna 120, 140, 150 A -C, 175, P172D; Ercoupe 415-C, 415-CD, 415-D, ERCO E, ERCO G, FORNEY F-1, FORNEY F-1A, ALON A-2, ALON A2-A; Piper PA-16; Mooney M10; and Taylorcraft Install

Install Parts Kit:
ETX900-TSO-25-KIT (note: not all parts are required)

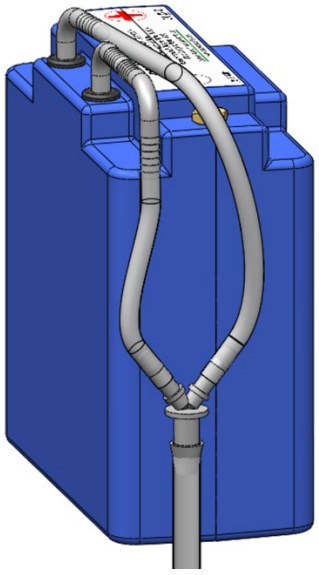
Note: the vent routing and battery position within the battery box is shown as a representative installation, but alternate tube routes and battery positions are also acceptable. Follow guidelines in the installation section of this manual and that of AC 43.13-2B, 11-19 and 11-22 (Installation Practices/Ventilating Systems).

Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing

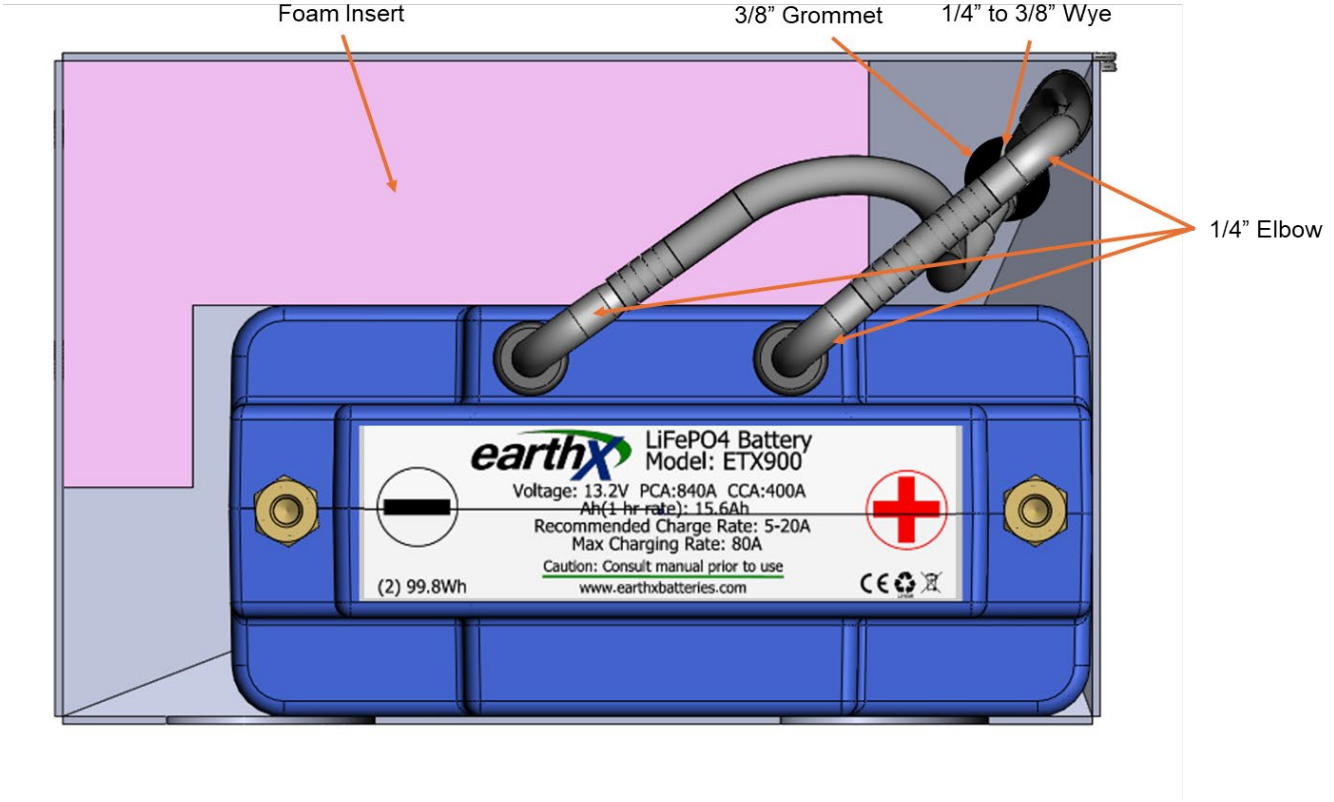
1. Install the supplied stainless-steel elbows to the battery vent tube stubs. Be sure the entire barbed part of the elbow is completely inserted into the tubing.

2. Connect the 3/8" wye fitting to the 3/8" tube (long enough to extend to the exterior of the aircraft) and then to the ¼" tube from battery (do not kink the tubes). Next heat the ¼" tubes while bending them to create a 90-degree swiping bend (see image below). If a tighter bend radius is required, use stainless

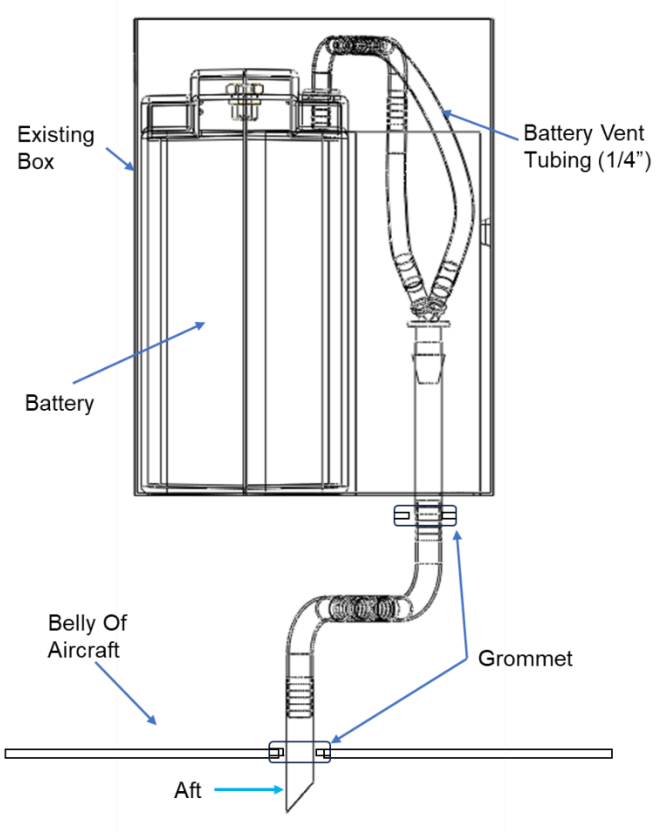


elbow(s).
3. Drill a 9/16" hole in the bottom corner of the existing battery box at the current drain hole (or desired location). Install 9/16" grommet for 1/16" panel thickness in the vent hole.
4. Remove the existing drain tubing from the battery box to the belly of the aircraft. Install a 9/16" grommet for 1/16" panel thickness at the battery drain exit hole.

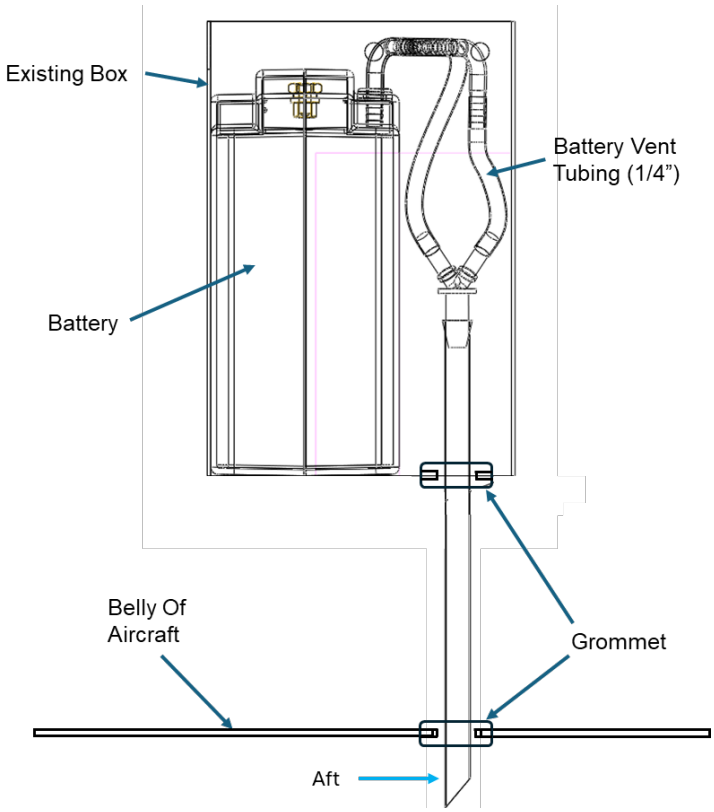
5. Feed the vent tube straight down and out the bottom of the battery box as the battery is placed into the box. Place the L-Shaped foam insert into the box around the battery. Position the spacer to not interfere with the vent tubes and to position the battery on the side of the box closest to the battery cables (see figure below). Note: the vent hole may need to be on the opposite corner as shown.



6. Use 3/8" tubing and fittings (if required for offset routing) to route the vent line to the existing drain tube hole (or opening) in the belly of the aircraft. See the figures below for straight and offset vent tube routing.



Offset Tube Routing Example



Straight Tube Routing Example

7. Cut exhaust tube to length; at least 9/16" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft (see image above). Secure tube in place with RTV Silicon.

Vent Tube Installation Notes:

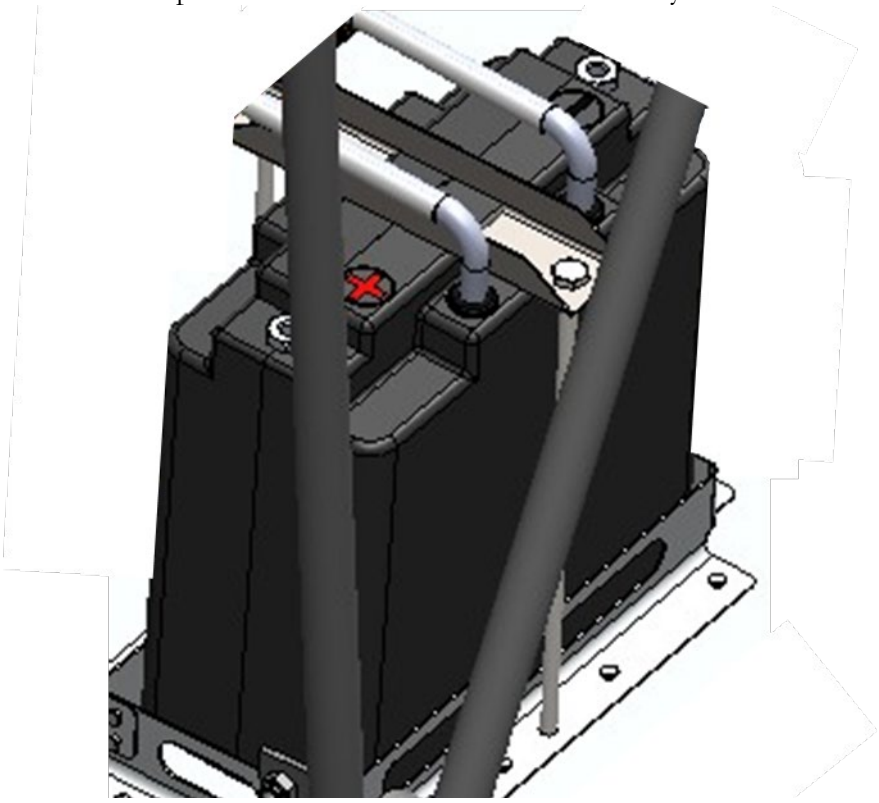
- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°.

Appendix F: Cub Crafters (CC-19) and Topcub (CC-18)

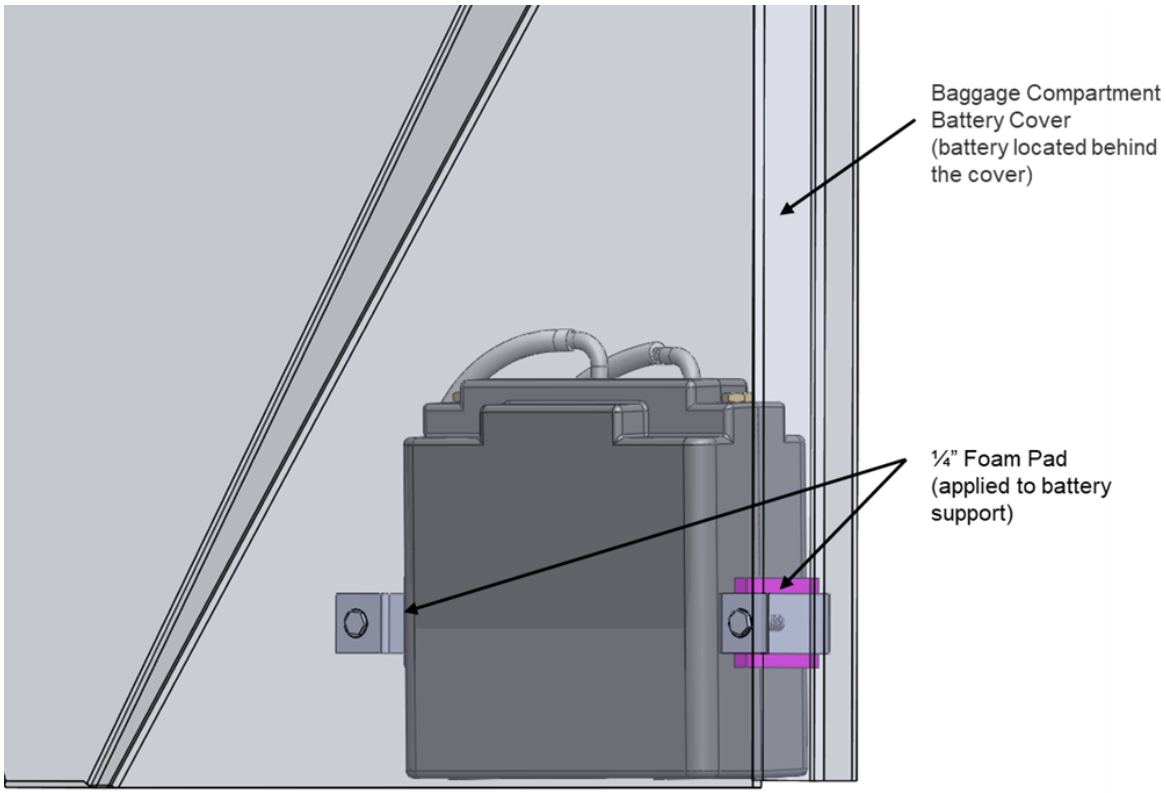
Install Parts Kit:
ETX900-TSO-CUB-KIT

Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing
1. The battery is installed in the existing location using the existing mounting brackets (see the figures below). Use a ¼" piece of foam on each side of the battery for fitment as required.

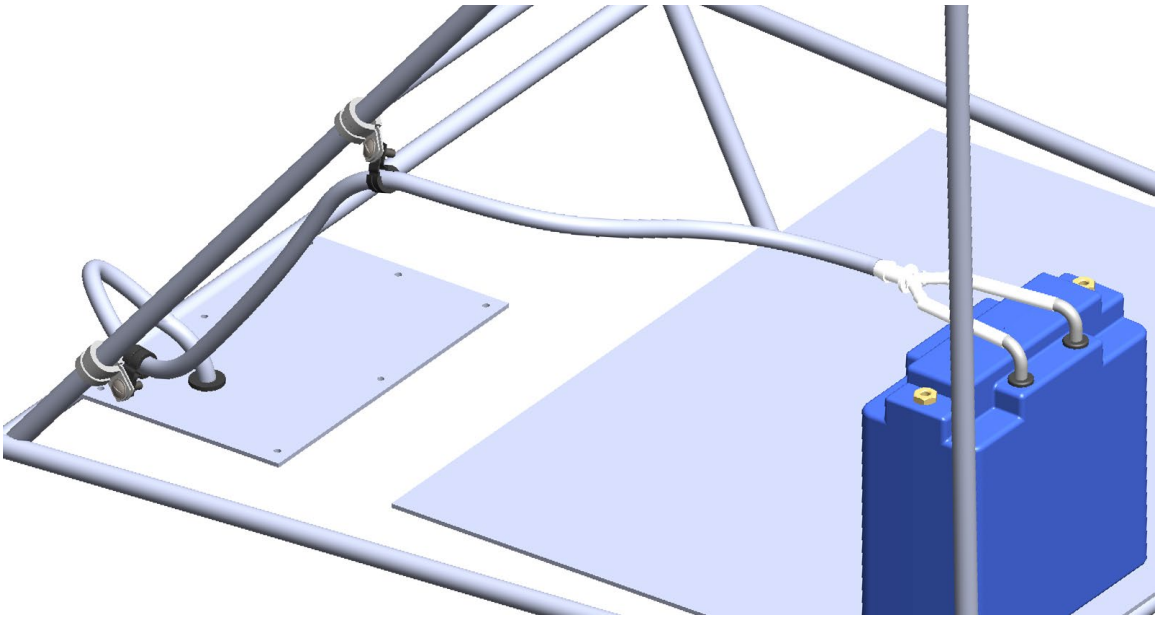


Carbon Cub CC-19

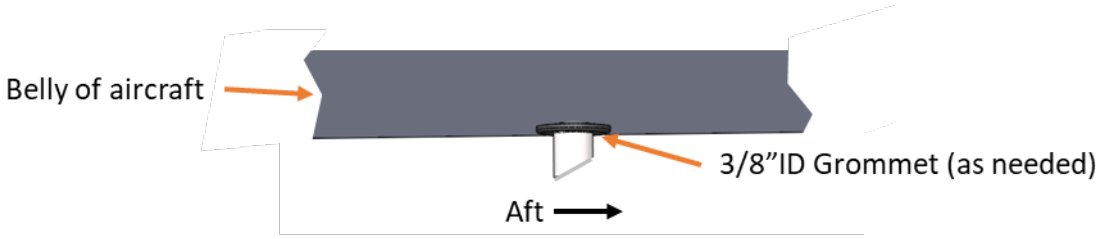


Top Cub CC-18

2. Install the supplied stainless-steel elbows to the battery vent tube stubs. It is helpful to heat the tubing to a couple hundred degrees F before pressing them into the tubes. Be sure the entire barbed part of the elbow is completely inserted into the tubing.
3. Cut two pieces of the supplied ¼" ID tubing to a length of 6 inches. Then, connect to each of the stainless elbows already installed on the battery.
4. Attach each of the two loose ends of the ¼" ID tubing to the supplied 3/8" wye fitting.
5. Connect the 3/8" tubing to the wye fitting and route to an inspection plate in the belly of the aircraft. The 3/8" tubing should be secured to the tube frame with Adel clamps at one or more locations (see example install below).



6. Drill a 9/16" hole through the inspection plate in the belly. Install a 9/16" grommet in the plate and run 3/8" tubing to outside of the aircraft. Use RTV Silicon to secure tube at the inspection plate grommet. Then cut the exhaust tube to length; at least 9/16" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft.



Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.

Appendix G: Beechcraft 19, 23, 24;

Commander;

Navion;

Stinson;

and Cessna 190, 195 Install

Install Parts Kit:
ETX900-TSO-35-BC-KIT (note not all parts are required)

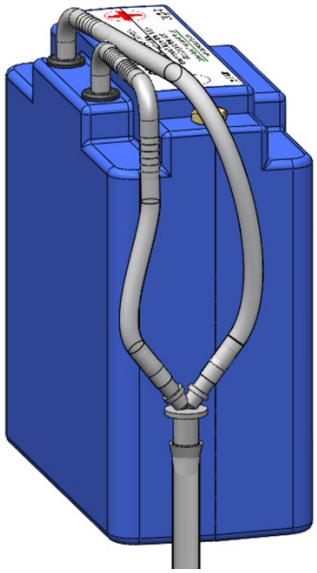
Note: the vent routing and battery position within the battery box is shown as a representative installation, but alternate tube routes and battery positions are also acceptable. Follow guidelines in the installation section of this manual and that of AC 43.13-2B, 11-19 and 11-22 (Installation Practices/Ventilating Systems).

Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing

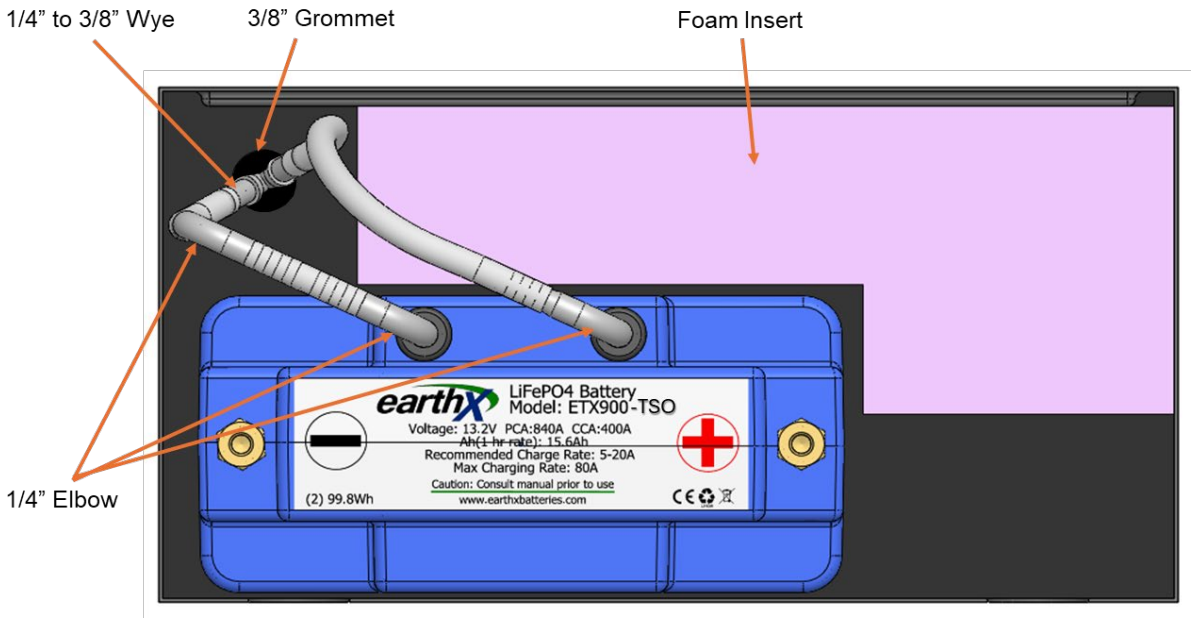
1. Install the supplied stainless-steel elbows to the battery vent tube stubs. It is helpful to heat the tubing to a couple hundred degrees F before pressing them into the tubes. Be sure the entire barbed part of the elbow is completely inserted into the tubing. Note: close elbows (aluminum) and sweeping elbows (stainless steel) are supplied with the kit. Use the close elbows to reduce the overall vent tube height so the lid fits properly.

2. Connect the 3/8" wye fitting to the 3/8" tube and ¼" tube supplied (do not kink the tubes). Next heat the ¼" tubes while bending them to create a 90-degree swiping bend (see image below). If a tighter bend radius is required, use the stainless elbow(s).

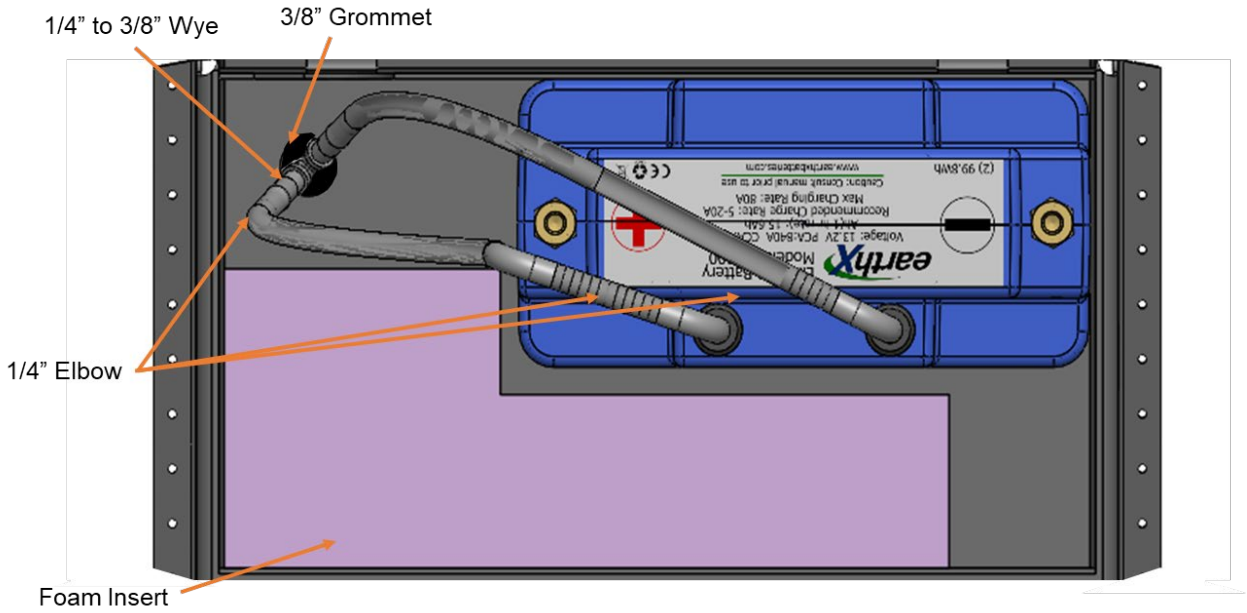


3. Drill a 9/16" hole in the bottom corner of the existing battery box at the current drain hole. Install a 9/16" grommet for 1/16" panel thickness in that exit hole (see figure below).

4. Install another 9/16" grommet for 1/16" panel thickness at the aircraft exit hole.
5. Feed the 3/8" exhaust tube straight down and out the aircraft's existing battery box drain tube as the battery is placed into the box (no need to modify the existing drain tube). Place the L-Shaped foam insert into the box around the battery. Position the spacer to not interfere with the vent tubes and to position the battery on the side of the box closest to the battery cables (see figure below).

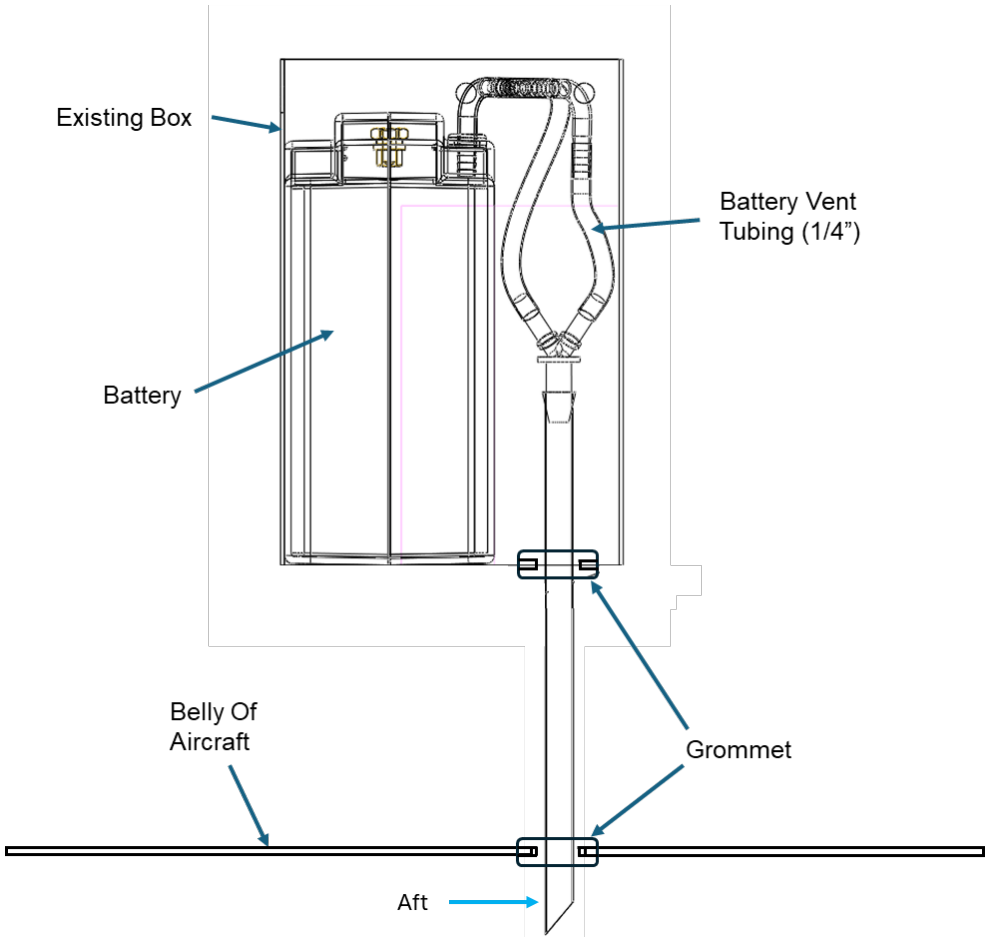


Typical Install for Beechcraft, Commander, Navion, Stinson



Typical Install for Cessna 190 & 195

6. With the battery box cover installed, push the vent tube up into the aircraft. Then cut exhaust tube to length; at least 9/16" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft. Secure in place with RTV Silicon.



Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.

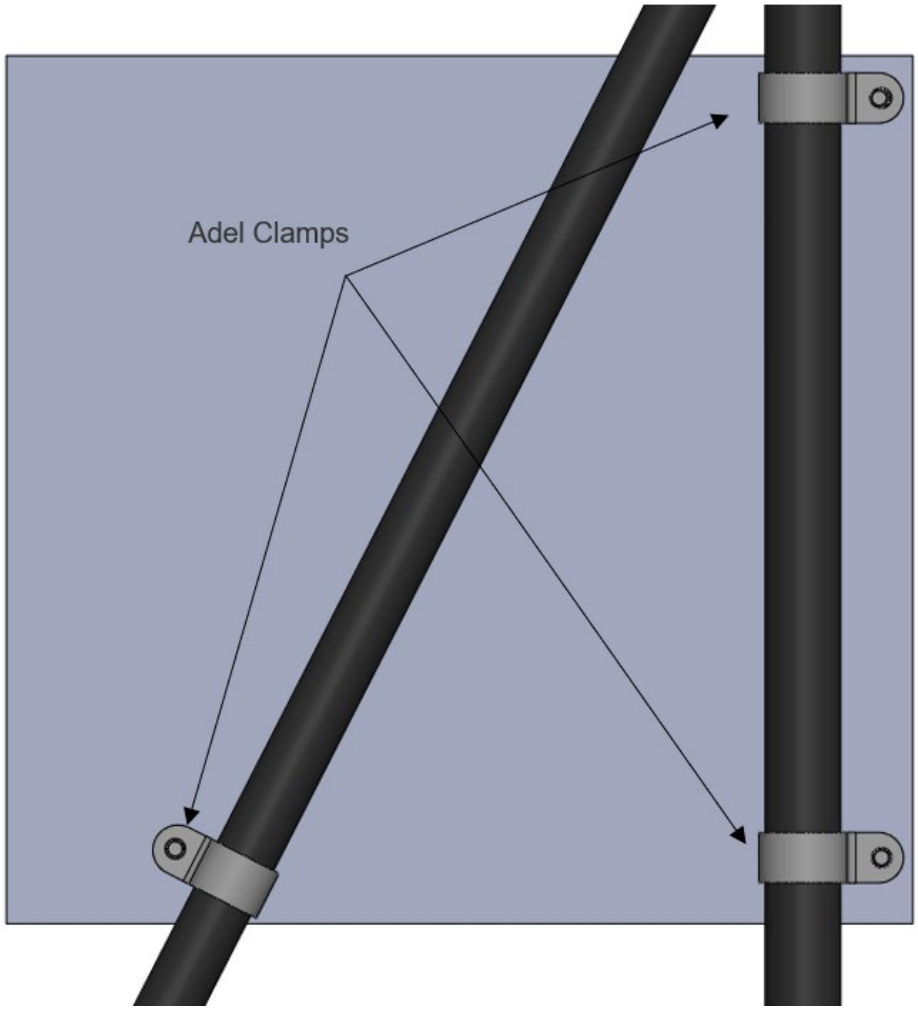
Appendix H: J3, J5, and PA-11 Install

Install Parts Kit:
ETX900-TSO-BB-TH-KIT

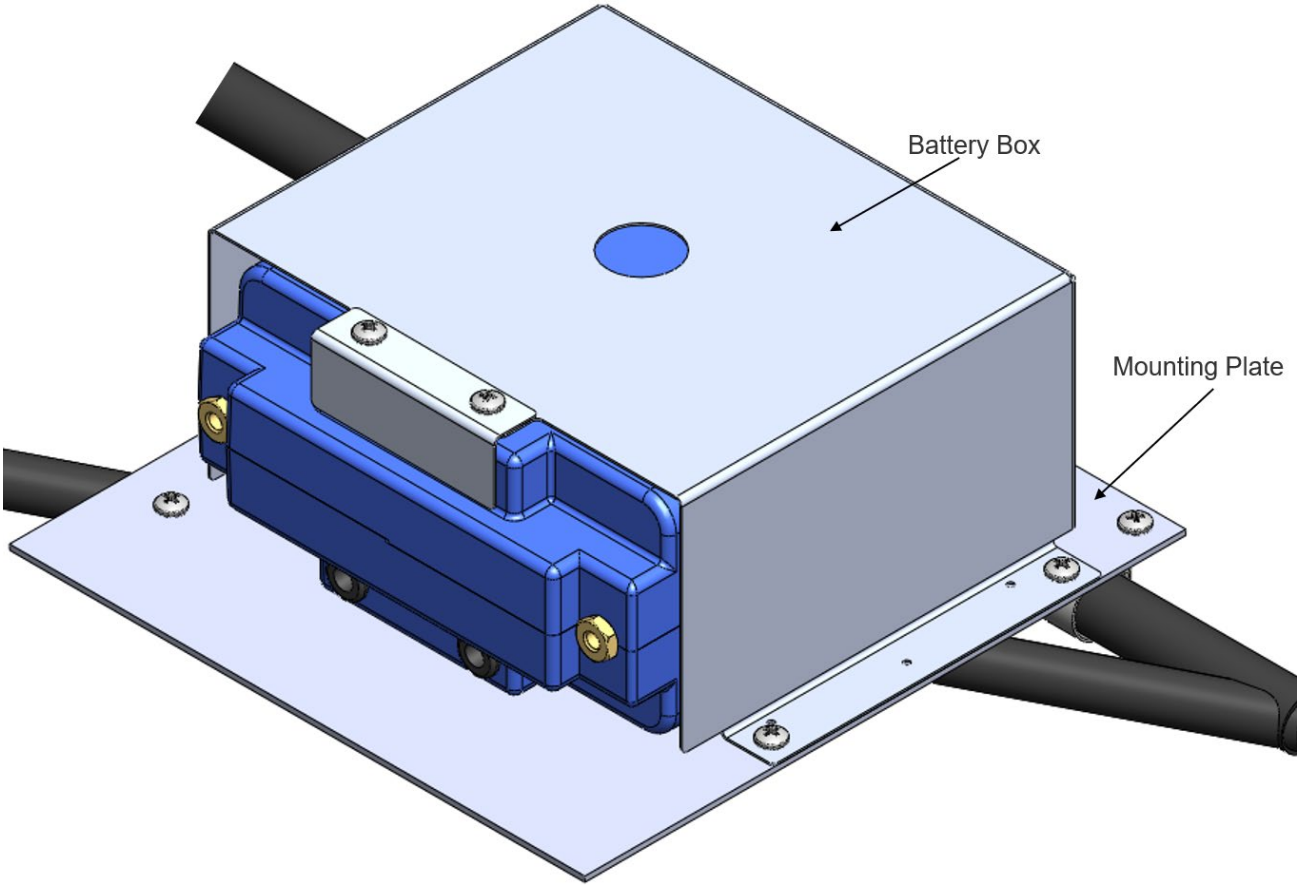
Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing

1. Mount an 8.75" x 6" aluminum mounting plate (1/8" thick 6061-T6 aluminum, supplied by others) to the tube frame under the rear seat using (3) Adel clamps and 10x32 screws (supplied by others). The left side of the rear seat is best.



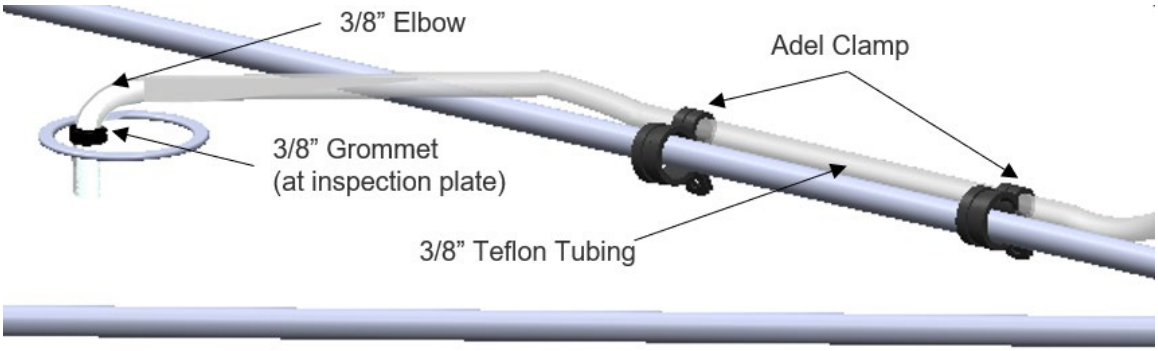
2. Mount the stainless-steel battery box (BB-TH) to the aluminum plate with (4) 10-32 screws (supplied by others).



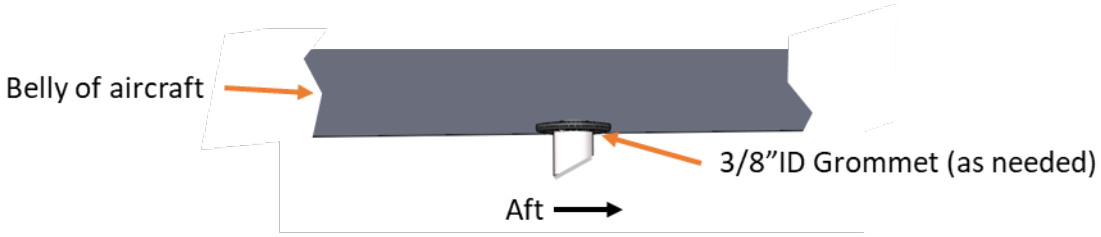
3. Install the supplied stainless-steel elbows to the battery vent tube stubs. Be sure the entire barbed part of the elbow is completely inserted into the tubing.
4. Cut two pieces of the supplied ¼" ID tubing to a length of 6 inches. Then, connect to each of the stainless elbows already installed on the battery.

5. Attach each of the two loose ends of the ¼" ID tubing to the supplied 3/8" wye fitting.

6. Slide the battery into the battery box and fasten the hold down tab in place.
7. Connect the 3/8" tubing to the wye fitting and route to an inspection plate in the belly of the aircraft aft of the battery (see representative routing below). The 3/8" tubing will run from the battery along the horizontal frame tube to an aft of the aircraft inspection plate. The 3/8" tubing is secured to the frame tubing with Adel clamps.



8. Drill a 9/16" hole through the center of the inspection plate in the belly of the tail section. Install a 9/16" grommet in the plate. Install a 3/8" elbow onto the vent tubing at the inspection plate hole location. Then connect a short piece of 3/8" tubing to the elbow which will feed down through the grommet to outside the aircraft. Use RTV Silicon to secure tube at the inspection plate grommet if required. Then cut the exhaust tubes to length; at least 9/16" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft.



Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.

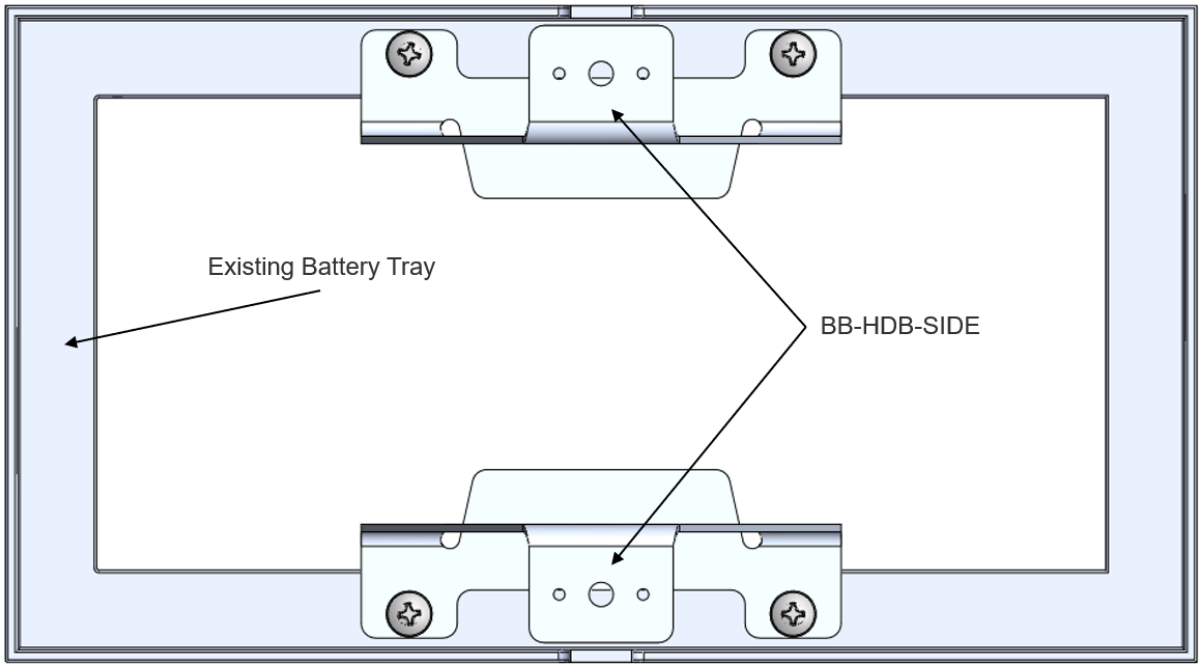
Appendix I: Maule and Bellanca Install

Install Parts Kit:
ETX900-TSO-BB-HDB-KIT

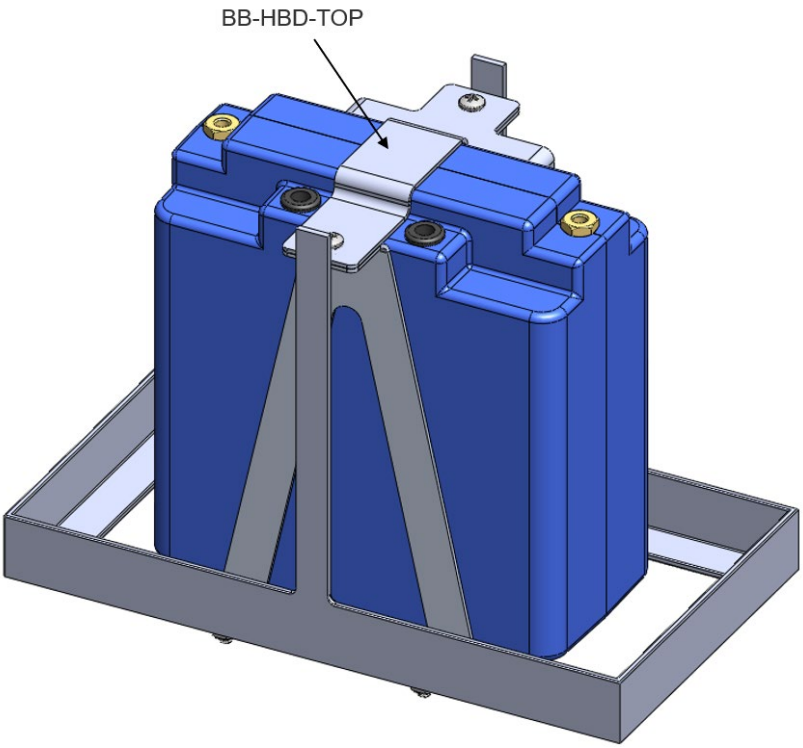
Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing

1. Mount the (2) battery bracket side pieces (of part # BB-HDB) to the existing battery tray frame with (4) 10-32 screws.



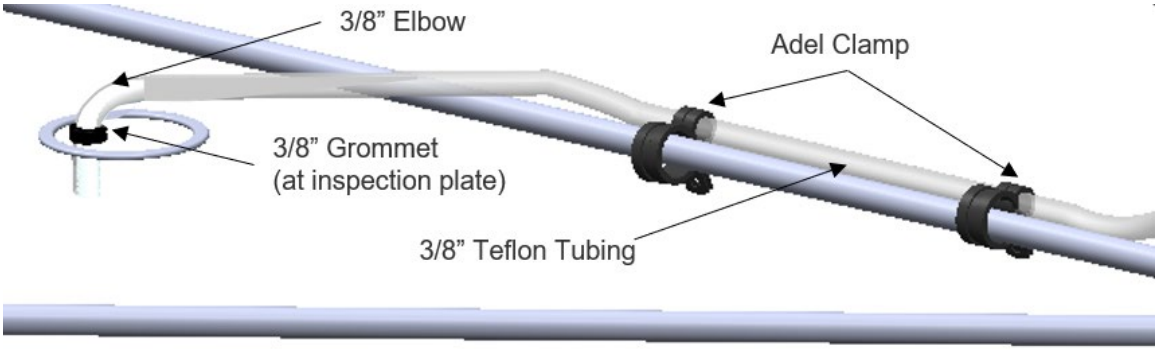
2. Install the battery on the tray and fasten down with the hold down bar (of part # BB_HDB) with supplied 10-32 machine screws.



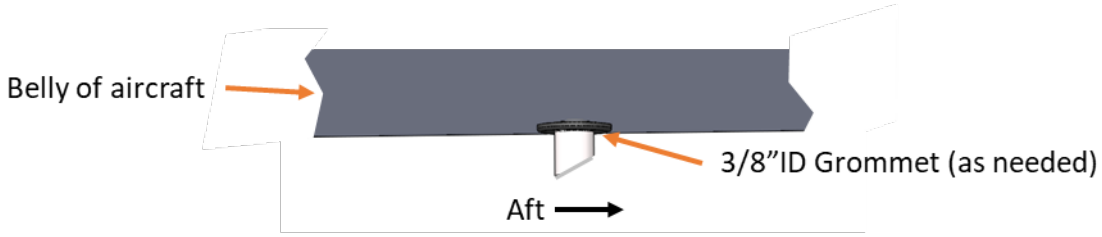
3. Install the supplied stainless-steel elbows to the battery vent tube stubs. Be sure the entire barbed part of the elbow is completely inserted into the tubing.
4. Cut two pieces of the supplied ¼" ID tubing to a length of 6 inches. Then, connect to each of the stainless elbows already installed on the battery.

5. Attach each of the two loose ends of the ¼" ID tubing to the supplied 3/8" wye fitting.

6. Connect the 3/8" tubing to the wye fitting and route to an inspection plate in the belly of the aircraft aft of the battery (see representative routing below, slight variation between models). The 3/8" tubing will run from the battery along the horizontal frame tube to the aft of the aircraft inspection plate. The 3/8" tubing is secured to the frame tubing with Adel clamps.



7. Drill a 9/16" hole through the center of the inspection plate in the belly of the tail section. Install a 9/16" grommet in the plate. Install a 3/8" elbow onto the vent tubing at the inspection plate hole location. Then connect a short piece of 3/8" tubing to the elbow which will feed down thru the grommet to outside the aircraft. Use RTV Silicon to secure tube at the inspection plate grommet if required. Then cut the exhaust tubes to length; at least 9/16" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft.



Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.

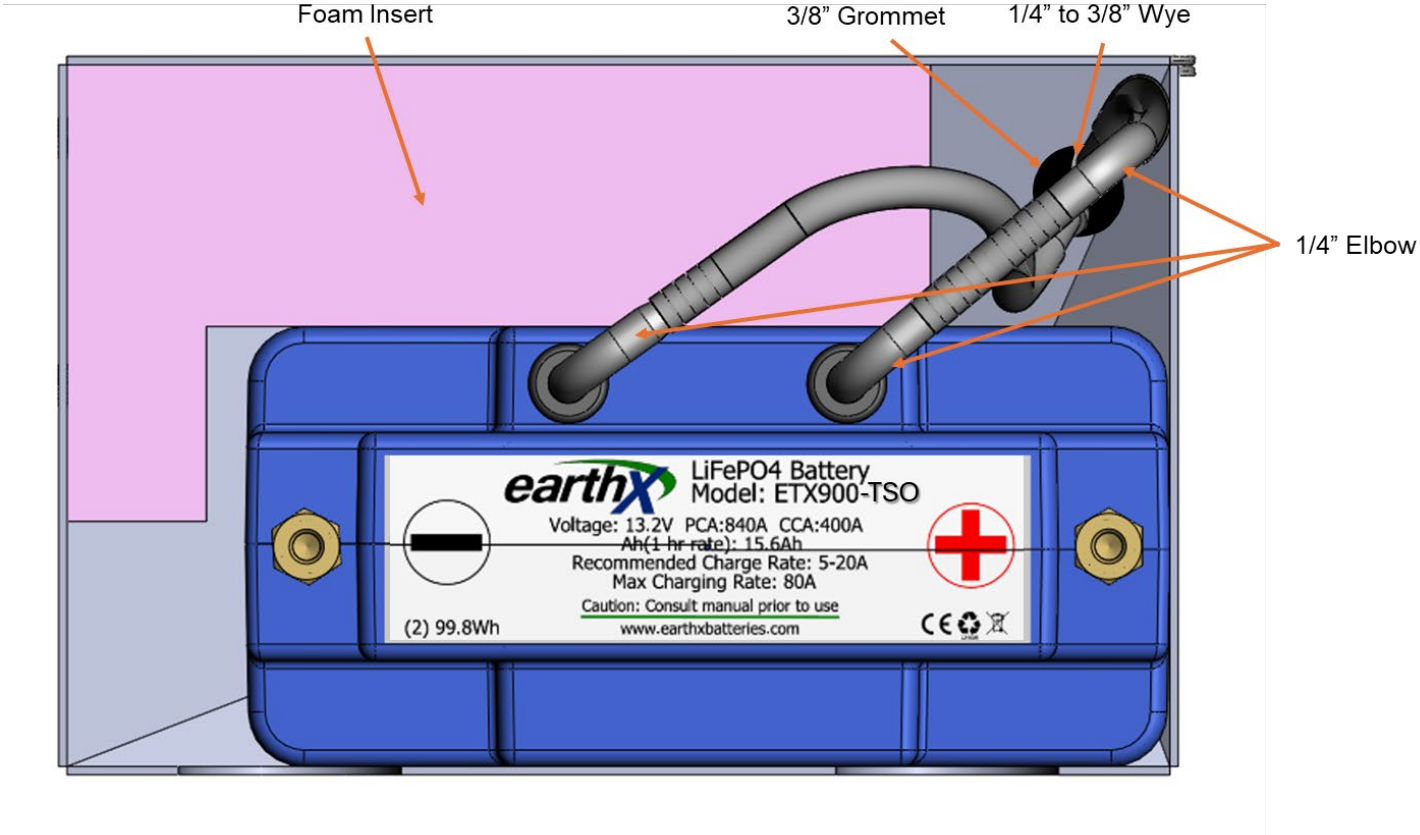
Appendix J: Cessna 172

Install Parts Kit:
ETX900-TSO-25-KIT (note not all parts are required)

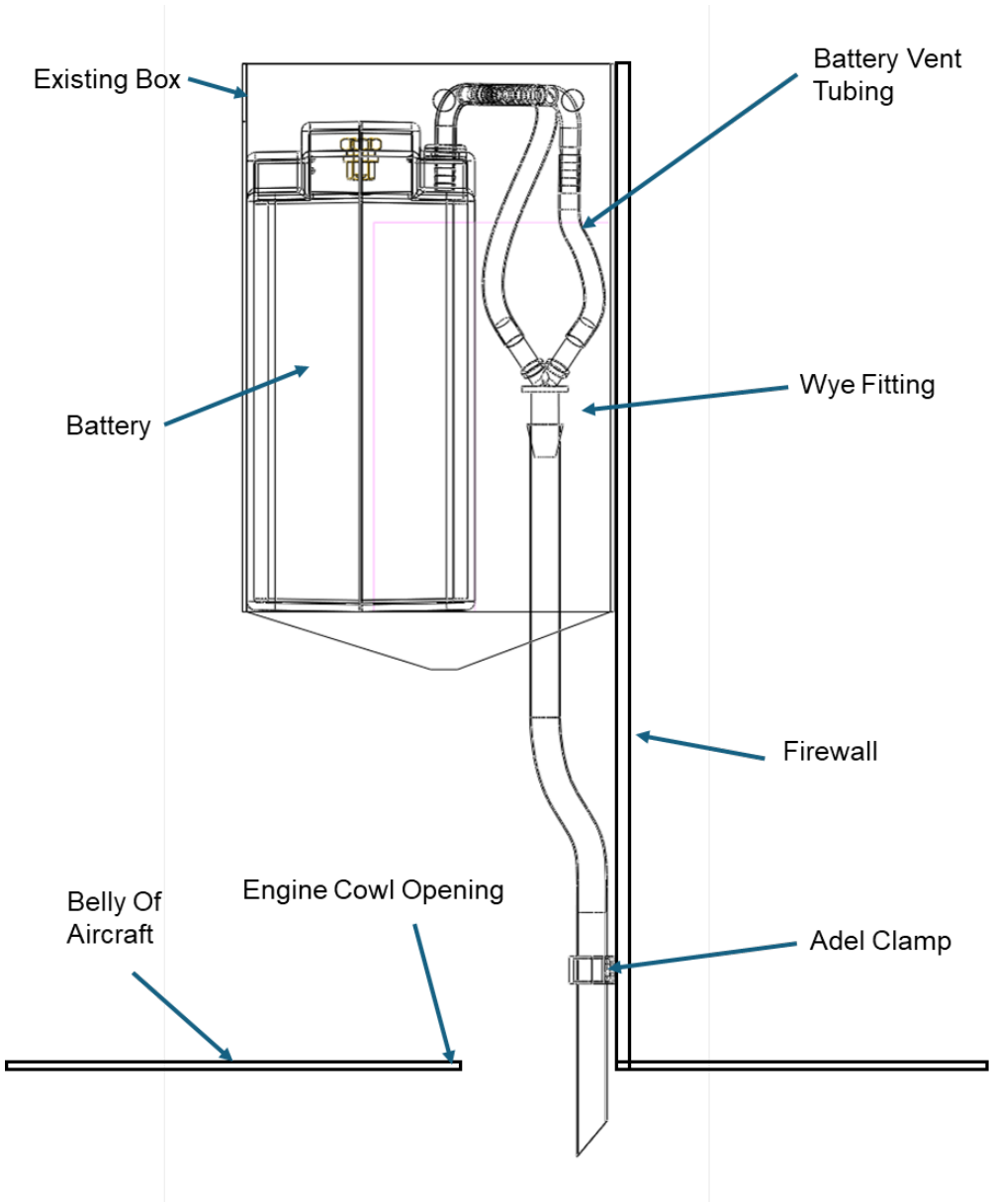
Fault/Status Indicator (LED) Install Procedure
Install the indicator LED per the instructions in the Appendix i.

Battery and Vent Tubing

1. Drill a 9/16" diameter hole though the bottom corner of the existing battery box (see image below). Install 9/16" grommet for 1/16" panel thickness at that hole.
2. Install the supplied stainless-steel elbows to the battery vent tube stubs. Be sure the entire barbed part of the elbow is completely inserted into the tubing.
3. Route ¼" tubing from the battery per the figure below to the 3/8" wye fitting, with an additional ¼" elbow to make the tight radius. Connect a 2-foot piece of 3/8" tube to the wye fitting.
4. Place the battery with vent tubes and L-Shaped foam insert into the battery box while routing the 3/8" vent tube though the grommet in the bottom of the box. Ensure the battery is on the side of the battery box closest to the battery cables.



5. Use the supplied 3/8" tubing and 3/8" elbows (as needed) to route the 3/8" tubing from the battery box though existing Adel clamps to the lower cowl opening. Then cut exhaust tube to length; at least 1" should be exposed on the outside of the aircraft. Cut the tube at an angle towards the aft of the aircraft (see image below).



Vent Tube Installation Notes:

- The route of vent tubes should include a vertical and or downward sloping section, so condensate drains to the outside of the aircraft.
- Be careful not to crush or restrict flow through the tubing.
- Only EarthX supplied tubing should be used. The tubing is chemical resistant and rated for 400°F.