



## **INSTRUCTION - PREHEAT INSTALLATION**

**TSTPW100-2209 SERIES PREHEAT KITS**

**DOCUMENT No.: TNT2209, REV. B**

**DATED: SEP-05-2014**

**FOR**

**PRATT AND WHITNEY  
PW100 TURBOPROP ENGINES  
118/120/121/123**



### **PROPRIETARY DATA**

Tanis Aircraft Products proprietary rights are included in the information disclosed herein. The recipient by accepting this document agrees that neither this document nor the information disclosed herein nor any part thereof shall be reproduced or transferred to other documents or used or disclosed to others for manufacturing or for any other purpose except as specifically authorized in writing by Tanis Aircraft Products.

## RECORD OF REVISIONS

*When updated, this document is changed in its entirety.*

REV	DATE	DESCRIPTION	BY	RELEASE
B	SEP-05-2014	Change to LED indicator light	GDO	
A	NOV-20-2013	Initial Release	DNE	DNE

## CONTENTS

<b>RECORD OF REVISIONS .....</b>	<b>2</b>
<b>CONTENTS .....</b>	<b>2</b>
<b>1. PURPOSE .....</b>	<b>3</b>
<b>2. REQUIREMENTS.....</b>	<b>3</b>
2.1 Sourced Separately .....	3
<b>2.2 Tools.....</b>	<b>4</b>
<b>3. DESCRIPTIONS.....</b>	<b>4</b>
3.1 Power Requirements .....	4
3.2 Operation .....	4
3.3 Options.....	4
3.4 Inspection and Cleaning .....	4
3.5 Weight and Balance .....	5
3.6 Electrical Values .....	5
<b>4. INSTALLATION .....</b>	<b>5</b>
4.1 Overview .....	5
4.2 Standards.....	5
4.3 Elements .....	6
4.4 Suggested Cable/Wire Routing.....	7
<b>5. TABLES AND FIGURES .....</b>	<b>8</b>
<b>6. COMPLETION CHECK LIST .....</b>	<b>15</b>
<b>7. SIGN OFF.....</b>	<b>16</b>

## 1. PURPOSE

The purpose of this instruction is to provide guidance for the installation of the preheat kit listed on the cover page of this document. It is the responsibility of the technician and/or maintenance/repair facility performing the installation to read this instruction, become familiar with all processes, and resolve conflicting issues before proceeding. Final judgment regarding the proper installation and inspection details are the responsibility of the authority releasing the aircraft for service. Contact Tanis engineering for design change approvals as needed (952-224-4425).

**Note:** *This instruction is for the installation of both 115 Volt and 230 Volt kits. The last numbers in a part number sequence (after the dash), represent the voltage requirement 115 or 230, and may be omitted in narrative. Example: TU02615- (115 or 230).*

**All Referenced Tables and Figures are found in Section 5.**

## 2. REQUIREMENTS

Retrofitting of this aircraft with the Tanis preheat kit is to be accomplished by certified technician or maintenance/repair facility.

Installation is to be in accordance with (IAW) AC43.13-1b, industry standards, acceptable methods, techniques and practices, airframe/engine manufacturer's recommendations, and approved procedures set in place by the installing authority. Securing, tying, and clamping of wire/cable is to be IAW AC43.13-1b Chapter 11, Section 9 through 12. Grounding and bonding IAW AC43.13-1b Chapter 11, Section 15. Feed-through penetration IAW AC43.13-1b Chapter 11, Section 17.

For global standardization of power connection point (shore power plug), a non-locking blade type NEMA connector is used (Figure 1). A corresponding receptacle connector (supplied for field installation with 230-volt kits), is required on power supply (extension cord). Approved receptacles are available through Tanis (TP02872-115, TP02829-230).

Installation requires clear access to the engine. Work is to be performed in a clean environment under standard temperature conditions of 18°C / 65°F to 27°C / 80°F.

Installation times vary depending on shop procedures, plug location and installation options.

Required supporting documents listed in Section 5, Table 1.

Record system information as indicated in Operating Guide and ICA.

### 2.1 Sourced Separately

Due to shelf life limitations, pad heat element bonding sealant is sourced at time of installation. Refer to element Bonding Instructions for approved sealant (Table 1).

Power supply and shore power connection (extension cord) is supplied by operator.

Tools, consumables, finish materials, installation hardware, brackets, lacing, and various MS21919 cushion clamps are sourced separately. Cushion Clamp and their suggested application are listed in Table 2.

## 2.2 Tools

Required: Ohmmeter certified to traceable standard.

Suggested: Connector tool DT-RT1, Crimp tool, Tanis TU02793, or DMC: AF8-TH163.

## 3. DESCRIPTIONS

Preheating is a cold weather aviation procedure that increases reliability and safety of operations, reduces torque oscillations, thermal stress, warm up, and launch times.

Engine preheating is accomplished through electrical resistance heat in the form of thin pads sized and shaped to fit various parts. The pads are surface mounted with a bonding adhesive. This includes engine accessory and reduction gearboxes, fluids, and attached accessories. Power is routed to the heat elements through a dedicated wiring assembly with power indication and circuit overload protection. System is self-regulating through design. Heated components reach an average state of thermal equilibrium in approximately six hours.

### 3.1 Power Requirements

System does not operate in flight and is not connected to or dependent on aircraft systems.

Ground based power source capable of supplying or producing required voltage and load for duration of operation is required, commonly AC (alternating current).

System design is for operation at plus or minus 10% of system voltage requirement.

Voltage and load requirements are listed Section 5, Table 3.

### 3.2 Operation



**Caution:** Only operate the system after completing Completion Check List in Section 6, and verifying fluids are at operating levels.

Connection to ground power controls operation, reference Operating Guide (Table 1), for connection procedures and extension cord requirements.

### 3.3 Options

Specific operational requirements may require modifications or additional elements. In addition, avionics and battery preheat is suggested. Heating of avionics allows for proper glass panel activation, reducing condensation build up and cold weather induced gyroscopic errors. Battery heating reduces freeze point depression, allowing higher amperage outputs and proper charge.

Modification and/or additional kits are available for installation with base kit.

Total operational load not to exceed 12-Amps.

### 3.4 Inspection and Cleaning

Instructions for Continued Airworthiness (Table 1), lists inspection and cleaning procedures. All processes are in accordance (IAW) with aircraft/engine manufacturer's recommendations, and 43.13-1b Chapter 11, Sections 1, 3, 4, 8, and 9.

The Airworthiness Limitations section of the FAA specifies inspections and other maintenance required by 14 CFR Part 43.16 and 91.403, of the Federal Aviation Regulations unless an alternative program has been approved.

### 3.5 Weight and Balance

Record modification by updating the aircrafts equipment list and/or flight manual. As required, include an adjustment to the weight and center of gravity (CG) for the preheat kit. Approximate installed weight is 3.5 pounds (lb), use engine CG moment arm.

### 3.6 Electrical Values

Preheat system and individual element values listed in Table 3.

\*Note: Battery elements vary and are not supplied with engine kit. Commonly installed battery elements are listed for reference.

## 4. INSTALLATION



**Caution:** For personal safety and system integrity, only operate the system after completing Completion Check List in Section 6, and verifying fluids are at operating levels.

All components are to be installed in a manner that allows for proper inspection and maintenance. Installation is not to interfere with other systems such as engine or flight controls.

Note: Record system information as indicated in Operating Guide and ICA.

Referenced documents and figures are found in Section 5 - Tables and Figures.

### 4.1 Overview

- a. Review all instructions and documents included with this kit.
- b. Weigh kit contents and intended installation hardware.
- c. Access engine and identify installation sites for elements, junction, shore power plug, power indicator, fused link, and cable routing.
- d. Install components per instructions.
- e. Verify installation by completing checklist in Section 6.

### 4.2 Standards

Installation is to follow 43.13-1b, and airframe/engine manufacturer's procedures.

- a. Wires and cables are to be supported by suitable cable ties, clamps, grommets, or other devices at intervals of not more than 6 inches apart except when contained in ducts or conduits.
- b. Do not allow connectors to free hang. Properly secure wires and cables so movement is restricted to the span between the points of support and not on the connectors.
- c. Supporting devices should be of a size and type, with the wires and cables held securely in place without damage to the insulation.
- d. Adequately support and secure wire and connectors to prevent excessive movement in areas of high vibration.
- e. Route, wiring and cabling with enough slack to compensate for movement of shock mounts.
- f. Route, cable/wire in a manner that ensures system components are not in close proximity to high heat sources and use fire sleeve to protect wiring and connectors in questionable high heat areas.
- g. Where practical, route wires and cables above fluid lines, and provide separation from fuel lines. Such wiring should be closely clamped and rigidly supported and tied at intervals

such that contact between lines and related equipment would not occur in the case of a broken wire and/or a missing wire tie or clamp.

- h. Check for proper installation of engine to airframe ground strap bonding.
- i. To compensate for routing options, it is acceptable to service loop, racetrack, or shorten cables by cutting and re-terminating with appropriate connector, or lengthen with extension cable.
- j. Use existing feed-through and fire barrier penetrations whenever possible. Feed-through penetrations are to be IAW with 43.13-1b Chapter 11, section 17. If routing requires a new fire barrier penetration use Tanis Fireproof Grommet TG01056, Firewall connector kit TU03030, or approved fitting.

#### 4.3 Elements



**Caution:** Contact with hot element can cause 2nd degree burns.

Verify element resistance before installing (Table 3).

Abbreviations: RGB (Reduction Gearbox), AGB (Accessory Gearbox), PRGB (Prop Reduction Gearbox)

Qty	P/N	Pad heat element location and orientation (Figures 7 through 12)
2	TEP2650	RGB sump (forward of air intake) just forward of case split one left and right, leads inboard.
1	TEP2685	AGB sump (aft of air intake), lead right.
1	TEP2686	RGB sump (just aft of engine mount), lead inboard.
1	TEP2687	RGB sump (just aft of engine mount), lead inboard.
1	TEP2877	PRGB lower.
1	TEP2878	PRGB upper.

Varies Battery heat element(s) ordered separately, varies by order (Figure 2).

Battery element installation does not use bonding sealant. Wrap element around the perimeter of vertical surface with flat side toward battery. Element ends should not overlap. Use cable-ties or appropriate lacing, and gently lace element in place. Pull lacing gently and alternate tension between grommets while avoiding power lugs and sensor connector. Adaptor panel (TB02645) may be supplied for fitting around terminal and sensor contacts. While lacing element in place, do not pull too hard, this could result in pulling grommets out. For installation and maintenance information refer to, battery ICA listed in Table 1

#### 4.4 Suggested Cable/Wire Routing

Locating and mounting of the power plug is commonly the most involved part of installation and is at the discretion of the installer. Depending on location and mounting options, installation of the shore power plug and circuit protection may require additional sheet metal and/or brackets. Plug may also be installed with existing shore power connections.

- a) Layout cabling/wiring. Components and cabling are labeled and identified as depicted in the item list and cable kit wire diagram.
- b) Identify location for system power plug, fused link, and indicator light. Common location for the plug is in a fabricated bracket or existing inspection panel on the side of each engine nacelle. A circular free hanging power plug can be secured to an engine mount accessible through cowl door or access panel (Figures 2, 3, 5, and 6).

**Note:** Optional circular plug for mounting with cushioned clamps available (TP02770-115, TP02980-230). For power lead disconnect, install 3 contact connector kits (TCS2603 and TCP2603), Reference Cable Kit - Wire Diagram (Table 1).

- c) Note: 230 Volt kits are supplied with power plug adapter (TP02829-230) for installation on extension cord supplied by the operator.
- d) Connect the systems ground wire (green) to a grounding location adjacent to the power plug, or on engine, preferably on existing ground lug.
- e) Identify mounting location for the cable junction that allows junction cable leads to reach corresponding elements. Cabling and Junction can be mounted using cushioned clamps and standoffs as depicted (Figures 5 and 6).
- f) Using the cabling diagram for reference, identify numbered leads from junction route as follows:
  - 01 - Primary power lead, from shore power plug through circuit protection to junction.
  - 02 - Power indication lead, returns from junction to light located near power plug.
  - 03 - PRGB lead, with secondary for elements located on front of engine.
  - 04 - AGB lead, for sump element aft of air intake.
  - 05 - RGB lead, with secondary for forward sump elements aft of engine mounts.
  - 06 - RGB lead, with secondary for aft sump elements forward of air intake.
- g) Once locations for the above are verified install and mount as indicated.
- h) Affix the placard (Figures 1 and 4) or equivalent stating at a minimum; *Tanis*, and the *system voltage*, near the shore power plug.
- i) Perform functional test by completing checklist in Section 6, and sign off in Section 7.

## 5. TABLES AND FIGURES

**TABLE 1** - Supporting Installation Documents

2209	Preheat Kit - Item List
02893	Cable Kit - Wire Diagram
TFMS2209	Operating Guide (FMS)
TICA2209	Instructions for Continued Airworthiness
TICA2800	ICA - Battery Heat Kit (Supplied with battery kit)
TN02070	Instruction - Shore Power Plug
TN02782	Instruction - Click bond
TN02788	Instruction - Pad Bonding
TN02793	Instruction - Connector (Termination and Assembly)
TN03039	Instruction - Indicator

**TABLE 2** - Cushioned Clamp Reference. (Alternate: MS21919WCH-)  
(Clamp sizes vary by manufacturer, properly size for secure fit)

<u>Size</u>	<u>MS number</u>	<u>Application</u>
1/8"	MS21919WDG-2	1 - 2 wire
1/4"	MS21919WDG-4	2 - 3 wire
5/16"	MS21919WDG-6	Indicator light
5/8"	MS21919WDG-10	2 contact connector
7/8"	MS21919WDG-14	3 contact connector and fused link
1"	MS21919WDG-16	4 lead junction
1 3/16"	MS21919WDG-19	6 lead junction (WCH-18)
1 1/2"	MS21919WDG-24	Circular shore power plug

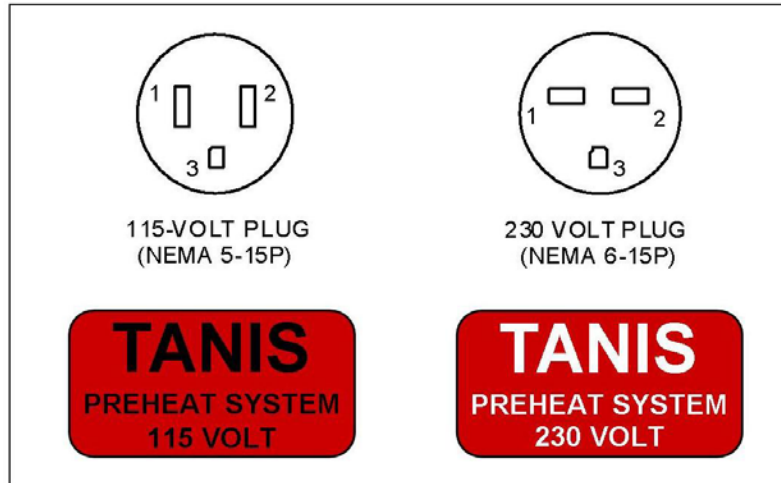


**TABLE 3 - Electrical Values +/- 10%**

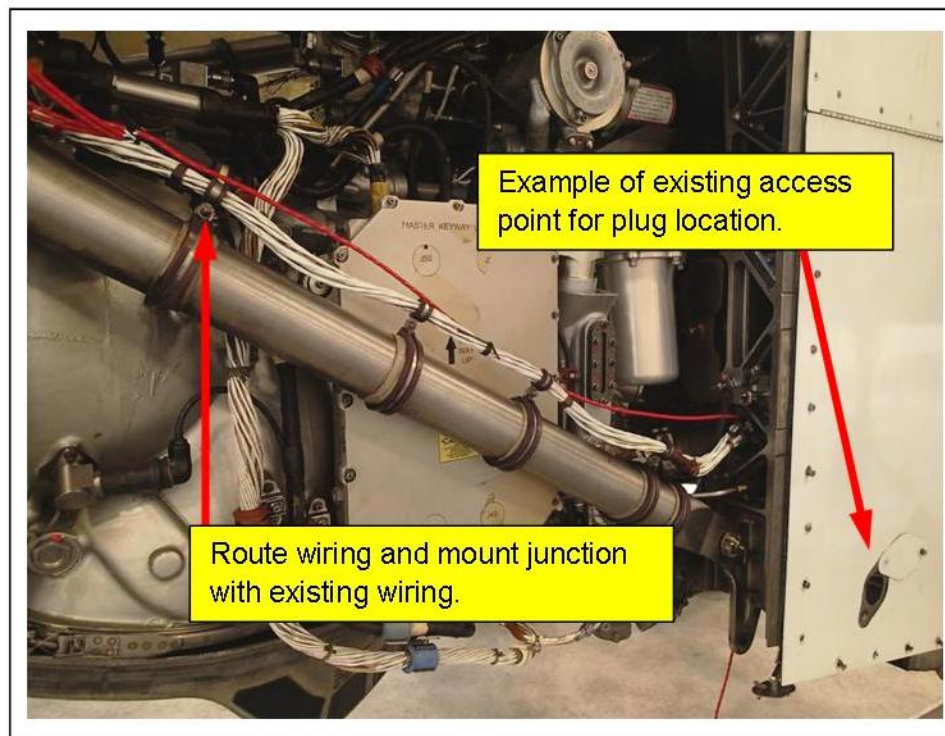
\* Reference; battery heat elements ordered separately and vary by installation.

<b>115 Volt System</b>	<b>10.0 Amps</b>	<b>1150 Watts</b>	<b>11.5 Ohms</b>
Qty	Element P/N:	Wattage	Ohms
2	TEP2650-115/120	120	110.2
1	TEP2685-115/280	280	47.2
1	TEP2686-115/150	150	88.2
1	TEP2687-115/150	150	88.2
1	TEP2877-115/210	210	63.0
1	TEP2878-115/120	120	110.2
*	TBP2646-115/60	60	220.4
*	TBP2648-115/74	74	178.7

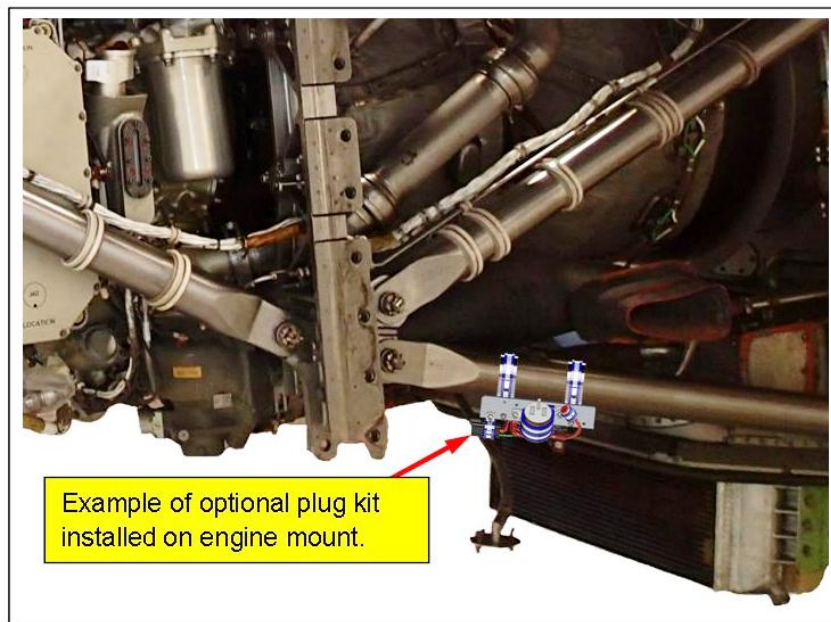
<b>230 Volt System</b>	<b>5.0 Amps</b>	<b>1150 Watts</b>	<b>46.0 Ohms</b>
Qty	Element P/N:	Wattage	Ohms
2	TEP2650-230/120	120	440.8
1	TEP2685-230/280	280	188.9
1	TEP2686-230/150	150	352.7
1	TEP2687-230/150	150	352.7
1	TEP2877-230/210	210	251.9
1	TEP2878-230/120	120	440.8
*	TBP2646-230/60	60	881.7
*	TBP2648-230/74	74	714.9



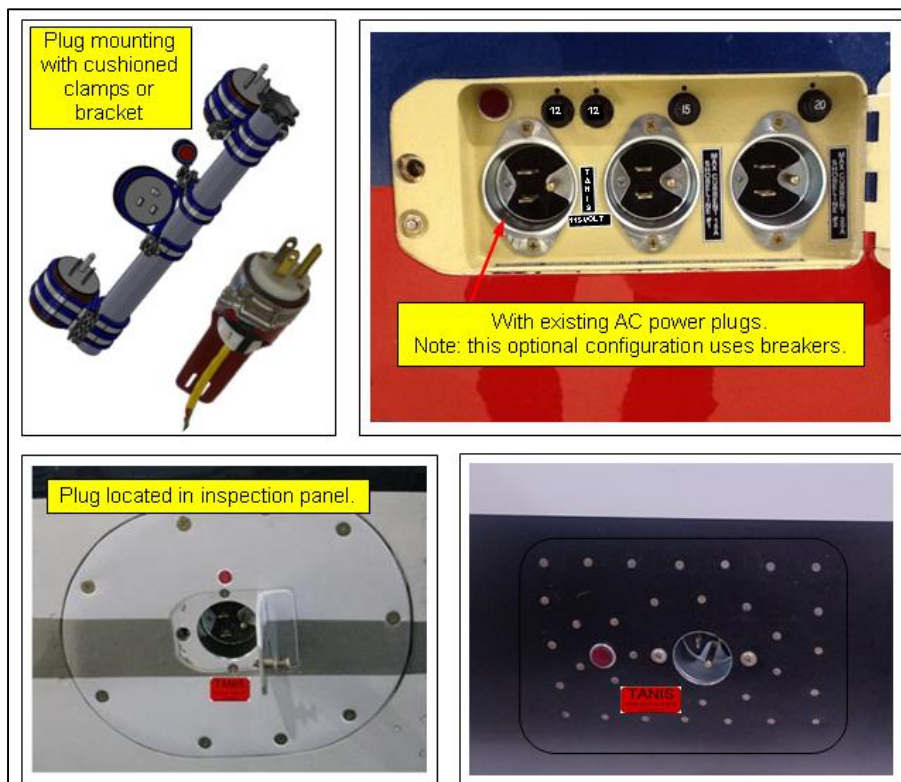
**Figure 1** - Power connection. Shore power plugs and placards.  
Alternate placard stating *Tanis and voltage requirement* is acceptable



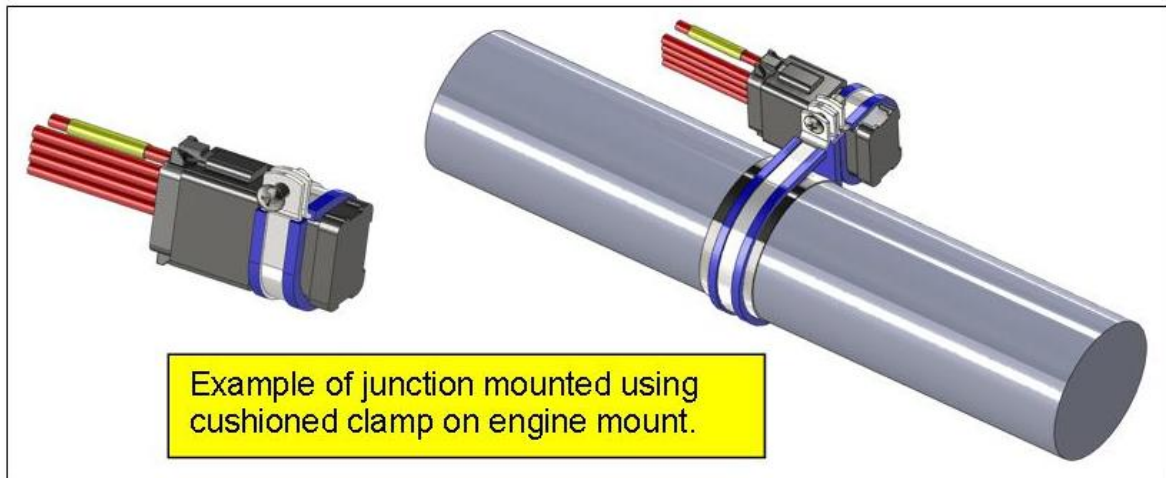
**Figure 2** - Suggested routing for wiring is on the left side of the engine with existing wiring. Example shown has the junction mounted with existing clamp.



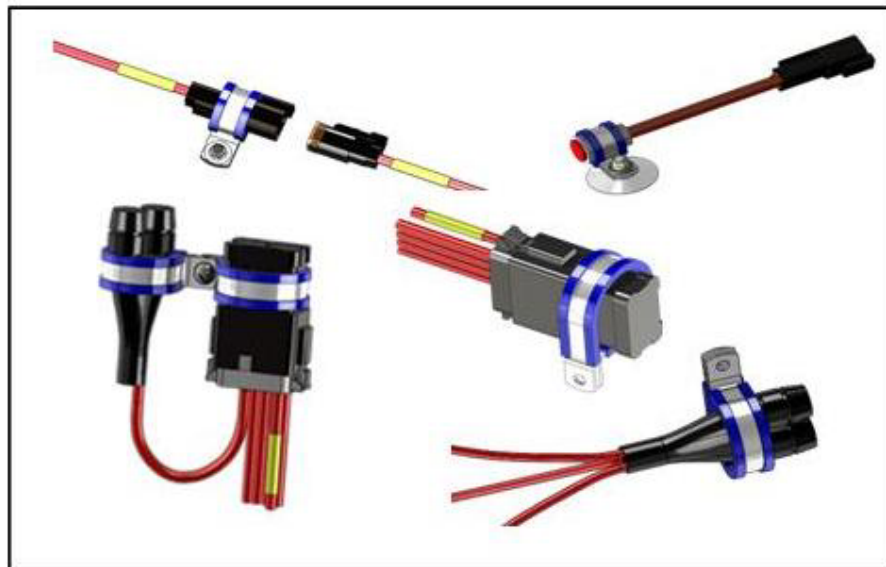
**Figure 3** - On some installations, the shore power plug can be mounted using optional bracket for circular plug (TD02983), to be installed on left lower nacelle strut behind access in cowl (Figure 2).



**Figure 4** - Examples of circular and flush plug mounting options. When installing in panel or cowl, suggest adding connector (TCP2603 and TCS2603), in power lead to aid in inspection panel removal and/or engine access.

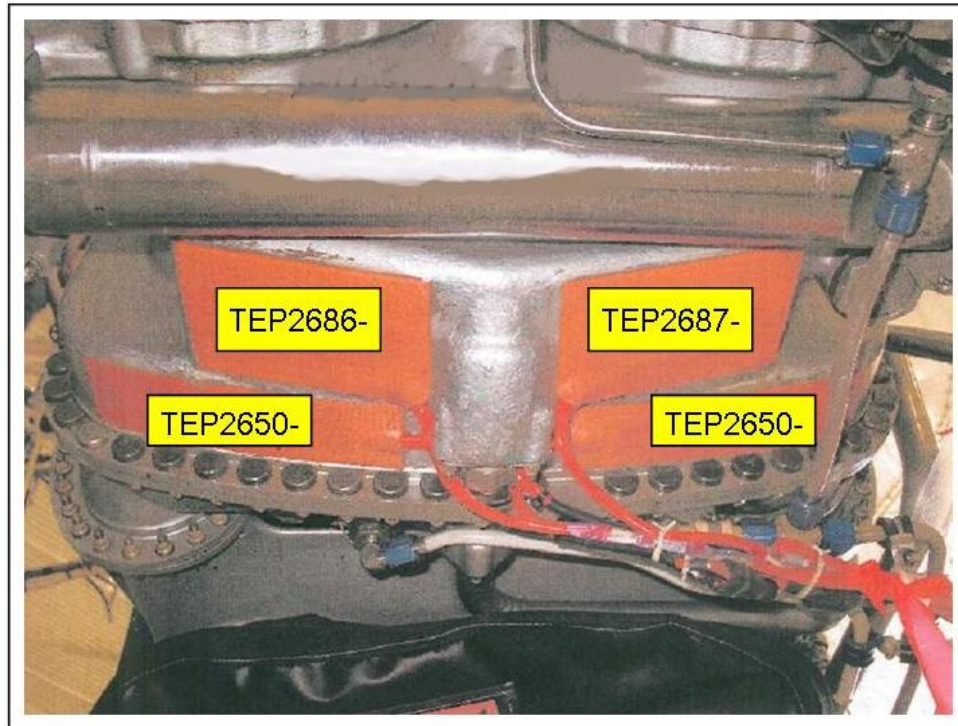


**Figure 5** - Securely mount cable junction. Example shown is on engine mount with cushioned clamp. Note: properly protect engine mount with F-4 self fusing tape (SFT), Teflon or by other approved means.

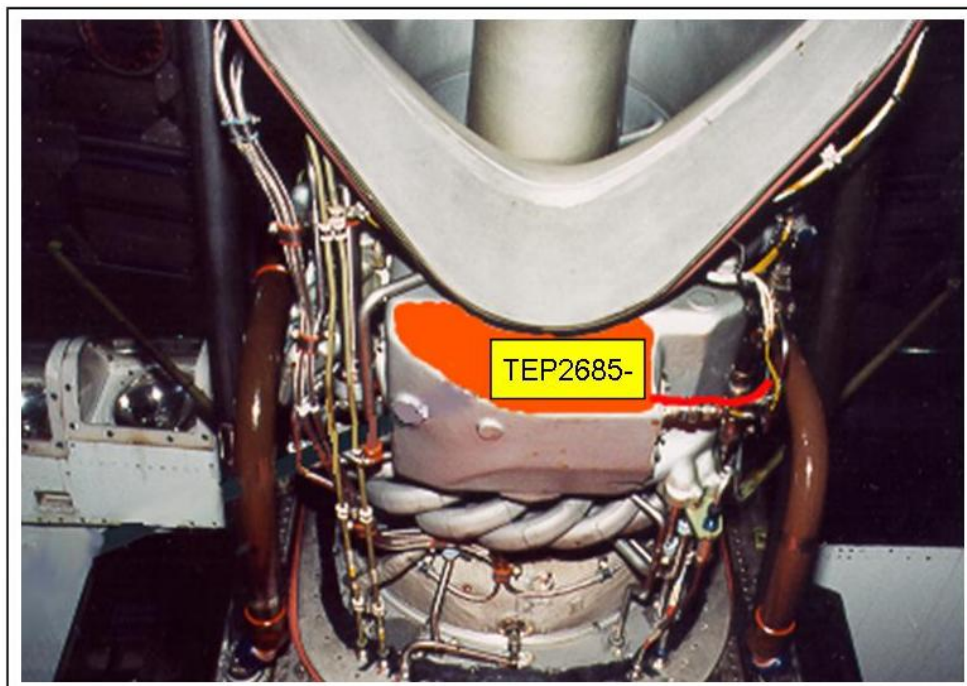


**Figure 6** - Clamp positions, connectors, optional light, junctions, and fused link.





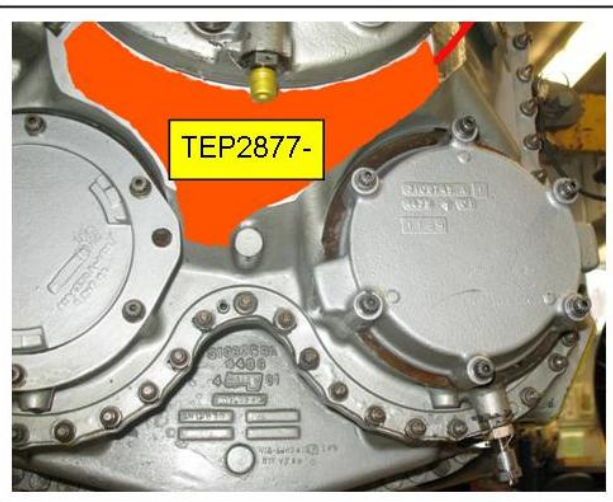
**Figure 7** - RGB elements located on sumps forward of air intake, lead orientation may vary depending on routing options. Leads shown routed left with scupper lines.



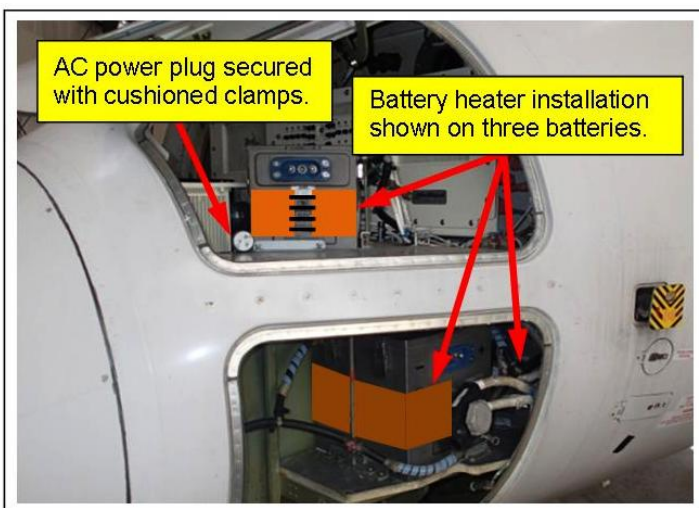
**Figure 8** - AGB sump element located forward surface (aft of air intake), lead left with existing wiring.



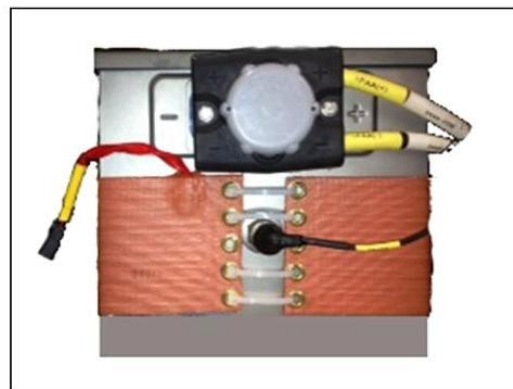
**Figure 9** - PRGB element, located on conical area upper left side, lead left.



**Figure 10** - PRGB element, located on conical area lower center, lead left.



**Figure 11** - Battery kit supplied separately due to variations in battery configurations and locations. Battery system can be interconnected with engine preheat systems.



**Figure 12** - Generic example of battery heater installed.

## 6. COMPLETION CHECK LIST



Caution: Do not touch hot elements they can burn bare skin.

Before proceeding, verify system is not powered, or connected, to a power source.

Verify that all elements are properly connected and bonding sealant is cured.

Follow in sequence, record as indicated, and check off when completed.

If a discrepancy is found, correct before proceeding to the next step.

\* Skip this procedure if optional battery heat kit is not connected to or installed with this kit.

[ √ ] Check the system as follows:

- 1) [ ] Verify system components are installed in accordance with kit installation instructions.
- 2) [ ] Verify engine to airframe bonding is as per OEM requirements.
- 3) [ ] Verify preheat system ground by checking for continuity between shore power plug ground, pin 3 (Figure 1), engine, and airframe.
- 4) [ ] Using an ohmmeter, verify there is no continuity between shore power plug pins 1 and 2, and the ground pin 3.
- 5) [ ] Using an ohmmeter, measure and record resistance between the plug power pins 1 and 2, and recorded resistance: \_\_\_\_\_, compare with Table 3.
- 6) [ ] Connect the system to appropriate AC power source.
- 7) [ ] Verify the system power indicator light on (Illuminated).
- 8) [ ] Within 30-minutes, area adjacent to the elements should feel warm. Check each element individually.
- 9) [ ] \* While the system is warming up, freeze (0°C) the battery thermo control and test battery heat element for heat. This element can be touched, as wattage density is low.
- 10) [ ] Update/modify weight and balance, and installed equipment lists (Section 3-5).
- 5) [ ] Complete/fill-in blanks as indicated on first and last pages of Operating Guide listed in Table 1, and file with POH/AFM..
- 6) [ ] Complete/fill-in blanks as indicated in Instructions for Continued Airworthiness (ICA), and file with aircraft manuals and logs.
- 11) [ ] Make a log entry to comply with 14 CFR Part 43.9 or other procedures set in place.
- 12) [ ] Complete and return Registration/Warranty Card.
- 13) [ ] Complete Sign Off in Section 7.

## 7. SIGN OFF

The undersigned found the system installed and operating correctly.

Date: \_\_\_\_ / \_\_\_\_ / \_\_\_\_

### **Preheat Kit**

Part Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

### **Airframe**

Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Registration: \_\_\_\_\_

### **Engine**

Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Serial Number: \_\_\_\_\_

System test performed by: \_\_\_\_\_

(Signature)

\_\_\_\_\_  
(Printed name, title and certificate number, if applicable)

\*\*\*\*\* NOTHING FOLLOWS \*\*\*\*\*