



INSTRUCTION - PREHEAT INSTALLATION

Document No.: TNP3172 REV. B

Dated: DEC-06-2016

TSP4CYL-3172 Series Engine Preheat Kits



Continental Motors

CD-230

4 Cylinder Jet-A Diesel

(4HOA TD-300 Series)

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 - 952-224-4425.

RECORD OF REVISIONS

When updated, this document is changed in its entirety.

REV	DATE	DESCRIPTION	BY	RELEASE
B	DEC-06-2016	Revise per installation qualification	DNE	
A	OCT-24-2016	Initial Release - Prototype	GDO	DNE

CONTENTS

RECORD OF REVISIONS	2
CONTENTS	2
1. PURPOSE	3
2. REQUIREMENTS.....	3
2.1 Materials	4
2.2 Tools	4
2.3 Power	4
3. DESCRIPTION	4
3.1 Physical Attributes	5
3.2 Technical Specifications	5
3.3 Weight and Balance	5
3.4 Operation	5
3.5 Maintenance	5
3.6 Options.....	5
4. INSTALLATION	6
4.1 Overview	6
4.2 Standards.....	6
4.3 Elements	7
4.4 Cable Routing	8
5. TABLES AND FIGURES	9
6. FUNCTIONAL SYSTEM CHECK.....	17
7. SIGN OFF.....	18

1. PURPOSE

The purpose of this instruction is to provide guidance for the installation of the Tanis Preheat Kit listed on the cover page of this document.

- The kit may be installed in conjunction with airframe or engine manufacturers instructions (SB or IPC) when available.
- 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.

Note: This instruction is for the installation of both 115 Volt and 230 Volt kits. Letters before and after the 4 digit drawing number are modifiers used for article configuration and maybe omitted in narratives. Example: TEP2653-115/40 = **Tanis Element with a Pin connector (2653)** 115-volts / 40-watts.

2. REQUIREMENTS

Required documents, and referenced figures and tables located in § 5.

Installation shall be:

- Accomplished by qualified technician or maintenance/repair facility
- IAW (In Accordance With) current regulatory requirements 14 CFR 33, AC 43.13-1 and 2 (as amended), approved procedures set in place by the installing authority, and Continental Installation and Operation Manual OI-30.
- AC 43.13-1 Chapter 11 references: Routing, securing, tying, and clamping §§ 9 through 12, Grounding and bonding § 15, Wire marking § 16, and feed-through penetrations § 17
- Performed in a clean environment under standard temperature conditions of 18°C / 65°F to 27°C / 80°F
- Installation requires clear access to the engine
- Installation time – with cowl off – is generally in the range of 2 to 5 hours, however may vary due to a wide range of variables refer to § 5
- All components used in association with this kit shall be of aeronautical quality: AN, MS, MIL, NAS, NSN, etc.
- For global standardization and safety of operations shore power inlet is a non-locking blade type NEMA plug (Figure 2)
- Corresponding receptacle (outlet) connector is required on power extension cord (supplied for field installation with 230-volt kits). Approved outlets - TP02872-115, TP02829-230
- Modifications and Options (§ 3.6):
 - a. Composites alterations (plug door and bracket installations), follow approved airframe manufacturer procedures and reference AC 43.13-1 (as amended) Chapter 3 as needed. When riveting use appropriate size blind rivets (Blind Cherry MS, CR and NAS series aluminum or Monel as appropriate, assemble wet and seal A/R with PS 870 or equivalent (MIL-PRF-81733).

- b. Sheet metal alterations (plug door and bracket installations), AC 43.13-1 (as amended) Chapter 4, Section 4 as needed. Use appropriate rivets per installation. For structural installations, rivet layout is patterned after a small patch, similar to Figure 4.16 of AC 43.13-1 (as amended). Assemble wet and seal A/R with PS 870 (PR 1422B-2) or equivalent OEM approved corrosive inhibitor sealant.
- c. AV heater installation, AC 43.13-2 (as amended) Chapters 1 and 2 for structural consideration and examples equipment mounting options (mounting is to be consistent with installation methods, techniques and practices for avionic components).

2.1 Materials

Installation may require additional hardware, consumables, finish-materials, brackets, lacing, various MS21919 cushion clamps (Table 2).

- Pad element bonding sealant is sourced at time of installation. Approved adhesive sealants and element installation procedures called out in Instruction - Bonding (Table 1)
- MS35489-35 or appropriately sized MS series grommet may be required for baffle penetration (Figure 11)

2.2 Tools

Various standard aviation hand tools are required and are not supplied.

Required:

- Ohmmeter certified to traceable standards.
- 1/4 inch drive torque wench certified to traceable standards.
- TU02905-05 1/2 inch Slotted Socket or equivalent.

Suggested tools for alternations and repairs include:

- Deutsch contact remover tool: DT-RT1
- Tanis 4 way indent crimp tool: TU02793
- Alternate crimp tool: DMC - AF8-TH163 or equivalent

2.3 Power

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

- Ground based power source capable of supplying or producing required voltage and load for duration of operation
- Voltage and load values listed § 5, Table 3

3. DESCRIPTION

Preconditioning is a procedure commonly referred to as preheating, which is a cold weather aviation procedure that is preformed while on the ground prior to flight.

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

- Preheating increases reliability and safety of operations, and reduces run-up times.
- System is self-regulating, does not operate in flight, and is not connected to or dependent on aircraft systems
- Heated components reach average state of thermal equilibrium in approximately six hours

3.1 Physical Attributes

Electrical resistance heat elements located on engine crankcase, oil sump and coolers, and in each cylinder head, and, apply heat. Power is routed to elements through a dedicated wiring assembly with plug, power indicator light, and CPD (Circuit Protection Device).

3.2 Technical Specifications


System and individual element values are listed in Table 3.

3.3 Weight and Balance

Weight kit and all installation hardware before installing.

- Approximate installed weight: 1.0 pounds (lbs) / 0.45 Kilograms (Kg)
- Use engine arm for C.G. calculations
- Record installed weight and arm calculation in § 5 Table 4.
- New empty weight and corresponding C.G. location is to be calculated and entered in the aircraft permanent records

3.4 Operation

 **Caution:** Before connecting system to power complete Functional System Check in § 6 and review Operating Guide.

3.5 Maintenance

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

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.

Repair or modifications to system shall be from aeronautical quality components; AN, MS, MIL, NAS, NSN, etc.

3.6 Options

Specific operational requirements may require modifications and/or additional elements.

- Additional cabling, components and interconnect kits available
- AC outlet and AV heater cable kits: TC03071, TC03159
- Flush plug kit w/cap: TP02533-T-115, TP02822-T-230
- Door kit: TD02840 Single place, TD03097 2-place, TD03152 2-place
- Circuit protection: Fuse kit TU03141 or TU03141-B. Breaker: MS26574-10, MS3320-10, or Klixon 2TC49-10 for 115V, W23-X1A1G-10 for 230V
- Sealed power switch: MS35059-22 (8822K20)
- Firewall Connector Kit: TU03030, TU03125 (non pressurized firewall and bulkheads)
- Fireproof Grommet Kit: TG01056 (non pressurized firewall and bulkheads)
- Disconnect connector kits: TU02968, TU03047, TU03127 (5015/38999 crimp type disconnect)
- AV/Cabin Heater THP3094-500, allows for proper glass panel activation, reduces condensation, cold weather induced gyroscopic errors, and helps to clear windows of

frost, snow and ice

- Battery Heat (TSB2800) reduces freeze point depression and allows for higher amperage outputs and proper charge
- Contact Tanis Aircraft Products for additional options

4. INSTALLATION

Referenced documents, documents, tables and figures, located in § 5.

- Final installation is to be in compliance with § 2 Requirements
- Record system information as indicated in Operating Guide and ICA
- Preheat system and individual element values are listed in Table 3

4.1 Overview

- (1) Review all instructions and documents listed in Table 1.
- (2) Weigh kit contents and intended installation hardware.
- (3) Identify installation sites for elements, shore power plug, and cable routing.
- (4) Locate components per instructions route cable/wire.
- (5) Record and retain documents as indicated in Operating Guide and ICA.
- (6) Complete, Functional System Check and Sign Off (§§ 6 and 7).

4.2 Standards

Installation is to be IAW current regulatory requirements (AC 43.13-1B.) and airframe/engine manufacturer's procedures.

Listing below may supplement above procedures:

- (1) All components are to be installed in a manner that allows for proper inspection and maintenance
- (2) Installation is not to interfere with other systems such as engine or flight controls.
- (3) 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.
- (4) 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.
- (5) Supporting devices should be of a size and type capable of supporting wires and cables securely without damage to insulation.
- (6) Adequately support and secure wire and connectors to prevent excessive movement in areas of high vibration.
- (7) Route wiring and cabling with enough slack to compensate for movement of shock mounts.
- (8) 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.
- (9) 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.

(10) To compensate for routing options it is acceptable to service loop, racetrack, shorten or lengthen, wires/cables by cutting and re-terminating with appropriate contacts, splice or connector.

(11) Check for proper installation of engine to airframe ground strap bonding.

4.3 Elements



Caution: Do not connect elements to power until installed and Functional System Check has been completed.

- Verify individual element resistance before installing (Table 3).

Threaded elements:

1. Locate with reference to instruction TN02771 and applicable Aircraft Maintenance Manual.
 - a) Threaded elements are to be in full contact through element head and threads.
 - b) Elements are not to bottom out, or overextend more than 2-3 threads at tip.
 - c) Use only flat steel or aluminum washers and/or spacer as required.

Pad elements:

2. Locate with reference to instruction TN02788.
 - a) Pad elements must be in full contact through bonding sealant
 - b) Only install using approved sealants.
 - c) When installing consider oil drip points, lead orientation, and cable routing

Qty P/N Heater description - General location (reference § 5. for examples)

- | | | |
|---|----------|--|
| 1 | TEP2652- | Pad element – Oil cooler (Figure 6) |
| 1 | TEP2688- | Pad element – Air/oil heat exchanger (Figure 6) |
| 1 | TEP3175- | Pad element – Upper engine crank case, inboard of cylinders 1 and 2 (Figure 7) |
| 1 | TEP3176- | Pad element – Engine oil sump below nominal oil level (Figure 8) |
| 4 | TTP2771- | Threaded elements – Locate one each cylinder head (Figures 9 and 10). |

Battery and AV/Cabin Heaters supplied separately (Figures 13 and 14).

4.4 Cable Routing

Referenced documents, figures, and tables are located in § 5.

Routing is suggested - variations of engine configuration may require deviation

- Review cable kit wire diagram
 - Note: Avoid transitioning from engine to airframe. Power lead 01 may transition from engine when routing option allows for movement of shock mounts and shore plug is located off engine.
1. Shore power plug (Figures 1, 2, 3, 10, and 11):
Locate circular plug on forwarded side rear baffle with cushioned clamps, position to allow access through oil filler door. The plug is not to be allowed to free-hang. It must be securely located in a bracket or with cushioned clamps.
Note:
 - a) Plug shall be secured with bracket or clamps.
 - b) Final location TBD by installer.
 - c) Optional plug locations and configurations available.
 2. Indicator light (Figures 3 and 11):
Locate power indicator light TLP3039 in bracket TU03145 and secure with power plug and clamps or locate viewable location with or near plug, reference instruction TN03039.
 3. Ground-wire (Figure 11):
Bond ground wire on existing ground lug or on engine adjacent to plug.
 4. CPD (Circuit Protection Device) (Figures 4, 10, and 12):
Locate on left aft side of rear engine baffle adjacent to engine junction J-A, reference CPD drawing 03141.
 5. Junctions (Figures 4, 10, and 12):
J-A - Locate on left aft side of rear engine baffle with clamp adjacent to CPD.
J-B - Locate on right aft side of rear engine baffle with clamp
 6. Leads (Figures 1 through 12):
01 - Power lead routed through baffle between plug and junction J-A through CPD.
02 - Route between junctions J-A and J-B
03 through 10 - Route between corresponding cylinder head and cooler elements.
11 - Route with lead 02 to left side then through baffle with lead 01 to indicator light located with plug.
 7. Placard (Figure 2):
Affix on inside of cowl oil door or adjacent to plug.
 8. Verify all connectors are connected and leads are secure.
 9. Complete Functional System Check and Sign Off, §§ 6 and 7.

5. TABLES AND FIGURES

TABLE 1 - Supporting Installation Documents

03141	Drawing – Dual Fuse Kit (CPD)
03172	Drawing - Preheat Kit Item List
03173	Drawing - Cable Kit Wire Diagram
TN02793	Instruction - Connector
TN02788	Instruction – Bonding (elements)
TN02829	Instruction - Receptacle (supplied with 230-volt kits)
TN02771	Instruction - Threaded Element
TNP3172	Instruction – Preheat Installation (this document)
TCA0001	Instructions for Continued Airworthiness (ICA)
TPG0001	Operating Guide

TABLE 2 - Cushioned Clamp Reference. (Alternate: MS21919WCH / WCE)

(Clamp sizes vary by manufacturer, properly size for secure fit)

Size	MS number	Application
1/8"	MS21919WDG-2	1 - 2 wire
1/4"	MS21919WDG-4	2 - 3 wire
5/16"	MS21919WDG-5	8mm 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.

Preheat system and individual element values +/- 10%.

115 Volt kit			4.3 Amps	500 Watts	26.5 Ohms
Qty	Part Number	Location		Wattage	Ohms
1	TEP2652-115/50	Oil cooler		50	264.5
1	TEP2688-115/20	Air/oil heat exchr		20	661.3
1	TEP3175-115/150	Upper crankcase		150	88.2
1	TEP3176-115/80	Engine oil sump		80	165.3
4	TTP2771-115/50	Cylinder		50	264.5

230 Volt kit			2.2 Amp	500 Watts	105.8 Ohms
Qty	Part Number	Location		Wattage	Ohms
1	TEP2652-230/50	Oil cooler		50	1058.0
1	TEP2688-230/20	Air/oil heat exchr		20	2645.0
1	TEP3175-230/150	Upper crankcase		150	352.7
1	TEP3176-230/80	Engine oil sump		80	661.3
4	TTP2771-230/50	Cylinder		50	1058.0

TABLE 4 - Weight and Balance

Record installed weight, arm, and moment calculations and update aircraft records accordingly (refer to § 3.3.).

For engine preheat system arm use engine arm. Optional AV/Heater and battery kits use arm location as installed.

	<i>WEIGHT LB (KG)</i>	<i>ARM IN (CM)</i>	<i>MOMENT IN (CM)</i>	<i>MOMENT WT x ARM/100 IN (CM)</i>
Engine Preheat System	+			
AV Heater (Option)	+			
Battery Kit (Option)	+			

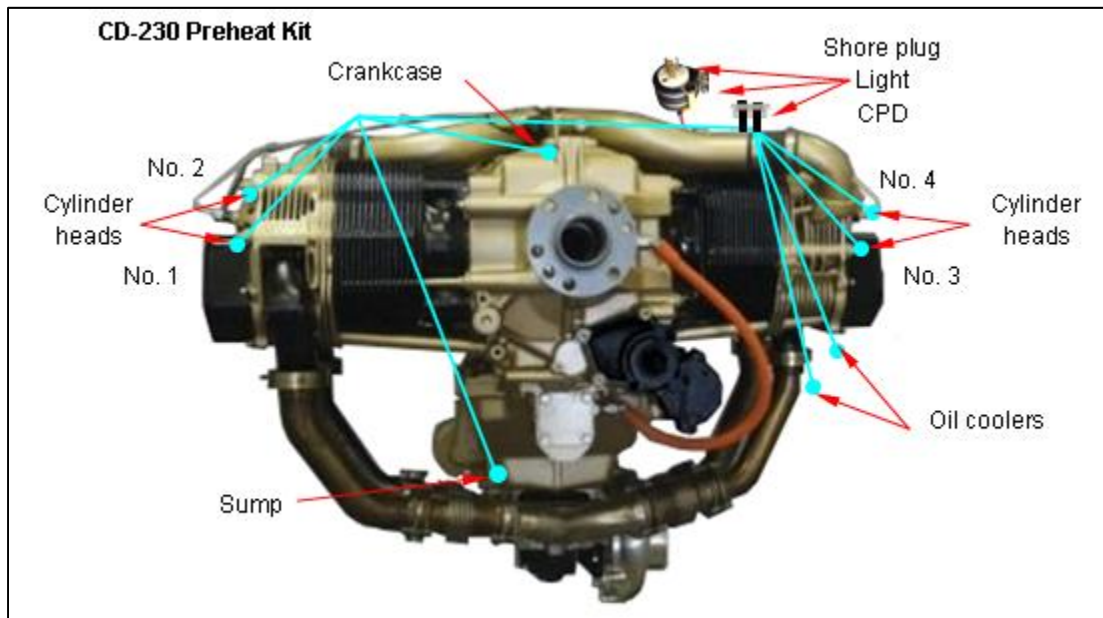


Figure 1 – CD-230 series preheat kit layout

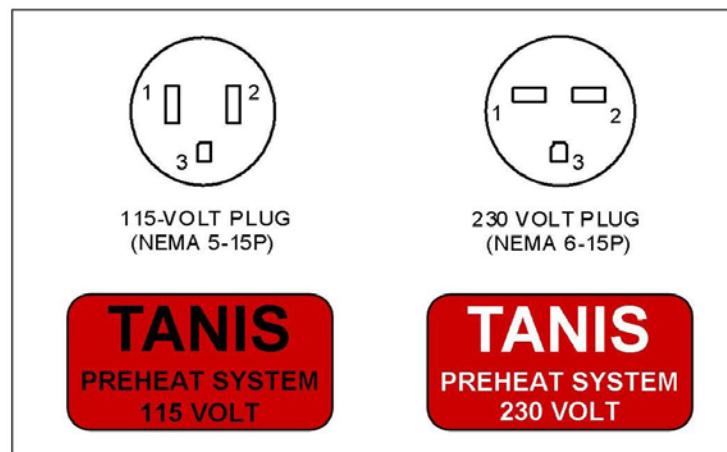


Figure 2 - Plugs and placards. Locate supplied placard on oil door or adjacent to plug, or placard with *Tanis Preheat* and voltage requirement (115 Volt or 230 Volt).

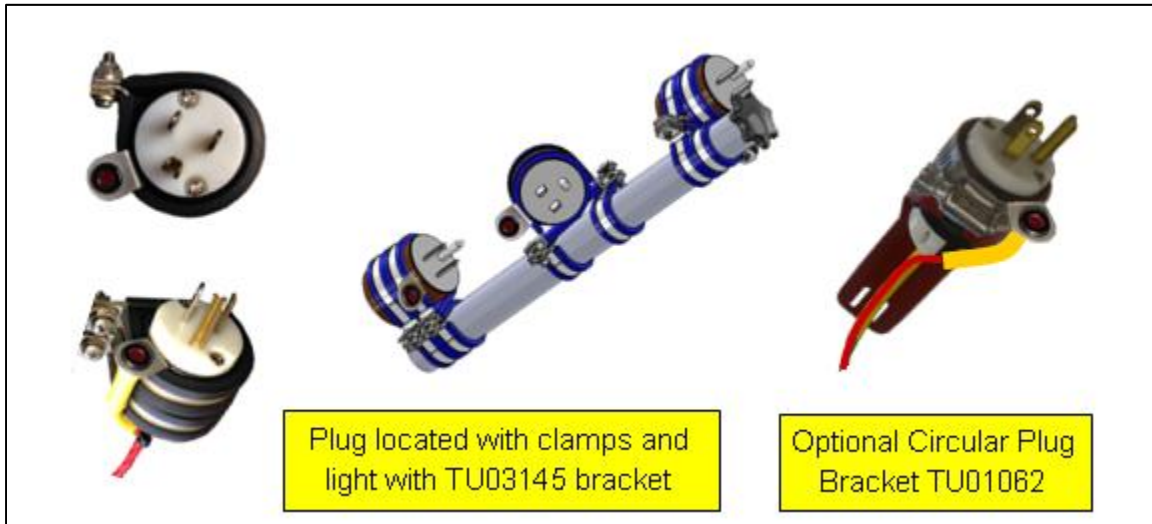


Figure 3 – Example of locating options for circular shore plug. Clamps referenced in Table 2.

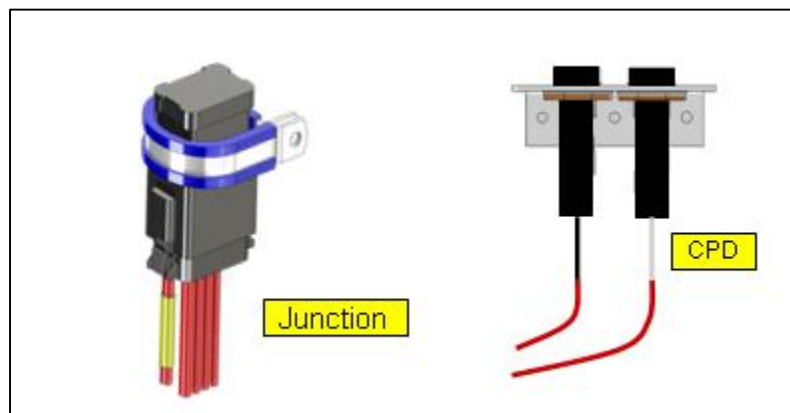


Figure 4 – Example of clamp positioning on junction and CPD (Circuit Protection Device) TU03141-B dual fuse kit.

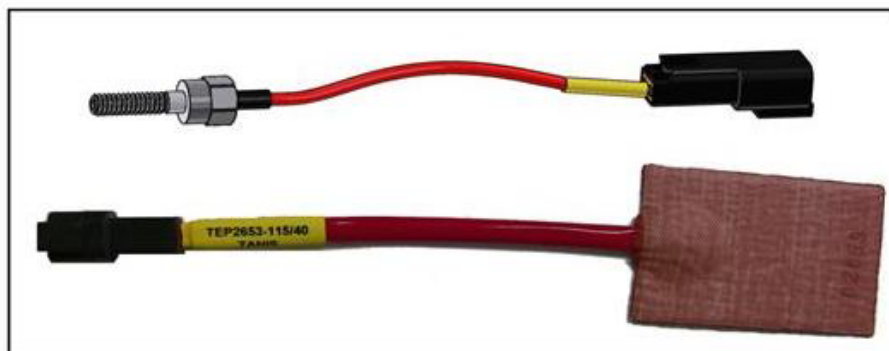


Figure 5 – Examples of threaded and pad heat elements.

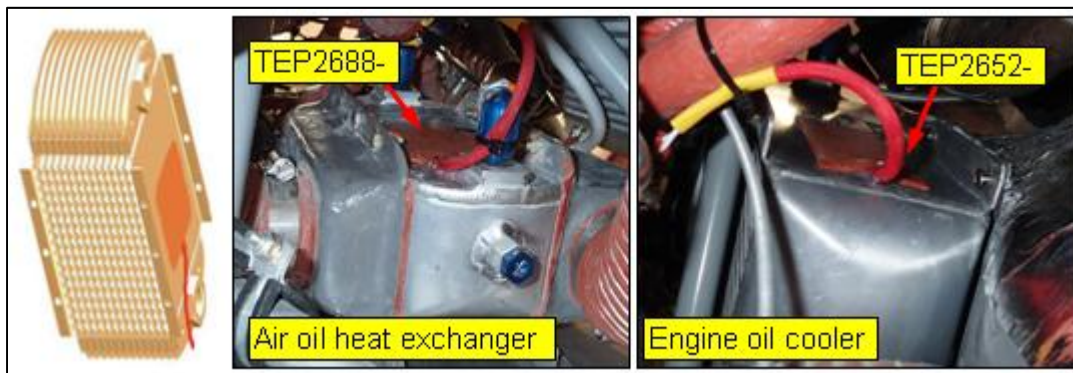


Figure 6 – Engine oil coolers viewed from bottom. Locate elements on side with leads down to allow routing with lines up to junction J-A located on aft left side of baffle.

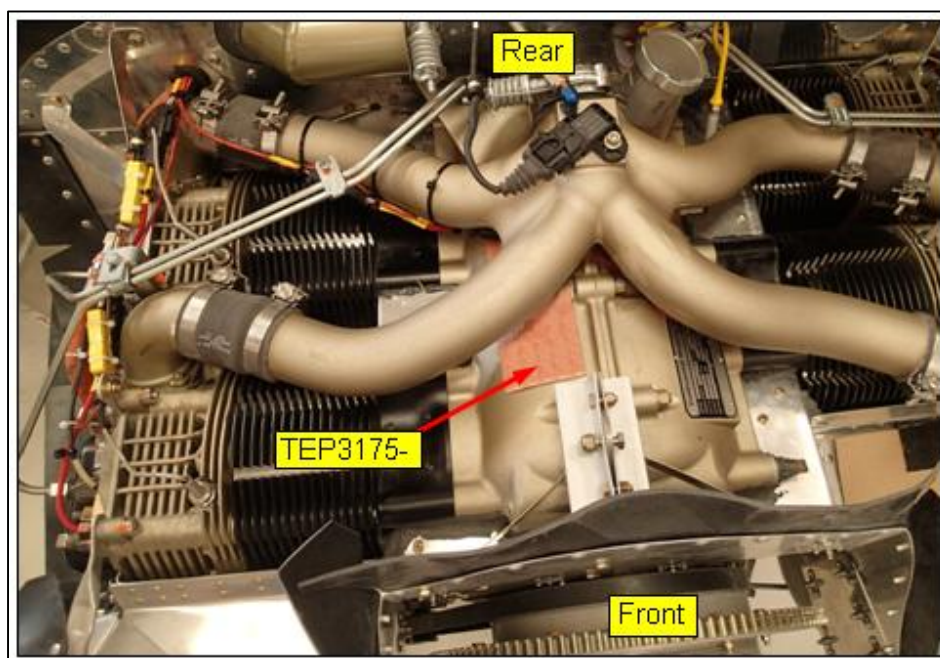


Figure 7 – Upper engine crankcase element, locate on upper right side of crankcase lead aft to follow No. 2 intake tube to right rear baffle penetration.



Figure 8 – Oil sump element, locate on right side below nominal oil level lead aft.

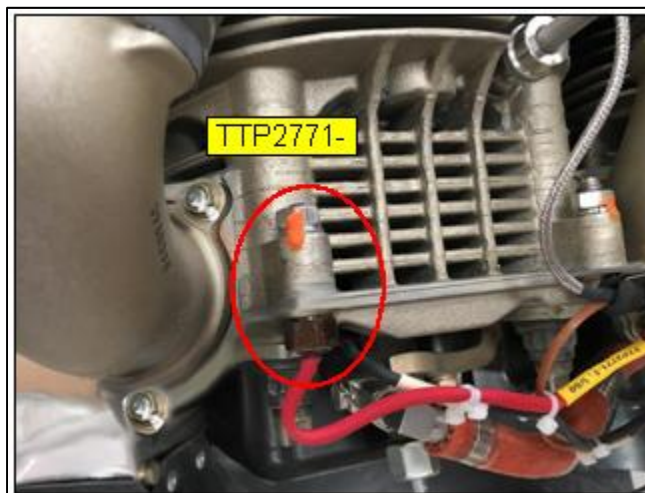


Figure 9 – Cylinder assembly heating element located in baffle pad nearest to intake tube.
Note: Do Not use threaded element to secure Adels or cushioned or insulated clamps.

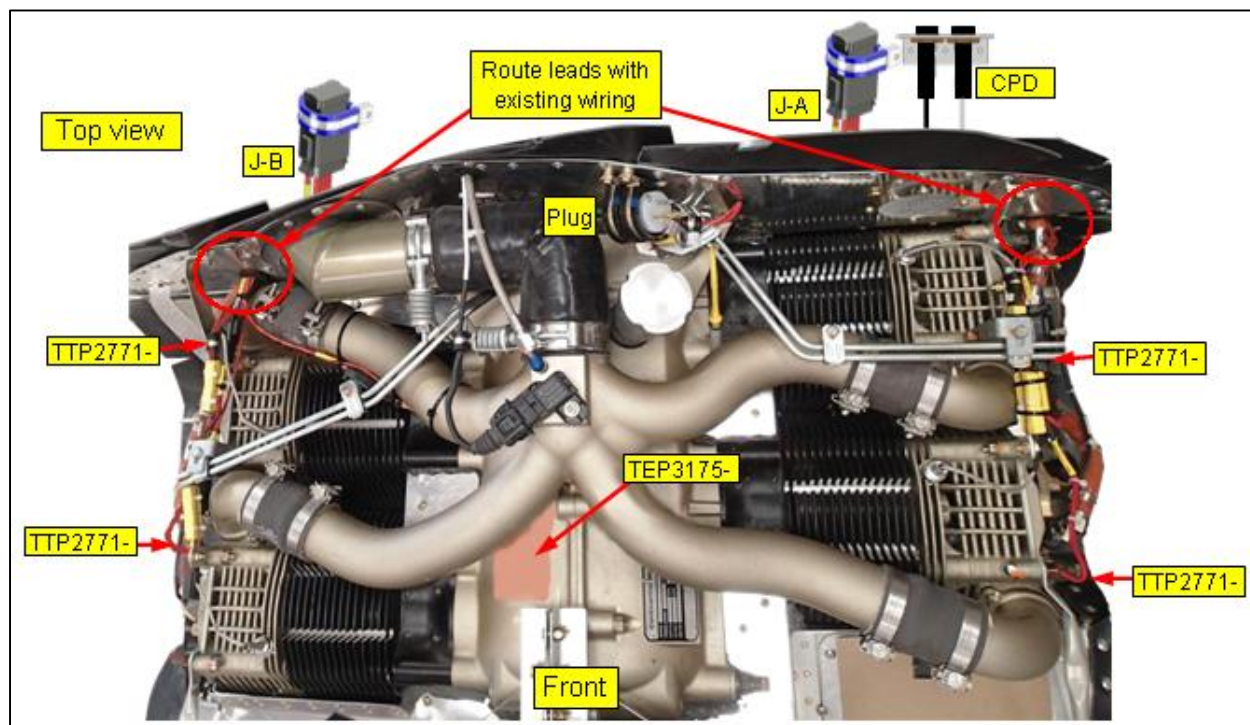


Figure 10 – Top view of cylinder and crankcase elements. Element leads routed aft with existing wiring through baffle to corresponding junctions located on aft side.

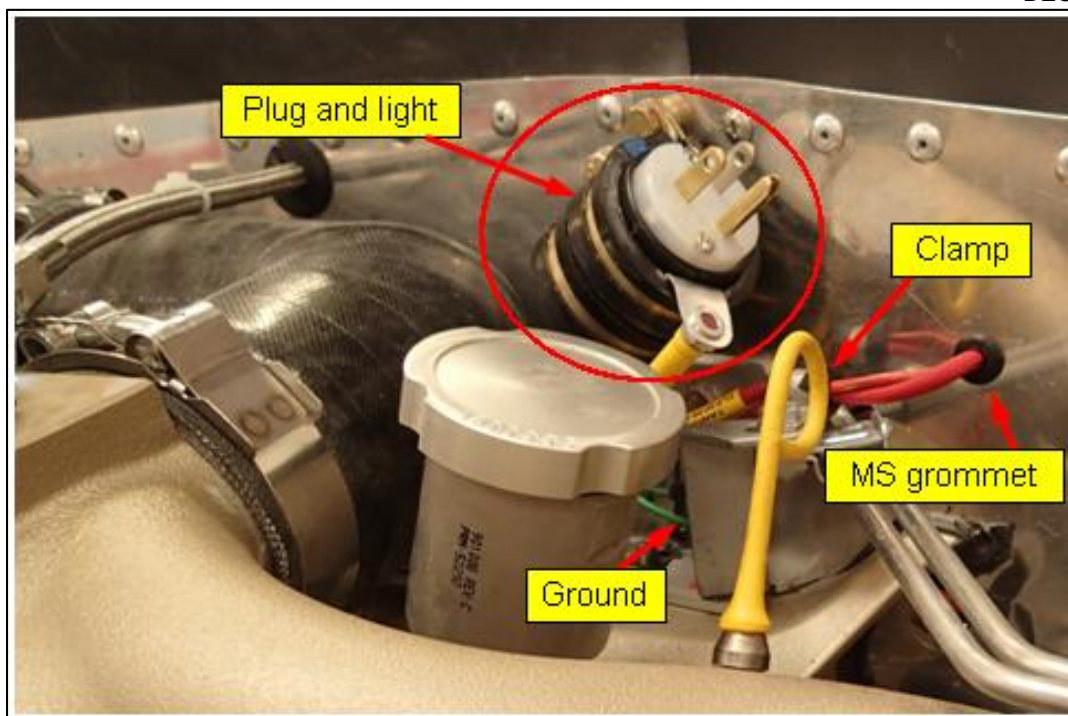


Figure 11 – Example of shore plug and light located on rear baffle. Light located in supplied bracket TU03145, secured with plug in clamps. Plug and light leads 01 and 11 routed through baffle using grommet to CPD and junction located on aft side of baffle. Location may vary due to engine or aircraft configuration.



Figure 12 – Locate junctions and CPD (TU03141-B fuse kit) on aft side of engine baffle

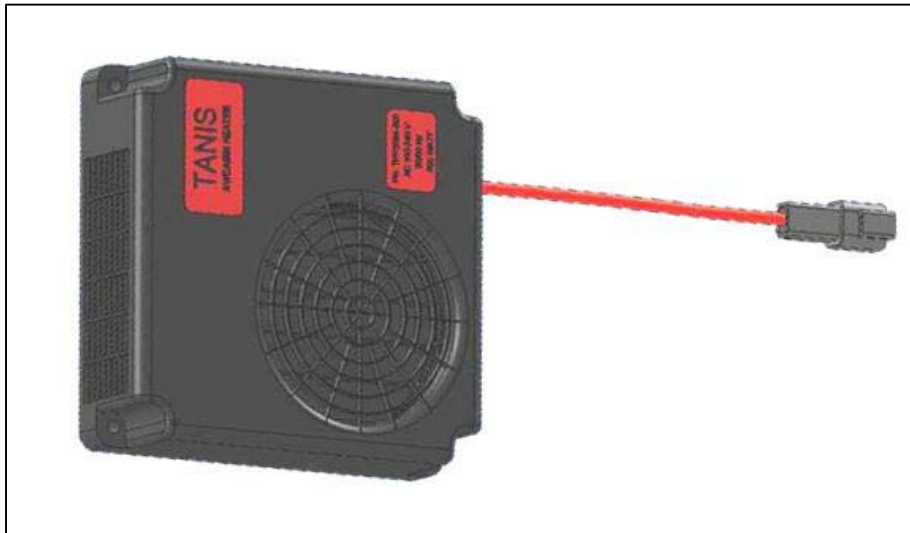


Figure 13 - Option: AV/Cabin Heater THP3094-500. Reference heater instruction TN03094, bracket drawings 03142 and 03171, and cable kit drawing 03159.



Figure 14 - Option: Battery Heat Kit (varies by application), requires additional thermal control cable assembly. Reference battery heat kit instruction TN02800.

6. FUNCTIONAL SYSTEM CHECK



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

- Before proceeding, verify that 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 when not installed, or test separately.

[☒] Check both power plugs as follows:

- 1) [☐] Verify installation is in accordance with kit installation instructions.
- 2) [☐] Verify engine oil level is at or above nominal operating level.
- 3) [☐] Verify visually and with ohm meter that airframe and engine bonding (ground strap) is in place and installed per OEM requirements.
- 4) [☐] Verify system ground by checking for continuity between shore power plug ground pin 3 (Figure 2), airframe and engine.
- 5) [☐] Verify there is no continuity between ground pin 3 and blades 1 or 2.
- 6) [☐] Using an ohmmeter measure resistance between blades 1 and 2 and record resistance: _____.
- 7) [☐] * Freeze (0°C) battery thermal control and repeat step 6, record: _____.
- 8) [☐] Compare resistance figures recorded in steps 6 and 7 with values in Table 3.
- 9) [☐] Review Operating Guide TPG0001 and connect power.
- 10) [☐] Connect system to power (Plug-It-In).
- 11) [☐] Verify power indicator light is on (illuminated).
- 12) [☐] Within 30-minutes, area adjacent to the elements will start to feel warm. Check each element individually.
- 13) [☐] * While system is warming up, freeze (0°C) battery thermal control, test battery heat element for heat. Element can be touched, as wattage density is low.
- 14) [☐] When testing is completed, disconnect (unplug) from power, latch any access doors that were open, and stow extension cord(s) in appropriate location.
- 15) [☐] Complete/fill-in blanks as indicated on first and last pages of Operating Guide listed in Table 1, and file with POH/FM.
- 16) [☐] Complete/fill-in blanks as indicated in Instructions for Continued Airworthiness (ICA) listed in Table 1, and file with aircraft manuals and logs.
- 17) [☐] Update aircraft Weight and Balance (recorded in Table 4) and Equipment List (§ 3.3).
- 18) [☐] Make a log entry to comply with 14 CFR Part 43.9 or other procedures set in place by the operator.
- 19) [☐] Complete and return Registration/Warranty Card.
- 20) [☐] Complete Sign Off in § 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 *****