TANIS
AIRCRAFT PRODUCTS

INSTRUCTION - PREHEAT INSTALLATION

TSHB407-2776- Heli-Preheat Kits

Document No: TNH2776, REV. C
Dated: DEC-11-2014

FOR

Bell Helicopter

407
AH/GT/GX

ROLLS ROYCE (ALLISON)
250-C47

RECORD OF REVISIONS

When updated, this document is changed in its entirety.

REV	DATE	DESCRIPTION	BY	APPROVAL
C	DEC-11-2014	Add door detail.	DNE	Dirk Ellis
B	OCT-15-2014	Change pad elements MRGB, update w/doubler	DNE	DNE
A	MAY-09-2014	Initial Release	GDO	DNE

CONTENTS

1. PURPOSE

The purpose of this instruction is to provide guidance for the installation of a Tanis Heli-Preheat Kit. 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).*

2. REQUIREMENTS

Required documents, and referenced figures and tables are located in Section 5.

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

- Work is to be performed in a clean environment under standard temperature conditions of 18°C / 65°F to 27°C / 80°F.
- Installation requires clear access to various stations throughout the aircraft. This may include interior panels, sidewalls, ceiling, engine, gearboxes, and battery.
- Installation times vary to a wide range of variables. Bonding sealant cure time is in the range of 8 hours, refer to Instruction - Bonding (Table 1).
- System information is to be recorded as indicated in Operating Guide and ICA (Table 1).
- Installation is to be in accordance with (IAW) current regulatory requirements, airframe/engine manufacturer's recommendations, approved procedures set in place by the installing authority. Reference AC 43.13-1B Chapter 11, Sections 9 through 12 for securing, tying, and clamping, Section 15 for Grounding and bonding, and Section 17 for feed-through penetrations.
- For global standardization and safety of operations, power connection point (shore power plug), is a non-locking blade type NEMA connector (Figure 1). A corresponding receptacle connector (supplied for field installation with 230-volt kits) is required on power connection/extension cord. Additional approved receptacles are available though Tanis (TP02872-115, TP02829-230).

2.1 Materials

Installation hardware, consumables, finish materials, brackets, lacing, various MS21919 cushion clamps (Table 2) and 1 each MS35489-1 and MS35489-9 Grommets are sourced separately.

- Pad element bonding sealant is sourced at time of installation. Approved adhesive sealants and element installation procedures called out in Instruction - Bonding (Table 1).
- Sheet metal work and sealants are required review Sections 4.4 and documents and figures listed in Section 5, (Figures 12 and 22).
- Power supply and shore power connection (extension cord) is supplied by operator.

2.2 Tools

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

Required:

- Ohmmeter certified to traceable standards.

Suggested tools for cable/wire termination called out in connector instructions (Table 1):

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

3. DESCRIPTION

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

System does not operate in flight, is not connected to or dependent on aircraft systems, and is self-regulating. Heated components reach an average state of thermal equilibrium in approximately six hours. System is self-regulating.

3.1 Physical Attributes

Preheat is applied through electrical resistance heat in the form of thin pads sized and shaped to fit various parts. This includes engine reduction gearboxes, attached accessories, main and tail rotor gearboxes, oil and hydraulic tanks, and battery. Power is routed to elements through dedicated wiring assembly with circuit overload protection and shore power indication.

3.2 Technical Specifications

Preheat system and individual element values listed in Table 3.

3.3 Weight and Balance

Record modification, update equipment list, and/or flight manual. Include adjustment to weight and balance. Approximate installed weight 7.5 pounds (lbs). Use engine CG for moment arm.

3.4 Power Requirements

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 listed Section 5, Table 3.

3.5 Operation

Caution: Only operate the system after reviewing the Operating Guide, and completing Functional System Check in Section 6.

3.6 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.

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.

3.7 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. Interior plug kit TC03071 is suggested.

4. INSTALLATION

Referenced documents, figures, and tables, located in Section 5. Tables and Figures.

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.

- 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 included with this kit.
(2) Weigh kit contents and intended installation hardware.
(3) Access engine and identify installation sites for shore power plug, elements, and cable routing.
(4) Install components per instructions.
(5) Complete, Functional System Check and Sigh Off (Sections 6 and 7).

4.2 Standards

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

(1) Wires and cables are to be supported by suitable cable ties, clamps, grommets, or other devices at intervals of not more that 6 inches apart except when contained in ducts or conduits.
(2) 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.
(3) Supporting devices should be of a size and type, with the wires and cables held securely in place without damage to the insulation.
(4) Adequately support and secure wire and connectors to prevent excessive movement in areas of high vibration.
(5) Route, wiring and cabling with enough slack to compensate for movement of shock mounts.
(6) 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.
(7) 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.

(8) 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.

(9) 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.

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

4.3 Elements

- Verify individual element resistance before installing (Table 3).
- Select locations that are relatively flat and clear of oil drip points.
- Only install using approved sealants, refer to Instruction - Bonding (Table 1).

When sealing around parameter/edge of element, use only enough sealant to create smooth transition along edge of element to mounting surface. Transition is not to extend beyond 3/8 of an inch (0.375") from the element, and not more than 3/16 of an inch (0.188") onto the element's upper surface.

Optional edge sealant: Parameter/edge of elements may be sealed with P/S 700 after primary element bonding sealant is cured. For proper adhesion, area adjacent to element and perimeter surface of pad must be free of primary element bonding sealant.

Abbreviations: Main rotor gearbox (MRGB), Tail rotor gearbox (TRGB).

Qty	P/N	Pad heat element location. Reference Figures 4 through 12, in Section 5.
1	TEP2649-	MRGB, right side forward of oil sight glass horizontally on case, lead aft.
1	TEP2653-	TRGB, bottom, lead aft.
1	TEP2653-	Engine OIL TANK, bottom and forward, position lead for wire routing.
1	TEP2658-	HYD TANK, outer tank surface below nominal oil level.
1	TEP2661-	FCU/HMU, bottom flat surface or near fuel inlet, position lead for routing.
2	TEP2675-	Engine AGB, left side on tank section of case, MRGB bottom.
1	TEP2714-	Engine AGB, right side below placard, lead up.
*1	TBP2646-31-	Battery element.
*1	TB02645-07	Adapter Panel (non-heating), field configured as required.

* Common configuration, listed for reference, supplied separately due to variations in battery configuration. When installed on Concord RG-407 battery element is installed with Adaptor Panel modified to fit around contact block as shown in Figure 7. Position panel and element flat side to battery. Use cable-ties or appropriate lacing, and gently lace element in place. Pull lacing gently and alternate tension between grommets. While lacing, do not pull too hard this could result in pulling grommets out. Note: positing of panel in this example shows cutout for contact block off centered in panel. Panel modification may vary by battery and/or other installation considerations. For additional installation and maintenance information, refer to battery ICA TICA2800.

4.4 Cable Routing

Reference Wire Diagram dwgs 2413 and 02774, and Section 5, Tables and Figures.
Cable routing is suggested. Mount Junctions using cushioned clamps (Figure 6).

1. Shore power door and plug, (TD02840), fusing, and indicator light:
   (a) Install Shore Power Door Kit (TD02840) and plug in aircraft on right aft side below secondary structural panel (Figures 12, 13, and 14). Secure fused link in accessible location near plug, and install light in aircraft skin adjacent to door.
   (b) Fused link may be replaced with 2 ea. HTB-42I panel mounted fuse holders, or 2 ea. MS26574-10 breakers, ,mounted in field fabricated bracket.
   (c) Plug may be collocated located with alternate shore power connection/plug(s).
2. Ground: Connect green ground wire to appropriate grounding location on airframe.
3. Cable routing: Configure panel pass through holes.
   a) Sta. 218 RBL 5.0 WL 59, aft fuselage web (Figure 15). Install 1 ea. MS35489-1 grommet in existing tooling hole in floor of tailboom service hold.
   b) Sta. 210 RBL 6.0 WL 72, aft upper deck (Figure 16). Install field-fabricated doubler (Figure 17) in fuselage skin below engine oil tank. Position doubler, drill corresponding holes for rivets and 9/16 inch pass through. De-bur holes, install doubler with P/S 870 on contact surfaces, 4 ea. MS20470AS3-3 rivets, and 1 ea. MS35489-9 grommet in feed through hole.
   c) Remove lead 01 from Junction A and route from plug to upper deck through existing panels (Figures 15 and 16).
   d) Install supplied Fireproof Grommets TG01056, or optional Firewall Connector Kits TU03030.

   Note: Due to variations in firewall configurations, penetration location may deviate from depictions. Reference drawings 1056, and drawings 02774 and 2413 for routing and firewall connector options.
4. Junction A: Mount with clamp adjacent to penetration on aft engine firewall and route leads as depicted on Wire Diagram.
   02 - Route to oil tank element.
   03 - Transitions through engine compartment to Junction B.
   04 - Route back through airframe pass-through to starter/generator battery cables and forward to battery compartment, and connect to Tanis battery cable assembly. Mount battery thermal control with Click Bond cable mount refer to Battery ICA for more information. For optional routing of Lead 04 reference Cable Kit - Wire Diagram (2413).
   05 - Route aft to tailboom disconnects station. Install TU03047 Tailboom Connector Kit. Mount in existing disconnect panel or in field fabricated bracket, follow applicable instructions and Cable Kit - Wire Diagram, and continue to tail rotor gearbox element.
5. Junction B: Mount with clamp adjacent to penetration on forward engine firewall and route leads as depicted on Wire Diagram.

   07, 08, and 09 - Route though firewall to corresponding engine elements.

   10 - Route forward through firewalls connectors to Hydraulic tank element.

   11 - Route to MRGB elements on lower area of transmission.

6. Verify all element leads and connectors are connected and secure.
7. Affix the placard (Figures 1 and 2) or placard with equivalent stating at a minimum; “Tanis”, and the system voltage near systems shoreline power plug.
8. Complete Functional System Check and Sign Off, Sections 6 and 7.

5. TABLES AND FIGURES

TABLE 1 - Installation Documents

(Record documents as indicated in Operating Guide and ICA).

02776	Preheat Kit - Item List (-115 or -230)
2413	Cable Kit - Wire Diagram
02774	Reference Drawing - Wire Routing
03030	Instruction - Firewall Connector Kit (TU03030 - Option replace 1056)
03047	Instruction - Tailboom Connector Kit (TU03047 - Option)
03071	Cable Kit - Diagram, (TC03071 - Option interior receptacle cabling)
TN01056	Instruction - Fireproof Grommet
TN02070	Instruction - Flush Mount Plug
TN02782	Instruction - Click Bond Kit
TN02788	Instruction - Bonding (Element Installation and Sealant)
TN02793	Instruction - Connector (Termination and Assembly)
TN02840	Instruction - Door Kit Single Plug
TN02829	Instruction - Receptacle (Supplied with 230-volt kits)
TN03039	Instruction - Indicator 8mm
TNH2776	Instruction - Heli-Preheat Installation
TCA0003	ICA - Rotorcraft Preheat System
TPG0003	Operating Guide - Rotorcraft Preheat System
TICA2800	ICA - Battery Heat Kit

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

(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-6	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 - System Values +/- 10%

Total preheat system and individual element values +/- 10%.

* Battery element and values listed for reference.

115 Volt kit **4.2 Amps** **478 Watts** **27.7 Ohms**

* With Battery 4.7 Amps 538 Watts 24.6 Ohms

Qty	Element Part Number	Location	Wattage	Ohms
1	TEP2649-115/120	MRGB RH Side	120	110.2
2	TEP2653-115/40	Oil Tank / TRGB	40	330.6
1	TEP2658-115/7.5	Hyd. Tank	7.5	1763.3
1	TEP2661-115/10	FCU	10	1322.5
2	TEP2675-115/95	Eng AGB LH / MRGB Bottom	95	139.2
1	TEP2714-115/60	Eng AGB RH	60	220.4
*	TBP2646-31-115/60	Battery	60	220.4

230 Volt kit **2.1 Amps** **478 Watts** **110.8 Ohms**

* With Battery 2.3 Amps 538 Watts 98.4 Ohms

Qty	Element Part Number	Location	Wattage	Ohms
1	TEP2649-230/120,	MRGB RH Side	120	440.8
2	TEP2653-230/40,	Oil Tank / TRGB	40	1322.5
1	TEP2658-230/7.5,	Hyd. Tank	7.5	7053.3
1	TEP2661-230/10,	FCU	10	5290.0
2	TEP2675-230/95,	Eng AGB LH / MRGB Bottom	95	556.8
1	TEP2714-230/60,	Eng AGB RH	60	881.7
*	TBP2646-31-230/60	Battery	60	881.7

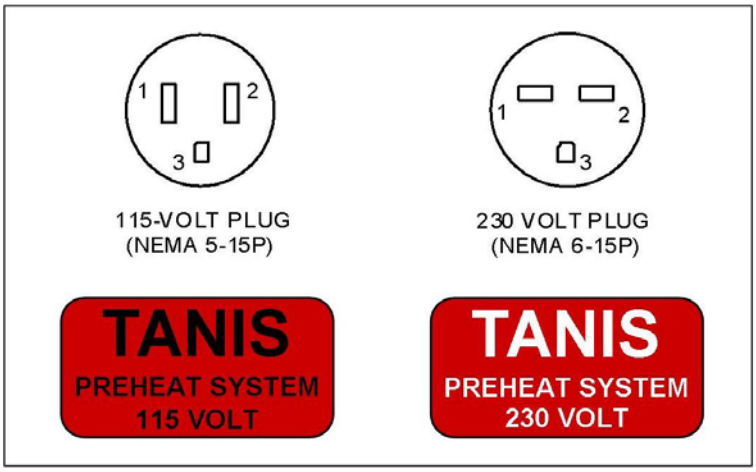

Figure 1 - Shore power plugs and placards. Placard that states at a minimum, *Tanis* and the system voltage requirement (*115 Volt* or *230 Volt)* is acceptable.

Figure 2 - Generic element with 6 inch lead, connector and yellow label with part number.

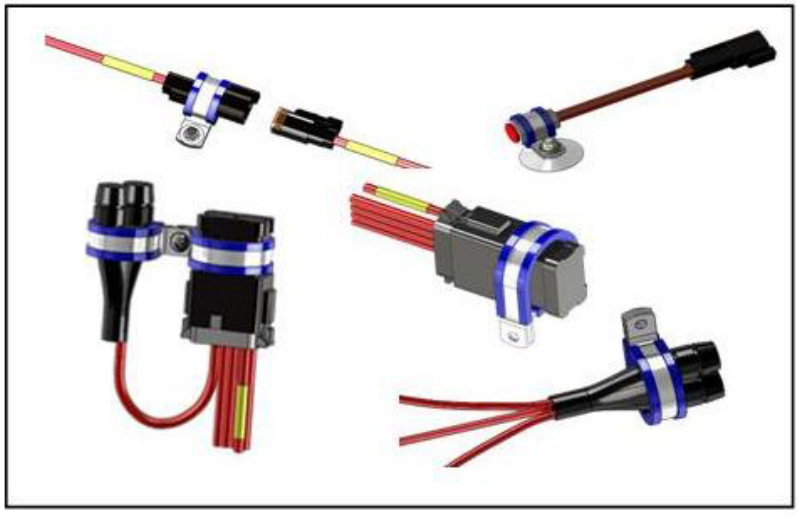

Figure 3 - Clamp positions, connectors, optional light, junctions, and optional fused link.

Figure 4 - TBP2646-31- battery element installed with TB02645-07 adapter panel.

Figure 5 - TEP2653- TRGB bottom, lead aft to follow existing wiring.

Figure 6 - MRGB, TEP2649- right side horizontally forward of oil sight glass, TEP2675- bottom of case, leads aft.

Figure 7 - TEP2653- engine oil tank bottom. Position element for wire routing.

Figure 8 - TEP2658- Forward hydraulic tank below nominal oil level.

Figure 9 - TEP2661- Engine FCU locate on surface near fuel inlet.

Figure 10 - TEP2675- Engine AGB left. Case variations may require optional element TEP2653-.

Figure 11 - TEP2714- Engine AGB right side below placard.

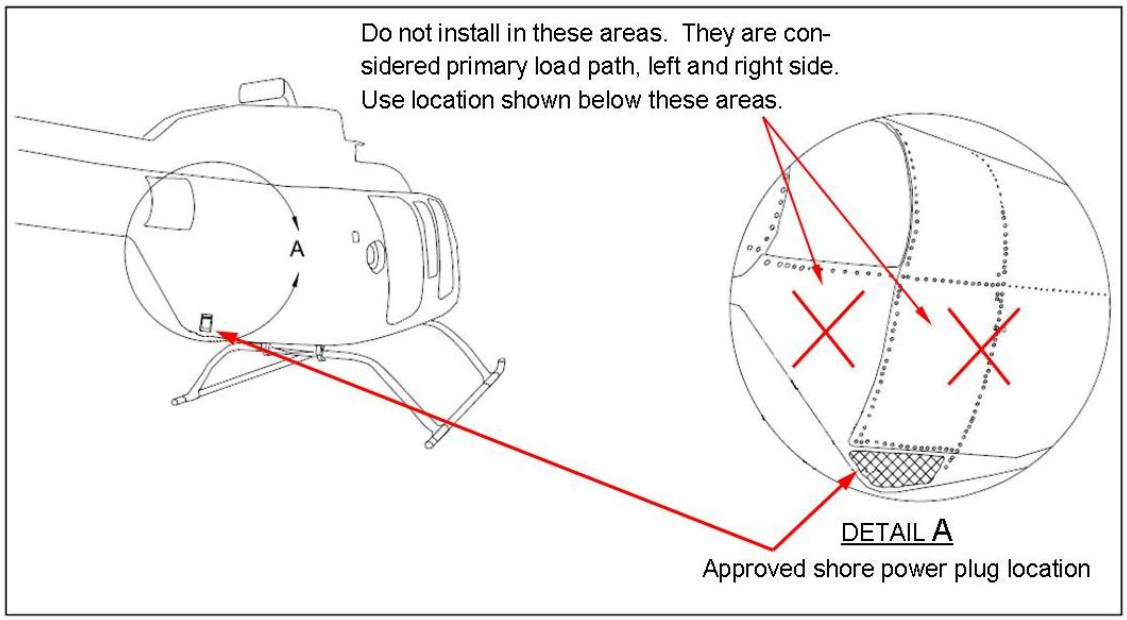

Figure 12 - TD02840 shore power plug door location (Figures 3 and 4). Review reference drawing 02774 and Wire Diagram 2413 for suggested cable routing options.

Figure 13 - TD02840 Door installed sandwiching composite panel between supplied doubler, and field fabricated doubler made from 0.040 2024-T3 or equivalent. Roll doublers to match panel curvature, fit, match drill, and cut panel/skin. De-bur, pot composite, alodine, prime as required, seal mating surfaces with PS 870, and install with rivets.

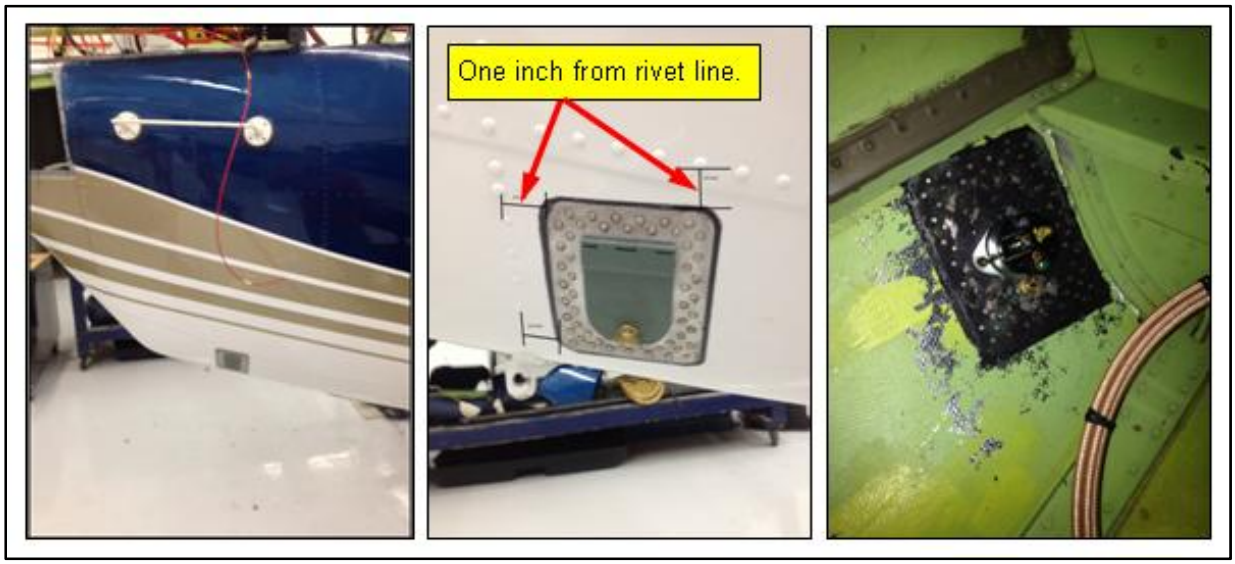

Figure 14 - Seal/pot composites A/R per Bell procedures. Coat/seal contact surfaces of inner and outer doublers with PS 870. Reference TD02840 for plug and door attachment.

Figure 15 - Sta. 218 RBL 5.0 WL 59, inside right rear service hold. Install MS35489-1 Grommet into existing tooling hole in fuselage web as shown.

Figure 16 - Sta. 210 RBL 6.0 WL 72. Field fabricate, and install doubler (Figure 22) and MS35489-9 Grommet.

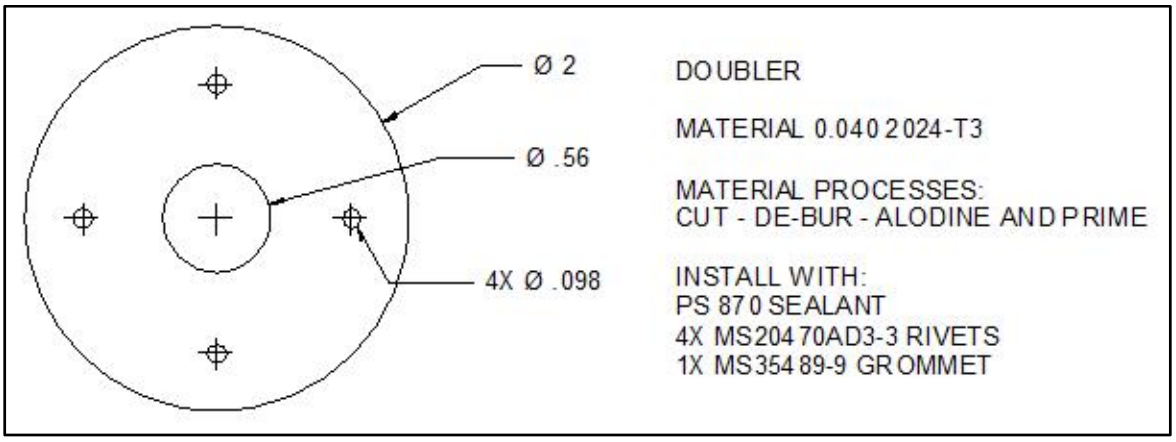

Figure 17 - Doubler field fabricated from 0.040 2024-T3 or equivalent Position on upper deck bellow engine oil tank (Figure 21). Drill corresponding holes for rivets and 9/16 inch pass through. De-bur, prime, and install doubler with P/S 870 on contact surfaces, 4 ea. MS20470AS3-3 rivets, and 1 ea. MS35489-9 grommet in feed through hole.

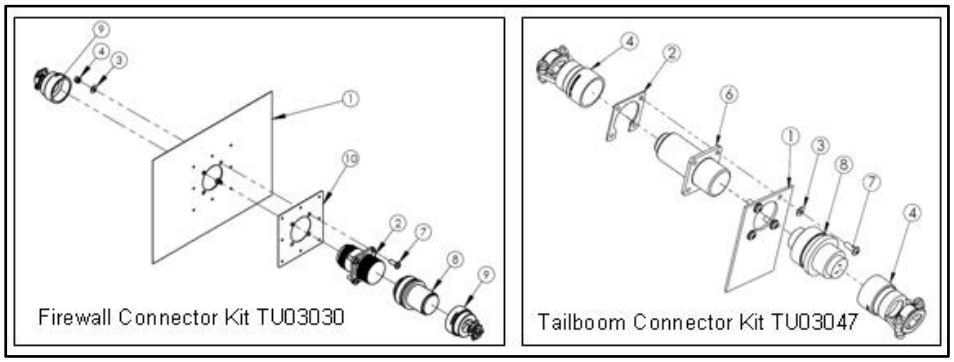

Figure 18 - Optional Firewall and Tailboom Connector Kits. When available mount tailboom connector in existing dismount plate, or fabricate bracket made from 0.063 - 2024-T6 or equivalent. Bracket not to exceed 3 inches in length. Add 1/4 inch 90° returns on long side for rigidity.

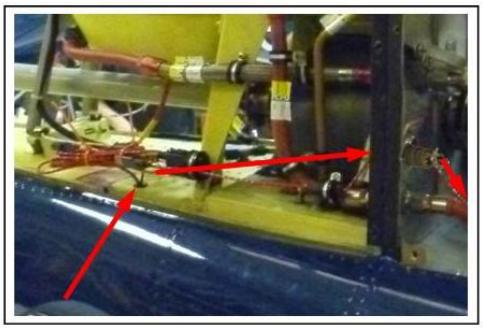

Figure 19 - Cabling routed from rear service hold transitioning through deck to aft engine firewall.

Figure 20 - Right view of cable routing option. Junctions mounted with clamps on outsides of engine firewalls adjacent to penetrations.

Figure 21 - Rear firewall, install supplied Fireproof Grommet TG01056 or optional Firewall Connector Kit TU03030. Location may vary from depiction depending on firewall configuration.

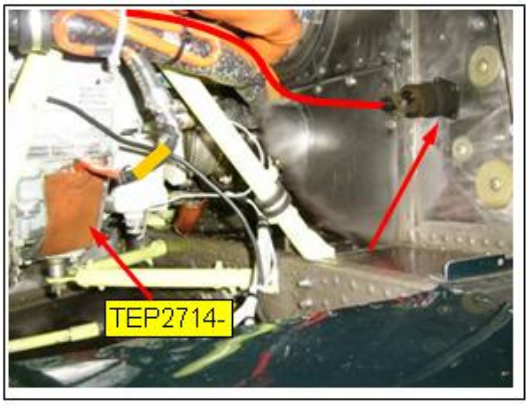

Figure 22 - Forward firewall penetration uses supplied TG01056 or optional TU03030. Location may vary common alternate location, upper left side of firewall.

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.

[√] Check the system as follows:

1. [ ] Verify system components are installed in accordance with kit installation instructions.
2. [ ] Verify effected component fluid levels are at operational levels.
3. [ ] Verify engine to airframe/engine bonding (ground strap) is as per OEM requirements.
4. [ ] Verify preheat system ground by checking for continuity between shore power plug ground, pin 3 (Figure 1), engine, and airframe.
5. [ ] 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 resistance between the power pins 1 and 2, and record total system resistance: _____. Compare with Table 3.

6) [ ] Freeze (0°C) the battery thermal control and repeat step 5, record: _____, Compare with Table 3.

7) [ ] Connect the system to appropriate power.

8) [ ] Verify power indicator light is on (illuminated).

9) [ ] Within 30-minutes, area adjacent to the elements will start to feel warm. Check each element individually.

10) [ ] * While system is warming up, freeze (0°C) battery thermal control, then test battery heat element for heat. Element can be touched, as wattage density is low.

11) [ ] When testing is completed, disconnect (unplug) from power, latch any access doors that were open, and stow extension cord in appropriate location.

12) [ ] Update/modify weight and balance, and installed equipment lists (Section 3.5).

13) [ ] Complete/fill-in blanks as indicated on first and last pages of Operating Guide listed in Table 1, and file with POH/AFM..

14) [ ] Complete/fill-in blanks as indicated in Instructions for Continued Airworthiness (ICA) listed in Table 1, and file with aircraft manuals and logs.

15) [ ] Make a log entry to comply with 14 CFR Part 43.9 or other procedures set in place.

16) [ ] Complete and return Registration/Warranty Card.

17) [ ] 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 *******