



## **INSTRUCTION – PREHEAT INSTALLATION**

**Document No: TNH2143, REV. B**

**Dated: NOV-02-2016**

**TSHEC145-2143 SERIES HELI-PREHEAT KIT**

**ON**



**EC145 / BK117C-2 - Arriel 1E2**

### **PROPRIETARY DATA**

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## RECORD OF REVISIONS

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

REV	DATE	DESCRIPTION	BY	RELEASE
B	NOV-02-2016	Reformat TN02143 and standardize part numbers	GDO	
A	FEB-20-2012	Initial Release (TN02143)	DNE	RCK

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## 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.

- 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 numbers are modifiers used for article configuration and maybe omitted in narratives. Example: TEP2653-115/40 = Tanis **E**lement with a **P**in connector (2653) 115-volts / 40-watts.

## 2. REQUIREMENTS

**Required documents, and referenced figures and tables 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. Consumables and installation hardware are not supplied.

- Installation is to be IAW current regulatory requirements 14 CFR Part 27, AC 43.13-1 and 2 (as amended), and engine and airframe manufacturer's procedures, and approved procedures set in place by the installing authority
- Reference AC 43.13-1 (as amended) Chapter 4, Section 4 for sheet metal penetration and shore power plug door installation
- Reference AC 43.13-1 (as amended) Chapter 11, §§ 9 through 12 for securing, tying, and clamping, § 15 for grounding and bonding, § 16 for wire marking, and § 17 for feed-through penetrations
- Reference AC 43.13-2 (as amended) 1. Chapters 1 and 2 for structural consideration and equipment mounting options (AV heater locating/mounting is to be consistent with installation methods, techniques and practices for avionics equipment)
- Retain documents and make record as indicated in Operating Guide and ICA
- 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 includes crew and passenger cabin, battery hold, engine, main and tailrotor gearboxes, and tailboom.
- Installation times vary due to a wide range of variables refer to § 5
- Element sealant cure time (approximately 8 hours)
- For global standardization and safety of operations shore power plug (inlet) is a non-locking blade type NEMA plug (Figure 2)
- Corresponding receptacle connector (outlet) is required on power extension cord (supplied for field installation with 230-volt kits). Approved outlets - TP02872-115, TP02829-230.

## 2.1 Materials

Installation hardware, consumables, finish materials, brackets, lacing, various MS21919 cushion clamps (Table 2) are to be supplied by the installer.

- Pad element bonding sealant is sourced at time of installation, TN02788.
- Sheet metal work and sealants are required review Sections 4.4, and 5. Tables and Figures.

## 2.2 Tools

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

Required:

- Ohmmeter certified to traceable standards
- Wire cutter/stripper
- Deutsch contact remover tool: DT-RT1 or equivalent
- 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 is required, reference Table 3 for load electrical listings

## 3. DESCRIPTIONS

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

- Preheating increases reliability and safety of operations.
- The preconditioning 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
- Primary preheat system preheats engines and engine oil tanks, main and tailrotor gearboxes, hydraulics and battery. This reduces torque oscillations, thermal stress, warm up, and launch times
- Optional battery heater reduces battery freeze point depression and allows for higher amperage outputs and proper charge
- Optional AV/Cabin heater allows for proper glass panel activation, reduces condensation, cold weather induced gyroscopic errors, and helps to clear windows of frost, snow and ice

### 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/hydraulic coolers and tanks. (Battery and AV/Cabin heat supplied separately). Power is routed to elements through dedicated wiring assembly with circuit overload protection and shore power indication.

### 3.2 Technical Specifications

Electrical values and loads listed in Table 3.


### 3.3 Weight and Balance

Kit and all installation hardware are to be weighed before installing

Approximate installed weight:

- Heli-Preheat Kit: 7.5 pounds (lb) / 3.4 Kilograms (Kg),
- Use engines CG for moment arm moment at aircraft center line.
- Record installed weight and arm calculation in Table 4 § 5
- 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 43.13-1 (as amended) 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.

### 3.6 Options

Specific operational requirements may require alternate component, and/or additional elements. Modifications and/or additional kits are available for installation with base kit.

- Additional cabling, components and interconnect kits available
- TD03097 Door Kit - 2 Place
- TC03071 Cable Kit - Interior Plug (outlet)
- TP02989-115 and TP02988-230 - Plug Receptacle w/ Cap (outlet)
- TP02770-115 and TP02980-230 Circular Shore Power Plug (inlet)
- CPD (Circuit Protection Device): Breaker: MS26574-10, MS3320-10, or Klixon 2TC49-10 for 115V, and W23-X1A1G-10 for 230V
- MS35059-22 - Sealed power switch (8822K20)
- TU03030 and TU03125 - Firewall Connector Kits (KT type 5015/38999 crimp type disconnect, non pressurized firewall and bulkheads)
- TG01056 - Fireproof Grommet Kit (non pressurized firewall and bulkheads)
- TU02968, TU03047, or TU03127 - Connector kits (5015/38999 crimp type bulkhead disconnect)
- Contact Tanis Aircraft Products for additional options

## 4. INSTALLATION

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

Note: Due to installed equipment and/or operating requirements cable routing options are suggested final installation may vary.

- 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 listed in Table 1.
- (2) Weigh kit contents and installation hardware.
- (3) Locate elements, shore power plug, and route cable/wiring.
- (4) Record and retain documents as indicated in Operating Guide and ICA.
- (5) Complete Functional System Check and Sign Off (§§ 6 and 7).

#### **4.2 Standards**


Review § 2 Requirements and standards below.

- (1) 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.
- (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 capable of supporting wires and cables securely without damage to 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, shorten or lengthen, wires/cables by cutting and re-terminating with appropriate contacts, splice or connector.
- (9) Check for proper installation of engines and gearboxes bond/ground.
- (10) Composite - follow approved airframe manufacturer procedures and reference AC 43.13-1 (as amended) Chapter 3 as needed. When riveting use appropriate length 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).
- (11) Sheet metal - reference AC 43.13-1 (as amended) Chapter 4, Section 4. Use appropriate rivets per installation. For structural installations, rivet layout is to be 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).

- (12) Optional firewall penetration, Firewall Connector Kit TU03125 per drawing 03125, reference 43.13-1 (as amended) Chapter 11, Section 17. Assemble wet and seal A/R with PS 700.
- (13) Optional AV heater installation refer to AC 43.13-2 (as amended) 1. 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).

### 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)
- Element positioning and lead orientation may vary from figures
- When installing consider oil drip points, lead orientation, and cable routing
- Only install using approved sealants, refer to Bonding Instruction TN02788 (Table 1)
- Elements must be in full contact through bonding sealant

Abbreviations: MRGB (main rotor gearbox), TRGB tailrotor gearbox), I/TRGB (intermediate tail rotor gearbox), MO1 (engine module one), MO5 (engine module five)

Qty	P/N	Pad heat element and general location (reference Figures § 5. for examples)
2	TEP2671	Engine MO1 - one each engine, aft side opposite of starter/generator lead outboard of engine (Figure 1).
1	TEP2673	TRGB - right side, lead down to follow chip light wiring (Figure 2).
2	TEP2673	Engine oil tank - one each tank forward side below nominal oil level, lead inboard (Figure 3).
1	TEP2718	I/TRGB (intermediate tail rotor gearbox), bottom, lead forward to follow chip light wiring (Figure 4).
2	TEP2733	MRGB - one each side inboard of input shafts, lead up to follow existing wiring (Figure 5).
2	TEP2737	Engine MO1 - one each engine below oil filter and FCU, lead down (Figure 6).
2	TEP2739	Engine MO5 - one each engine, aft side lead to starboard (Figure 7).
2	TEP2739	MRGB forward lower - left and right sides, below output drive, lead to port. (Figure 8).
1	TLP3039	Indicator light - mount in conjunction with shoreline power plug (Figure 10).
1	Battery heat element supplied separately reference Item List dwg 2143.	

Battery element installation does not use bonding sealant, installed using cable ties or appropriate lacing. Gently lace in place alternating tension between ties excessive tension may cause damaging or result in pulling grommets through element edge.

#### 4.4 Cable Routing

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

- Review cable kit wire diagram 02894
  - Use existing penetrations and route with existing wiring when possible
1. Shore power plug options (power connection/inlet) (Figure 10):
    - (a) Locate on starboard aft side, in back of step.
    - (b) Locate with field fabricated door assemble in location TBD by installer.
  2. Circuit Protection Device (CPD):
    - (a) Locate TU03141-B dual fuse kit near back side of plug in accessible location.
    - (b) Locate optional CPD (§ 3.6) TBD by installer.
  3. Ground (Figure 3):

Bond ground wire using plug mounting hardware.
  4. Junctions:

A and B - Locate near backside of power plug on the load side of circuit protection.

C – Right engine, locate in engine compartment or outside of engine compartment when installation connector kit TU03125

D – Left engine, locate in engine compartment or outside of engine compartment when installation connector kit TU03125

E and F – MRGB, locate on upper main rotor transmission deck adjacent to engine oil tanks outboard one left side and one right side on the existing bracket forward of each oil tanks, or locate in a serviceable area that allows leads to reaching corresponding elements.
  4. Leads:

02 - Connect to junction B.

03 - Route between junction and indicator light.

04 - Battery heater lead, route aft to the battery compartment and into battery compartment alongside battery cables or install the supplied MS35489-9 grommet, cap when not in use (DT04-2P-C017).

Optional battery heat kit - Battery heater thermal control cabling. Thermal control locate 6-18 inches from battery with supplied TU02782 cable mount reference instruction TN02782.

05 and 06 - Route the leads for MRGB junctions E and F, to the ceiling and forward to an existing penetration that allows access to the transmission upper deck. If one is not available penetrate the deck in a location in conjunction with other disconnects using the fireproof grommet TG01056, or optional TU03125 (MIL-5015, MIL-38999).

Route each of the corresponding leads to their junctions. Alternately it is acceptable for MRGB junction cables be routed into the engine compartment and forward through the firewall to the transmission zone to each MRGB junction.

07 and 08 - Route with the throttle cables to the ceiling, then to the rear outboard area of each engine compartment near the existing engine disconnects for each corresponding engine. Install the supplied fireproof grommet TG01056 (Figure 11), or optional

TU03125 (Figure 12).

- 09 - Route to the tail boom disconnect and install connector, for the boom disconnect, using the supplied DT connectors, or optional TU03047 (MIL-5015, MIL-38999). Mount disconnect on the existing bracket with the other boom wiring disconnects. The cabling continues aft in the boom to I/TRGB element and up to the TRGB element following existing wiring.
- 10 through 15 route from engine and MRGB junctions to corresponding elements.
5. Placard (Figure 10):  
Affix placard or placard with equivalent stating at a minimum; “Tanis”, and the system voltage near plug, near or on door.
6. Verify all connectors are connected and leads are secure.
7. Complete Functional System Check and Sign Off, §§ 6 and 7.

## 5. TABLES AND FIGURES

**TABLE 1** - Supporting Installation Documents

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

2143	Preheat Kit - Item List (-115 or -230)
02894	Drawing - Cable Kit/Wire Diagram
03141	Drawing - Dual fuse kit
TN01056	Instruction - Fireproof Grommet
TN02782	Instruction - Click Bond Kit
TN02788	Instruction - Bonding (Element Installation and Sealant)
TN02793	Instruction - Connector (Termination and Assembly)
TN02829	Instruction - Receptacle (Supplied with 230-volt kits)
TN03039	Instruction - Indicator 8mm
TNH2143	Instruction - Preheat Installation
TCA0003	Instruction for Continued Airworthiness - ICA
TPG0003	Operating Guide - Preheat System

**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 - System Values**

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

**115 Volt System                      878 Watts                      7.6 Amps                      15.1 Ohms**

<u>Quantity</u>	<u>Element P/N:</u>	<u>Wattage</u>	<u>Ohms</u>
2	TEP2671-115/57	57	232
3	TEP2673-115/28	28	472
1	TEP2718-115/28	28	472
2	TEP2733-115/53	53	250
2	TEP2737-115/33	33	401
4	TEP2739-115/120	120	110

**230 Volt System                      878 Watts                      3.8 Amps                      60.3 Ohms**

<u>Quantity</u>	<u>Element P/N:</u>	<u>Wattage</u>	<u>Ohms</u>
2	TEP2671-230/57	57	928
3	TEP2673-230/28	28	1889
1	TEP2718-230/28	28	1889
2	TEP2733-230/53	53	998
2	TEP2737-230/33	33	1603
4	TEP2739-230/120	120	441

**TABLE 4 - Weight and Balance**

Record installed weight, arm, and moment calculations.

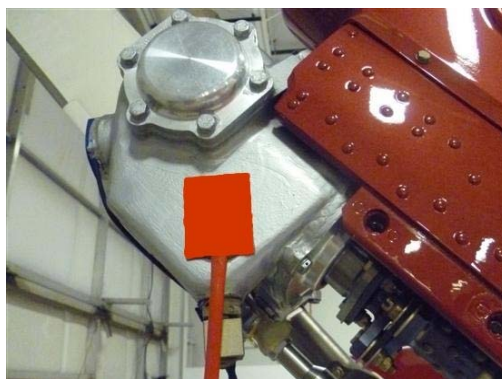
Preheat system arm use engine and airframe centerline, AV/heater (when installed) use location as installed.

	<i>WEIGHT LB (KG)</i>	<i>ARM IN (CM)</i>	<i>MOMENT IN (CM)</i>	<i>MOMENT WT x ARM/100 IN (CM)</i>
SYSTEM	+			
AV/HEATER	+			



**Figure 1**

TEP2671, each Engine MO1 right side opposite of starter/generator. Lead to starboard.



**Figure 2**

TEP2673, TRGB starboard lower side, lead down to follow chip light.



**Figure 3**

TEP2673, each engine oil tank forward side below nominal oil level, lead inboard.



**Figure 4**

TEP2718, I/TRGB bottom, lead forward to follow chip light.



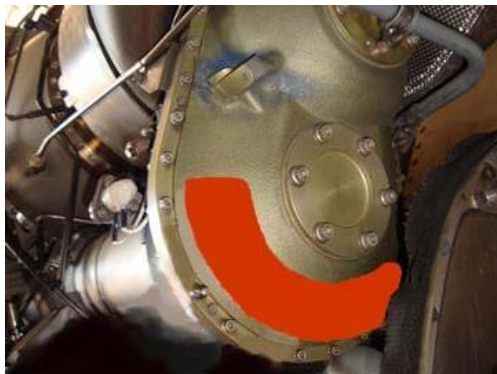
**Figure 5**

TEP2733, MRGB aft, left and right sides on flat circular area, lead up to follow existing wiring.

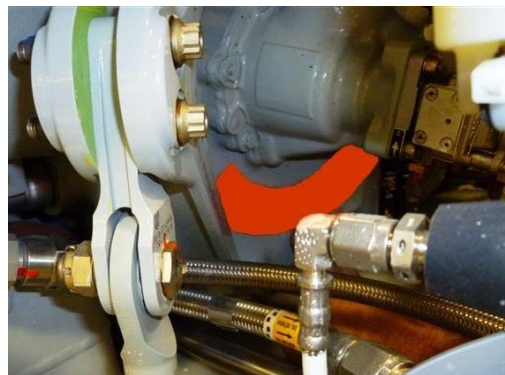


**Figure 6**

TEP2737, each engine MO1 left aft side below oil filter and FCU. lead down.



**Figure 7**  
TEP2739, each engine MO5 aft lower surface. lead to starboard.



**Figure 8**  
TEP2739, MRGB forward lower side left and right sides, below output drive, lead to port.



**Figure 9**  
Example of junction mounted using Adel clamp.



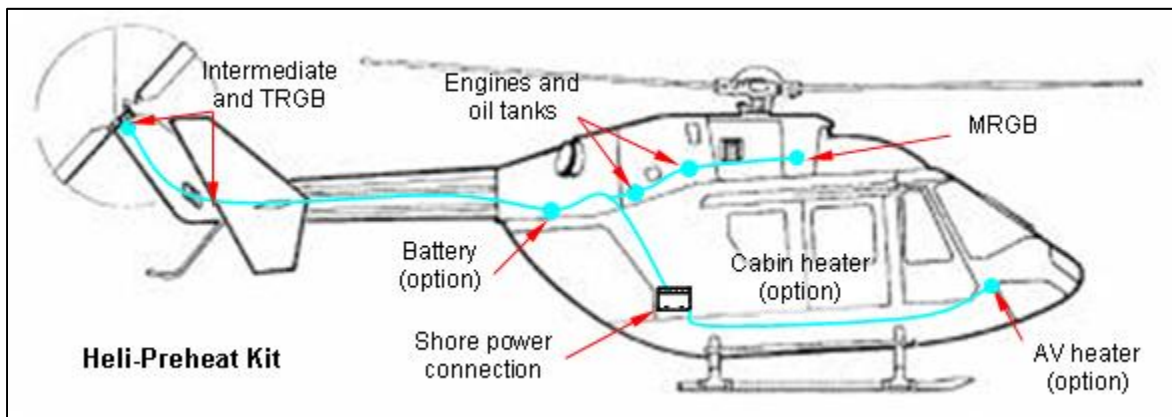
**Figure 10**  
Shoreline power plug, circuit protection, indicator light and placard, located in back of starboard step aft of door.



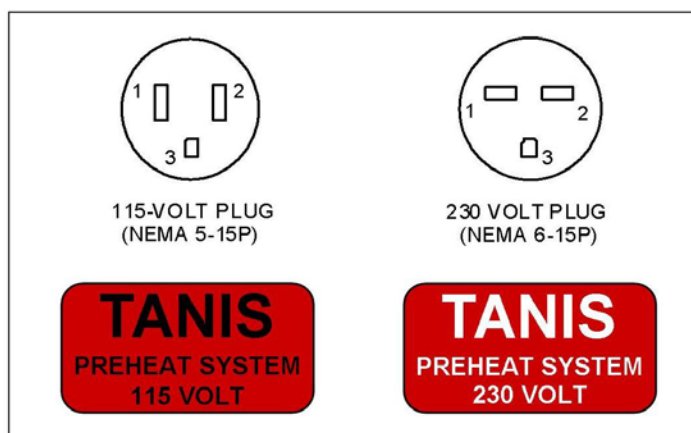
**Figure 11**  
Locate TG01056 fireproof grommet, and locate engine junction using Adel clamp.



**Figure 12**  
Example for optional TU03125 disconnect. Junction can be mounted near back side of connector with element lead transitioning through connector.



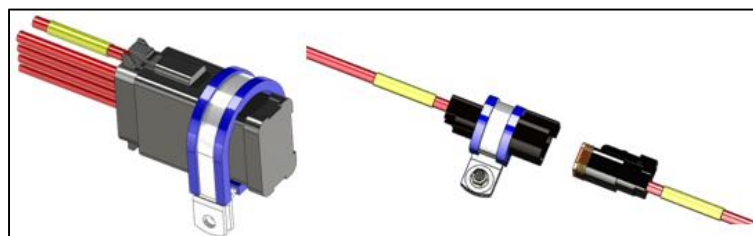
**Figure 13** – Preheat kit overview



**Figure 14** - 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 15** - Generic element, label with part number. Elements listed in § 4.3.



**Figure 16** - Locate junction and connectors with appropriate lacing, cable ties, and/or clamp (Table 2 ). Cable and lead routing descriptions § 4.4.

## 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 14), engine, and airframe.
- 5) [ ☐ ] Verify there is no continuity between shore power plug pins 1 and 2, and the ground pin 3.
- 6) [ ☐ ] Using an ohmmeter, measure resistance between the power pins 1 and 2, and record total system resistance: \_\_\_\_\_. Compare with Table 3.
- 7) [ ☐ ] \* Freeze (0°C) battery thermal control and repeat step 5, record: \_\_\_\_\_.
- 8) [ ☐ ] Connect the system to appropriate power.
- 9) [ ☐ ] Verify power indicator light is on (illuminated).
- 10) [ ☐ ] Within 30-minutes, area adjacent to the elements will start to feel warm. Check each element individually.
- 11) [ ☐ ] \* 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.
- 12) [ ☐ ] When testing is completed, disconnect (unplug) from power, latch any access doors that were open, and stow extension cord in appropriate location.
- 13) [ ☐ ] Update/modify weight and balance, and installed equipment lists (Section 3.5).
- 14) [ ☐ ] Complete/fill-in blanks as indicated on first and last pages of Operating Guide listed in Table 1, and file with POH/AFM..
- 15) [ ☐ ] Complete/fill-in blanks as indicated in Instructions for Continued Airworthiness (ICA), and file with aircraft manuals and logs.
- 16) [ ☐ ] Make a log entry to comply with 14 CFR Part 43.9 or other procedures set in place.
- 17) [ ☐ ] Complete and return Registration/Warranty Card.
- 18) [ ☐ ] 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(s)**

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

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

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

System test performed by: \_\_\_\_\_  
(Signature)

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

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