

ICA_030314

**INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
FOR THE
HARTZELL HC-E5A-3A/NC10245B PROPELLER
ON PILATUS PC-12 AIRCRAFT**

STC SA03466CH

LOG OF REVISIONS

Revision	Revised Page(s)	Description of Revision	Engineer	Date
New	All	Original Release	T. Parker	5/20/2015
A	5, 7-10	Revise De-Ice Adjustment/Test and Fault Isolation procedures to align with Pilatus Aircraft Maintenance Manual	L. Doud	6/27/17

NOTE: All changes are indicated by a black vertical line along the left margin.

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INTRODUCTION

The Instructions for Continued Airworthiness below document the unique maintenance requirements and procedures associated with the Hartzell HC-E5A-3A/NC10245B five-blade composite propeller installed on Pilatus PC-12 aircraft. These instructions only address areas that are affected by installation of the composite five-blade propeller, for all other information refer to the applicable PC-12 Aircraft Maintenance Manual.

Chapter 4 – AIRWORTHINESS LIMITATIONS

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

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

Chapter 5 - TIME LIMITS / MAINTENANCE CHECKS

All required maintenance, inspections, time intervals and procedures for Hartzell Propellers are provided in Hartzell Manual 147 (Hartzell Propeller Owner's Manual) provided with each propeller. Recommended Time-Between-Overhaul (TBO) for the STC propeller is also provided in Hartzell Service Letter HC-SL-61-61Y. Propeller overhaul must be accomplished by a certified propeller repair station with the appropriate rating.

All propeller inspection requirements contained in Phase, Special, Biennial, Interim, Complete and Unscheduled inspections remain unchanged and should be complied with as provided in Chapter 5 of the applicable Pilatus PC-12 Maintenance Manual. Procedures unique to the composite blade construction are provided in the Maintenance Practices section of Hartzell Manual 147 (Hartzell Propeller Owner's Manual).

Due to the composite construction of the propeller blade, in addition to the lightning strike inspection criteria provided in the Pilatus PC-12 Maintenance Manual, refer to Hartzell Propeller Owner's Manual 147, Chapter 5, Special Inspections - Lightning Strike for detailed information on propeller lightning strike inspection and disposition.

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Chapter 30 ICE AND RAIN PROTECTION

Propeller De-Ice System – Description and Operation

The Hartzell HC-E5A-3A/NC10245B propeller uses a dual heating element deicer boot that is functionally equivalent to the deicer installed on the Hartzell four-blade propeller de-ice system described in the Pilatus PC-12 Aircraft Maintenance Manual. The primary change is how the de-ice boots are heated. Instead of the whole boot on opposing blades being heated simultaneously and then alternating to the opposing pair of blades, the five-blade propeller de-ice design heats the inboard or outboard boot sectors of all five blades simultaneously, then alternates to the other sector based on the propeller de-ice timer mode as described below:

Mode Number	Timer Function
Mode 1 (IOAT above 0°C)	The timer is in standby and none of the de-ice boots are heated.
Mode 2 (IOAT from 0°C to -16°C)	The outboard sectors of all five blades are heated for 45 seconds, then the inboard sectors of all five blades are heated for 45 seconds, then all sectors/blades are off for 90 seconds. The cycle is then repeated.
Mode 3 (IOAT below -16°C)	The outboard sectors of all five blades are heated for 90 seconds, and then the inboard sectors of all five blades are heated for 90 seconds. The cycle is then repeated.

A new brush block bracket and MOV assembly is installed to accommodate the larger diameter slip ring used on the five-blade propeller. All other propeller de-ice system components and system functionality remains unchanged and the system description provided in the Pilatus Aircraft Maintenance Manual is applicable.

There is one operational warning/caution that must be observed to prevent damage to the composite blades when operating the propeller de-ice system without the engine running. If the propeller de-ice system is operated without the propeller turning, the deicer can heat the blades to temperatures that will damage the composite blade. The following caution is provided in the STC Installation Instructions and Airplane Flight Manual Supplement:

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CAUTION

DO NOT ALLOW THE PROPELLER DE-ICE BOOTS TO BE HEATED FOR MORE THAN 10 SECONDS OR SEVERE DAMAGE TO THE COMPOSITE BLADES MAY RESULT. IF 10 SECONDS IS EXCEEDED, CONTACT HARTZELL PRODUCT SUPPORT AT:

**Phone: (937) 778-4379 or 1-800-942-7767
e-mail: techsupport@hartzellprop.com**

Propeller De-Ice System – Inspection/Check

The inspection and check procedures provided in the PC-12 Aircraft Maintenance Manual are applicable to the five-blade propeller.

For propeller mounted de-ice system inspection and maintenance details, refer to Hartzell Manuals 181 and 182; refer to the Pilatus PC-12 manual and the STC Installation Instructions for the airframe mounted (non-rotating) system components.

Definition and maintenance of propeller-mounted deicer system components are provided in the Hartzell Manuals listed below:

Manual 180 – Propeller Ice Protection System Manual
Refer to “De-Ice Kits for Lightweight Turbine Propellers with Composite Blades” to see Illustrated Parts Lists for Propeller De-Ice Kit P/N 105934

Manual 181 – Propeller Ice Protection System Component Maintenance Manual

Manual 182 – Propeller Electrical De-Ice Boot Removal and Installation Manual.

These manuals can be viewed and/or obtained via the internet on the Hartzell Propeller website (www.hartzellprop.com). The manuals are located in the “Service & Support” section under Services/Reference Library/Manuals/Ice Protection Manuals.

The MOV module does not require troubleshooting because, much like a fuse, it is passive component that is only replaced in the event of a lightning strike.

The propeller de-ice installation drawings 105934, 105940, 105942, and 106103 (latest revisions) can also be referenced to aid in troubleshooting.

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Propeller De-Ice System – Adjustment/Test

Support equipment

Name	Identification / Reference	Qty
Safety clip (Circuit breaker hold open)	Part /110.88.07.065	as required
Stop watch	Part /Local supply	as required
Maintenance box	Part /985.99.99.610 (PC-12/47E) 1 Or Part /985.99.99.601 (PC-12, /45, /47)	
Voltmeter	Part Local supply	as required
Current Clamp Meter	Part Local supply	as required

Procedure

1 **General**

This section gives the test procedures to do:

- An operational test of the propeller de-ice system (after propeller installation, propeller de-ice system component replacement, and for normal maintenance checks)
- A fault isolation procedure of the propeller deice system when a PROPELLER DE-ICE caution is present and/or to aid troubleshooting when incorrect operation is suspected.

From when the system is set to on, a time delay of approximately 20 seconds occurs before the Caution and Advisory System (CAS) indications change. This is the time taken for the propeller de-ice timer built-in system test to be completed.

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Note

The following procedures cover multiple aircraft models with different avionics terminology. The generic terms used in the following operational and fault isolation procedures are defined for each system below:

Propeller De-Ice Switch = ICE PROTECTION PROPELLER (PC-12/47E)
= DE ICING PROP (PC-12, PC-12/45, PC-12/47)

The Propeller De-Ice Caution indicates the propeller de-ice system is in self-test, weight is on wheels, engine is off, or a fault in the system has been detected.

Propeller De-Ice Caution = "CAS PROPELLER DE-ICE"
(PC-12/47E on lower MFD)
= amber "DE ICE" and
green flashing "PROP DE ICE" on CAWS display
(S/N 101-320 and 322-400)
= amber "DE ICE" on CAWS display
(S/N 321 and 401-999)

The propeller De-Ice Advisory indicates the propeller de-ice system is functioning normally.

Propeller De-Ice Advisory = green "PROPELLER" in ICE PROTECTION
window (PC-12/47E on lower MFD)
= steady green "PROP DE ICE" on CAWS display
(S/N 101-320 and 322-400)
= Nothing displayed
(amber De-Ice Caution goes off)
(S/N 321 and 401-999)

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2 Operational Test of the Propeller Deicing System

2.1 Preparation

CAUTION

Two people are necessary to perform this procedure, one person in the cockpit and one person at the propeller. During the tests the person at the propeller must turn the propeller slowly and continuously. If the propeller is not turned continuously, the temperature between the brush pack and slip-ring assemblies can increase and cause damage to equipment.

CAUTION

DO NOT ALLOW THE PROPELLER DE-ICE BOOTS TO BE HEATED FOR MORE THAN 10 SECONDS OR SEVERE DAMAGE TO THE COMPOSITE BLADES MAY RESULT. IF 10 SECONDS IS EXCEEDED, CONTACT HARTZELL PRODUCT SUPPORT AT:

Phone: (937) 778-4379 or 1-800-942-7767
e-mail: techsupport@hartzellprop.com

CAUTION

WAIT FOR 2 MINUTES BETWEEN TESTS TO ALLOW THE PROPELLER BLADES TO COOL BEFORE INITIATING THE OPERATIONAL TEST AGAIN.

Note

The propeller De-Ice Caution message has a time delay of 20 seconds from when the Propeller De-Ice Switch is set to ON. This 20 second delay is due to the de-ice timer power on self-test.

- 2.1.1 Make sure the area around the propeller is clear of objects and the Propeller De-ice Switch is set to OFF.
- 2.1.2 Install Maintenance Test Box (if aircraft not equipped with Ground Maintenance Panel)
- 2.1.3 Open and install a Safety clip (Circuit breaker hold open) on this circuit breaker:
 - STARTER (ESSENTIAL BUS).
- 2.1.4 Energize the aircraft electrical system; refer to applicable Aircraft Maintenance Manual procedure.

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2.2 Procedure

Note: The aircraft is on the ground (weight on wheels) for steps 2.2.1 through 2.2.3 of this procedure.

Note: The following step initiates the 20 second power on self-test of the de-ice timer and energizes the propeller de-ice boot sectors for 5-10 seconds each. The outboard de-ice boot sector is heated first, followed by the inboard sector.

2.2.1 While the assistant is turning the propeller by hand, set the Propeller De-Ice switch to ON.

2.2.2 Verify the following Caution and Advisory messages:

- the Propeller De-Ice Caution message is ON.
- the Propeller De-Ice Advisory is OFF.

2.2.3 Have the assistant feel by hand while rotating the propeller, for heat on all five de-ice boots, outboard sector first, followed by inboard sector.

2.2.4 20 seconds after placing the Propeller De-Ice Switch to ON and confirming all boots, all sectors are heated, on the Maintenance Box (or Ground Maintenance Panel if equipped) momentarily (**less than 10 seconds**) set and hold the AIR/GND switch to AIR.

Note: The propeller heating will not operate if the ambient temperature is above 3°C.

2.2.5 Verify the following Caution and Advisory messages:

- the Propeller De-Ice Caution message is OFF.
- the Propeller De-Ice Advisory is ON.

Note: This step confirms the propeller de-ice timer power-on self-test was successful and the system is operational.

2.2.6 Release the AIR/GND switch.

2.2.7 Set the Propeller De-Ice Switch to OFF and have the assistant stop turning propeller.

2.2.8 De-energize the aircraft electrical system; refer to applicable Aircraft Maintenance Manual procedure.

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- 2.2.9 Remove the safety clip and close the circuit breaker:
- STARTER (ESSENTIAL BUS).
- 2.2.10 Remove Maintenance Test Box if installed.
- 2.2.11 If one or all inboard or outboard de-ice boot sectors does not get warm to the touch during this operational test, inspect the brush block connections and propeller mounted de-ice components per Hartzell Manuals 180 and 181 and then repeat the Operational Test. If the Operational Test continues to be unsuccessful, perform the Fault Isolation procedures of Section 3.

3 Fault Isolation of the Propeller Deicing System

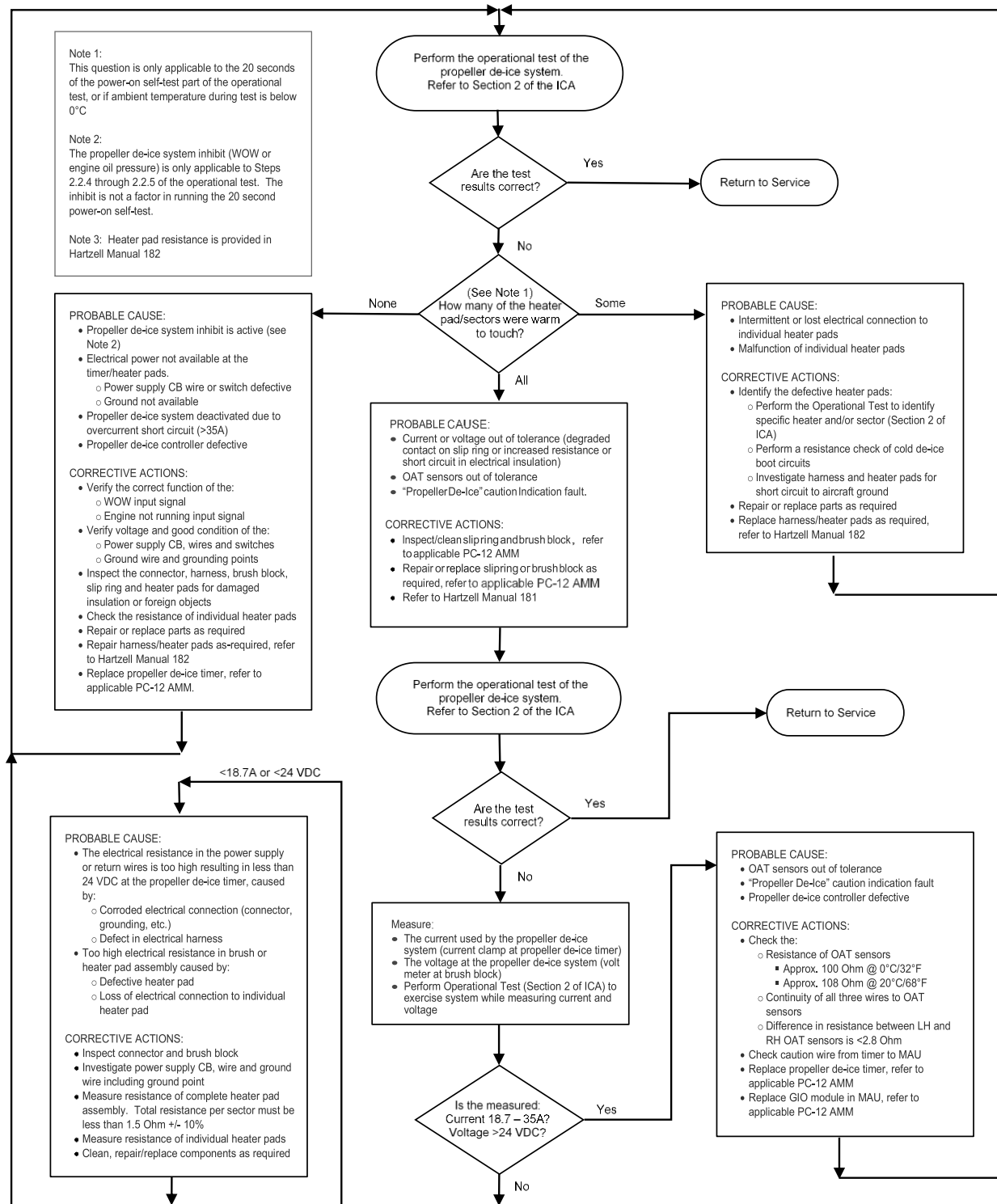
The fault isolation procedures of the propeller deice system are performed when one or more de-ice boots or boot sectors does not get warm during the Operational Test, a PROPELLER DE-ICE caution is presented after the system power-on self-test with the AIR/GND switch set to AIR, and/or to aid troubleshooting when incorrect operation is suspected.

Use the fault isolation flowchart on the following page to determine which components require service or replacement to restore propeller de-ice system functionality.

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Close up

- 4 De-energize the aircraft electrical system; refer to the applicable Aircraft Maintenance Manual procedure.
- 5 Remove the jumper wire from the engine oil pressure switch at the engine AGB.
- 6 Connect engine oil pressure switch electrical connector to the engine oil pressure switch.
- 7 Remove the Propeller De-Ice Check box connector from the de-ice timer and associated aircraft harness (connector A030P2 on Schematic 30-60-00), re-install on de-ice timer and safety wire connector.
- 8 Disconnect the Maintenance box from the maintenance panel.
- 9 Make sure that the work area is clean and clear of tools and other items.
- 10 Close access panel 52 NB and 62 NB near the OAT sensors.
- 11 Close access panel 21 QZ.
- 12 Close the engine cowlings 43 AL and 43 AR.
- 13 Perform Operational Test of the Propeller Deicing System (Section 2) to verify system integrity and boot heating during power-on self-test.
- 14 Remove the safety clip and close the circuit breaker:
 - STARTER (ESSENTIAL BUS).

Brush Pack and MOV – Removal/Installation

The brush block and MOV installation for the five-blade propeller are very similar to the original four-blade propeller except for the bracket used to locate the brushes at a larger radius. The brush block and MOV removal and installation procedures provided in the PC-12 Aircraft Maintenance Manual apply except for part numbers and brush block shim location. Refer to Hartzell Drawing 106103, de-ice kit drawing 105940 and Installation Instructions INST_030314 for brush block installation details.

The Metal Oxide Varistor (MOV) module is installed on a new bracket near the brush block assembly for propeller de-ice system lightning protection. Hartzell recommends the MOV be replaced in the event of a lightning strike per Hartzell Manual 181. Refer to Hartzell airframe de-ice kit P/N 105940 (defined in Hartzell Manual 180) and STC installation instructions INST_030314 for MOV installation details.

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Deicer Boot Removal and Installation

See latest revision of Hartzell Manual 182, Propeller Electrical De-ice Boot Removal and Installation Manual.

Chapter 61 - PROPELLERS

Propeller – Description and Operation

The STC propeller is a 105" diameter, five-blade, constant-speed, feathering and reversing propeller. For additional information refer to "Description and Operation" section of Hartzell Manual 147 (Hartzell Propeller Owner's Manual) for "Feathering and Reversing Propellers HC-E(4,5)()-3() Series."

Propeller – Adjustment/Test

The dynamic balancing procedures provided in the PC-12 Aircraft Maintenance Manual are applicable to the composite five-blade propeller.

Propeller Blades – Repair

All required maintenance, inspections, time intervals and procedures are provided or referenced in Hartzell Manual 147 (Hartzell Propeller Owner's Manual) provided with each propeller.

Recommended Time-Between-Overhaul (TBO) limits for the STC propeller are provided in Hartzell Service Letter HC-SL-61-61Y. Propeller overhaul must be accomplished by a certified propeller repair station with the appropriate rating.

Propeller – Removal/Installation

The STC propeller is installed in accordance with STC Installation Instructions INST_030314. Installation and removal details are provided in Hartzell Manual 147 (Hartzell Propeller Owner's Manual) for "Feathering and Reversing Propellers HC-E(4,5)()-3() Series."

Spinner Inspection/Maintenance

Refer to Hartzell Manual 127 for 105820(P) aluminum spinner assembly inspection and maintenance information.

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