KELLY AEROSPACE

Thermal Systems

Document Number:	NC-09-048
Title:	LC42-550FG & LC41-550FG Thermawing Deice System ICA
Revision:	B
Date:	04 March, 2014

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Revisions

Rev.	Description	Author	Date	Approved
A	Initial Release	JH	4/10/09	EP
B	See ECN 14-011	JB	03/04/14	EF

The latest revision of the maintenance manual can be obtained from the Kelly Aerospace website at www.kellyaerospace.com.

IN THE EVENT INTERNET ACCESS IS NOT AVAILABLE, PLEASE CONTACT THE CUSTOMER SERVICE OFFICE FOR INQUIRY OR A COPY OF THE LATEST REVISION:

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1.0 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA)

1.1 Introduction

The Kelly Aerospace Thermawing Deice System is designed to remove ice from the leading edge of the wings and horizontal stabilizers of the aircraft. The system is intended as an aid during inadvertent flight in icing conditions. The system is not intended to allow flight into known icing conditions.

1.2 Description

The Kelly Aerospace Thermawing Deice System Kit is comprised of the Thermawing electrically heated deice heaters, a dedicated alternator including drive pulley and belt, Deicer Control Module, Heater Control Modules, Control Switch with integral annunciator, 2 amp circuit breaker, current limiter, and miscellaneous mounts, covers, hardware and wire.

1.3 Control, Operation Information

The pilot controls the system via the Thermawing De-Ice Control Switch. After setting the Control Switch to the 'ON' position, the controller will conduct a self-test and then illuminate the 'AIRFRAME' annunciator in green. The system operates automatically by sensing the outside air temperature and other system inputs. When the system enters operational mode the 'ON' annunciator will illuminate in green.

1.4 Maintenance Instructions

Perform a system functional test after any maintenance is performed on the propeller deice system.

NOTE: Before inspections or maintenance are performed it is the responsibility of the owner/operator and maintenance agency to assure that they are in possession of the proper revision level of the applicable documentation and drawings.

1.5 TROUBLESHOOTING

Fault conditions are divided into two broad categories. Hard faults indicate that safe operation of the system cannot continue without repair, and lock out system operation until the next power cycle. Note that operation of the Deice Selector switch does not remove power from the system. Soft faults indicate that the Controller has detected either a temporary condition that prevents operation of the system, or a partial failure that degrades the ice removal capability of the system.

1.5.1 Soft Faults

In case of a soft fault, the 'FAIL' annunciator illuminates and the 'AIRFRAME' annunciator remains illuminated. The following conditions can cause a soft fault indication:

Low Aircraft Bus Voltage

The system requires a minimum of 11V from the Avionics Bus to guarantee safe operation. If the Avionics Bus falls below this level, the Controller will cease operation but continue to monitor for restoration of proper power, and will then resume operation without operator intervention. Note that this condition suggests problems outside of the Deice system, such as failure of the ship's alternator.

Low Deice Alternator Output

If the output of the deice alternator drops significantly below the commanded power, the system enters a soft fault state. Deicing may or may not be effective in this condition. The most common cause would be low engine RPM, as during a rapid descent at idle power, or during landing rollout. This condition can also occur if the system is left enabled, at icing temperatures, after the engine run-up is complete and the engine has been returned to idle power while awaiting takeoff or departure clearance. Normal operation will resume without operator intervention when alternator operation returns to normal.

Heater Failure

A failure of a heater can be sensed by the system in several ways. Operation will continue with no deicing on the affected heater(s), but the system should be serviced to correct the fault and restore full system capability.

1.5.2 Hard Faults

In a hard fault condition, the 'FAIL' annunciator illuminates and the 'AIRFRAME' annunciator extinguishes. The system is completely disabled until the next power cycle. A fault code and textual description is saved in nonvolatile memory for maintenance use. To retrieve the fault code, connect the Field Diagnostic Cable and the Diagnostic Display as described above, and apply power to the Controller. The Controller will display the software identification and version number, followed by a line beginning with "Last Flt:". On this same line will appear a fault code followed by further information in text form. The fault codes that can occur are listed below.

ftNone

No previous fault has been recorded.

ftDeiceVolt

The deice alternator is not producing any significant power, suggesting a broken belt, a failed alternator, or an open or short in the deice alternator field circuit or output circuit.

ftHtrOvrTemp

A specific heater will be named and the measured temperature at the time of the fault will be specified. Troubleshoot for a failed temperature sensor or a failed HCM on the indicated heater.

ftOverCurr

Deice alternator output exceeded 80A during the Powerup Test or 150A at any other time. Troubleshoot for a short in the power wiring or one or more failed HCM's.

ftHiResist

A specific heater appears to have increased its resistance substantially above nominal. Troubleshoot for an open power connection, an open heater, or a failed (open) HCM in that position.

ftLoResist

A specific heater appears to have decreased its resistance substantially below nominal. Troubleshoot for a shorted power connection, a short between the heater and the airframe, or a failed (shorted) HCM in any position other than the indicated heater.

ftOverVolt

The deice alternator output voltage is excessive during heating of a specific heater. Troubleshoot for an open in the power wiring or a failed (open) HCM, especially on the indicated heater.

ftIntrnlErr

An internal error has occurred in the Controller. Record the error message and contact the factory.

ftBadTemp

During the Powerup Test, either the average of all temperature sensors was out of range, or the OAT sensor disagreed with the average of the heater temperature sensors before power was applied. Troubleshoot for a defective OAT sensor.

ftRtdOpen

The indicated temperature sensor (RTD) appears to have a break in the wiring. Troubleshoot for a disconnected temperature sensor, a break in the wiring between the HCM and the RTD, or a failed RTD.

ftRtdShort

The indicated temperature sensor (RTD) appears to have a short in the wiring. Troubleshoot for a short between the HCM and the RTD, or a failed RTD.

ftExcitatn

The indicated temperature sensor (RTD) is not receiving the correct excitation current. Troubleshoot for a failed RTD or HCM.

ftConfigErr

No HCM's were found during powerup configuration. Check for correct wiring of the HCM and OAT cables.

ftWatchdog

An internal error has occurred in the Controller. Record the error message and contact the factory.

ftRamFail

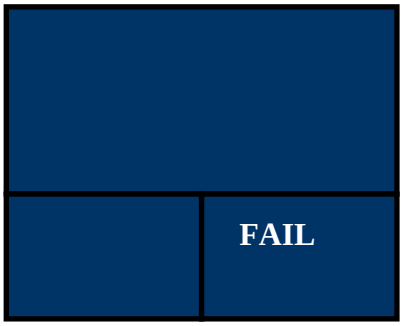
An internal error has occurred in the Controller. Record the error message and contact the factory.

ftFailedHtr

More than two heaters have been identified as failed. The most likely single failure in this case is a shorted HCM on some heater other than the three identified as failed. Alternately, troubleshoot for multiple failed heaters and/or HCM's, which is only likely if the system has flown for an extended time after a single heater failure, or if there has been a significant electrical event such as a very close lightning strike or even a direct strike.

GFS Trip

Ground Fault Sensor Trip, same indication as hard fault except it is generated by the Ground Fault Sensor System:



Airframe De-Ice Switch selected OFF

Ground Fault Sensor Trip also disables the system until the next power cycle. The indication is identical to a Hard Fault and can be identified by turning off the De-Ice switch. With the De-Ice switch in the OFF position and the FAIL light illuminated, this indicates a GFS Trip. When the GFS trips, it locks open the Field Isolation Relay and the FAIL light remains illuminated.
Maintenance can verify a GFS sensor trip by an illuminated light on the GFS sensor.
One reset may be attempted if desired by pulling the 2A Deice Controller circuit breaker and resetting the circuit breaker after at least 10 seconds.

1.6 100Hr/Annual

1.6.1 Alternator Belt

Check the alternator belt tension slip torque to insure 300 in-lbs slip torque.

Even if the Thermawing system is never operated, after every 25 hours of flight time the belt tension must be reset to 300 in-lbs.

If a new belt is installed fly the aircraft for 1 hour and reset tensioning slip torque to 300 in-lbs after belt has returned to ambient temperature.

Check pulley alignment using a straight edge.

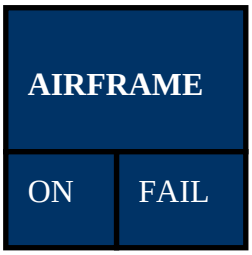
Remove necessary access covers including engine upper cowl and interior trim panels per the AMM.

1.6.2 Deice Heaters

Visually inspect the heaters for general condition, wrinkles, loose or torn areas. Check for abrasion or cuts along leading edge of flight surface and on edges of heater.
Look for hot spots or blistering along the copper strips at each end of the heaters, and along the parting strip areas.
Inspect the heater electrical connections for looseness, or tears around the electrical connection areas.
Verify all hardware is properly secured.

1.6.3 Control Switch / Annunciator

With aircraft power on, verify annunciator bulbs are operating by pressing the 'LAMP TEST' switch. Replace bulbs as necessary



NOTE: The Airframe Deice Selector Switch does NOT have to be ON to do the LAMP TEST

1.6.4 Lamp Test

There are diodes in the wire harnesses P/N DI-00067 and DI-00068.
If after replacing bulbs the LAMP TEST is still not successful, check the diodes by using an ohmmeter and referring to the proper wiring diagram. Replace as necessary.
Check switch mounting for security and loose components.

1.6.5 Deice Control Module

The deice control module performs a self-test of the entire system on initial activation or after a power interruption. The engine has to be running to perform a successful test. The test may be performed at any outside air temperature.
When the Deice Control Switch is selected ON, the 'AIRFRAME' annunciator will illuminate, indicating that the switch is in the ON position, the 'ON' and 'FAIL' annunciators will flash during a self test. About 30 seconds.
After the self-test is completed the 'AIRFRAME' annunciator will illuminate steady, indicating the DE-ICE system is powered and armed. The 'ON' annunciator will illuminate whenever the OAT senses a temperature at which

icing can be expected. If a fault condition occurs, the 'FAIL' annunciator will illuminate.
Two types of fault indications can be displayed.

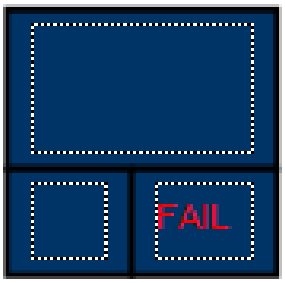


Figure 1: Hard fault

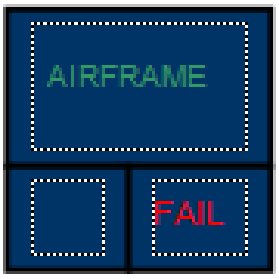


Figure 2: Soft fault

The selector switch may be turned on at any temperature and a self-test will be performed, but the system will not operate until it senses icing conditions, temperature below 42 degrees F.
Check attachment of Control Module to the electronics bay floor. Look for loose fasteners and wire harness connectors.
Inspect wiring for damage or abrasion.

1.6.6 Heater Control Modules

The Heater Control Modules are tested as part of the system during the Power on Self Test. Refer to the Deice Control Module for fault indications.
Check attachment of the Heater Control Modules in the wings and tail of the aircraft. Look for loose fasteners and wire harness connectors.
Inspect wiring for damage or abrasion.

1.6.7 Wiring

Inspect all wiring harnesses for general condition, security abrasion, or damage.
Check for loose connections at terminals. Loose connections increase resistance that causes the connection to heat up. During operation and power-

up testing the total of heater resistance and associated wiring is monitored and if out of limits the system will shut down and indicate a hard fault.
Check wire harness plugs for looseness.

1.6.8 De-Ice Heaters

The Thermawing Deicer Heaters are serviceable. Some minor defects may be repaired by placing a patch over the affected area. Minor damage in shedding zone: damage no bigger than the surface area of a quarter, one on the upper surface and one on the lower surface per 24 inches of heater length.

Minor damage of parting Strip zone: .125 inches along the edges may be damaged. A minimum of .500 inches of undamaged width is required for a total length of 2 inches.

Damage so severe that a short is created between the heating element and the grounding mesh or skin, on a power up test it will be indicated as a hard fault.
If the surface and the heating element has been damaged, and the heating element material has been damaged or is missing, the heating element may still be repaired and the heater will function normally except the area where the element is missing or damaged.

Parting strip is .625 inches wide, .500 inches of the parting strip width may not have any damage to the heating element; only the edges of the parting strip heating element and the outside TEDLAR® surface may be repaired.
After repairs are made, and the power-up test is successful, the system may be returned to service.

Repair Kits are available at Kelly Aerospace.

Replacement of defective heaters with the proper Kelly Aerospace parts is recommended.

1.6.9 Control Switch / Annunciator

The Control Switch is non repairable and should be replaced with an equivalent device if found to be defective. The annunciator lamps should be replaced if burnt out with LTX 6014 bulbs or equivalent.

1.6.10 Deice Control Module

The Control Module is non repairable and should be replaced with an equivalent device if found to be defective.

1.6.11 Heater Control Module

The Heater Control Modules are non repairable and should be replaced with an equivalent device if found to be defective.

1.6.12 Ground fault sensor

The ground fault sensor is non repairable and should be replaced with an equivalent device if found to be defective.

1.6.13 RTD's

The RTD's are non repairable and should be replaced with an equivalent device if found to be defective. The associated deice heater will also need to be removed to gain access to the RTD. The deice heater must also be replaced at the same time. The length of the RTD lead is 48 inches and may not be altered; any change to the length will change the calibrated resistance of the RTD.

1.6.14 Shunt

The Shunt is non repairable and should be replaced with an equivalent device if found to be defective. The shunt is an electrical device and if found to be defective, the cause of the failure should be determined.

1.6.15 Alternator

Check the condition and security of all associated wiring in the engine compartment.
Alternator mounting and tension brackets, turnbuckle, belt cutter and attaching hardware should be inspected for cracks, security and alignment. The alternator belt should be inspected for condition and replaced if any defects are detected.
Check the Torque of the alternator belt with Kelly Aerospace drawing AL-00030 for the torque values and procedures.

1.6.16 Fuses

The fuses are non repairable and should be replaced with an equivalent device if found to be defective. The fuses are protective devices and if found to be defective, the cause of the over current condition should be determined.

1.6.17 Circuit Breaker

The circuit breaker is non repairable and should be replaced with an equivalent device if found to be defective.

1.6.18 Wiring

Wiring should be repaired using recommended practices per the AMM, AEM, AC43.13-1 or other approved sources.

1.6.19 Overhaul

There are no overhaul time limitations on the Thermawing Deice System installation. All components for the Thermawing Deice System are to be overhauled or replaced on condition.

2.0 MISCELLANEOUS

2.1 Placards

Required placards for safe operation must be located in plain sight of the pilot.

Avoid use of Deice System at low engine RPM or while taxiing

Not Approved for flight into Known Icing Conditions

The ALT 3 FIELD placard is placed by the 7.5 amp circuit breaker on the circuit breaker panel.

ALT 3 FIELD

The AIRFRAME Deice placard is installed by the 2-amp circuit breaker on the avionics panel.

AIRFRAME DEICE

A placard should be placed near the field control relay in the aft electronics bay. The placard should clearly identify the field control relay. See Figure 3.

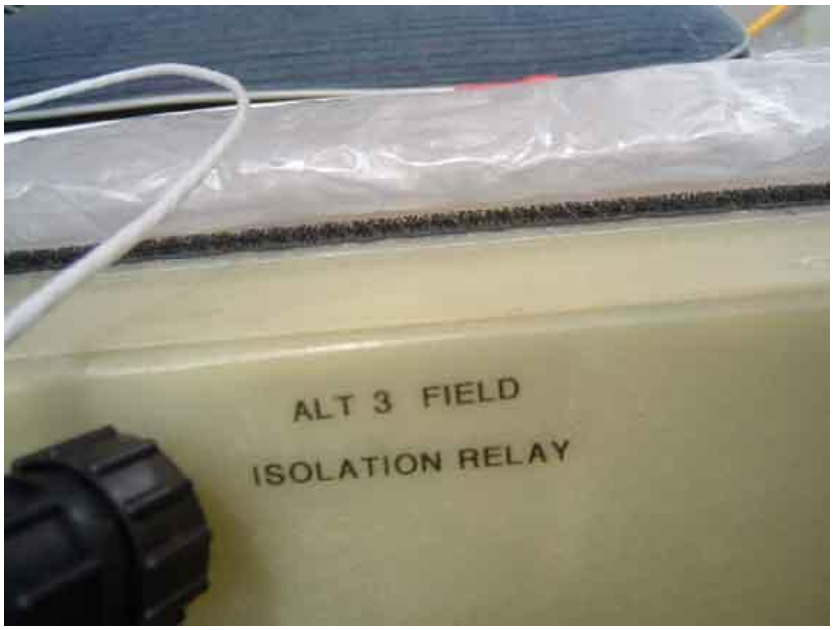


Figure 3: Field control relay placard

2.2 Removal and or Replacement information

Refer to the installation manual for removal and re-installation of components.

2.3 Diagrams

All diagrams and drawings are located on the installation CD.

NOTE: It is the responsibility of the owner/operator and maintenance agency to assure that they are in possession of the proper revision level of this document and drawings. This may be obtained by contacting Kelly Aerospace by phone (440) 951-4744, fax (440) 951-4725 or email www.KellyAerospace.com

2.4 Special Inspection Requirements

Even if the Thermawing system is never operated, after every 25 hours of flight time the belt tension must be reset to 300 in-lbs.

2.5 Application of Protective Treatments

There are no special treatments required before, during or after inspection of this system.

2.6 Data

For original equipment removed to facilitate installation, refer to OEM service manual for proper installation.

2.7 List of Special Tools

There are no special tools required for installation or inspection of this system.