FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR
LC40-550FG
AIRFRAME DE-ICING SYSTEM

Aircraft SN: _____

Aircraft Registration Number: _____

This supplement must be attached to the FAA approved flight manual when the Kelly Aerospace airframe de-icing system is installed in accordance with STC SA02660CH. The information contained in this document supplements or supersedes the basic manual only in those areas listed. For limitations, procedures, performance, and loading information not contained in this supplement, consult the basic FAA airplane flight manual.

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FAA-Approved _____
Charles L. Smalley, Manager
Systems & Flight Test Branch
Chicago Aircraft Certification Office
ACE-115C, Federal Aviation Administration

DATE _____

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SECTION 1
GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Airframe De-ice System is installed in accordance with FAA Approved Data, either STC or Original Equipment.

Note - FLIGHT INTO KNOWN ICING CONDITIONS PROHIBITED.

SECTION 2
LIMITATIONS

(a) **This aircraft has NOT been certified for flight into FAR 25 Appendix C conditions, freezing drizzle conditions, or freezing rain.** The Airframe De-ice System has been installed as optional safety equipment in case of an inadvertent encounter in icing conditions.

(b) **This aircraft does not have a heated stall indicator.** The aircraft stall indicator **WILL** freeze over while in icing conditions, and is not to be relied upon.

(c) **The following placard must be installed in full view of the pilot.**

WARNING
FLIGHT INTO KNOWN ICING CONDITIONS PROHIBITED.

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SECTION 3
EMERGENCY PROCEDURES

WARNING

INADVERTENT FLIGHT INTO KNOWN ICING CONDITIONS

Inadvertent flight into known icing conditions requires immediate action to exit icing conditions. Depending on the severity of the icing encounter, failure to take immediate positive action will lead to performance losses severe enough to make level flight impossible. Therefore, climb or descend out of icing conditions if this proves the shortest route. If exit must be made in level flight, consider the use of MAXIMUM POWER and exit by the most direct route. The effect of the additional fuel burned at higher power settings on aircraft range must be considered and an alternate airport chosen if necessary. Watch and maintain airspeed. The autopilot, if engaged, will not maintain airspeed.

CAUTION

Foreword visibility may be limited or restricted upon approach; visibility should be available through side windows. Take necessary precautions during approach.

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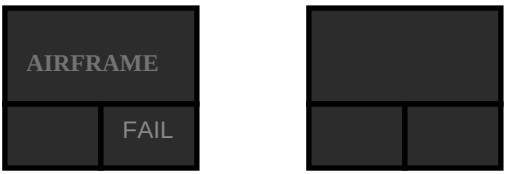
AIRFRAME DE-ICE SYSTEM MALFUNCTIONS

The Airframe De-ice System performs extensive self-tests both at startup and during operation. Three types of faults are detected by the De-ice system:

Soft Fault

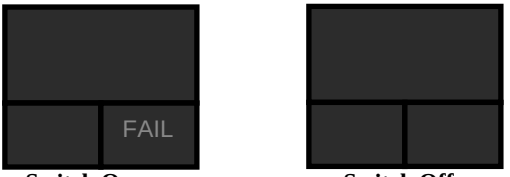


Switch On **Switch Off**

Soft Faults indicate a temporary or partial degradation of system function and are indicated by the Airframe and Fail annunciators being illuminated together. Monitor the system function visually to determine whether to manually disable the system. Typical indications that would dictate manually disabling the system would include large asymmetries in ice removal.

Note that a Soft Fault may occur when engine RPM is below 2000.

Hard Fault



Switch On **Switch Off**

Hard Faults disable the system until the next power cycle. In case of a hard fault, the Airframe annunciator will be extinguished and the Fail annunciator will be illuminated. 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. If the fault recurs, the system shall be disabled by pulling both the 2A Deice Controller circuit breaker and the 7.5A Deice Alternator Field circuit breaker. The system must be evaluated by qualified maintenance personnel for return to service.

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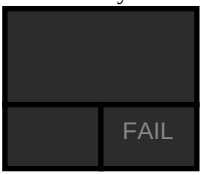
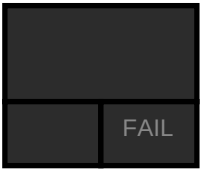
GFS Trip

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



Switch On



Switch 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.

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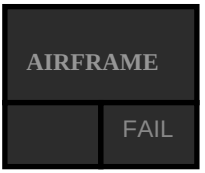
EMERGENCY CHECKLIST

SOFT FAULT

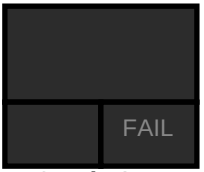


Switch **ON**

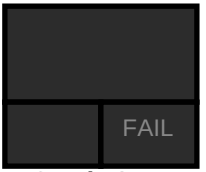
1) Monitor Flight surfaces for Asymmetric Icing

2) If asymmetric icing is observed disable the system and avoid icing conditions.

HARD FAULT or GFS TRIP



Switch **ON**



Switch **OFF**

1) Move De-Ice Switch to off position. If FAIL light remains illuminated in the off position then the De-Ice System has a Ground Fault (GFS) Trip

2) Pull 2-amp AIRFRAME DE_ICE SYSTEM Circuit Breaker

3) Wait 10 seconds

4) Reset 2-amp AIRFRAME DE-ICE SYSTEM Circuit Breaker

5) Move De-Ice Switch to the on position

6) The De-Ice System will attempt to go through a power-up test.

7) If after resetting the Circuit Breaker and after the subsequent power-up test the condition still exists then disable the De-Ice System

8) Move De-Ice Switch to off position

9) Pull 2-amp AIRFRAME DE-ICE SYSTEM Circuit Breaker

10) Pull 7.5-amp ALT 3 FIELD Circuit Breaker

11) Exit or Avoid Icing Conditions

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SECTION 4
NORMAL PROCEDURES

The system should be turned on prior to entering conditions where possible icing may be encountered

The LC40-550FG is not approved for flight into known or forecast icing conditions, and the Airframe De-ice System is not intended for sustained flight in icing conditions. Rather, it is for *preventative* and *emergency* purposes only.

Therefore, the following guidelines must be observed.

(a) Flight into Icing Conditions PROHIBITED
(b) Flight into freezing drizzle or freezing rain is PROHIBITED.
(c) These guidelines must be observed at all flight altitudes.

WARNING
DO NOT ATTEMPT FLIGHT WITH FROST, ICE OR SNOW ADHERING TO THE EXTERIOR SURFACES OF THE AIRCRAFT OR LANDING GEAR.

Icing conditions exist in any clouds when the temperature is below freezing; therefore it is necessary to closely monitor Outside Air Temperature (OAT) when flying in visible moisture. Clouds which are dark and have sharply defined edges have high water content and should be avoided whenever possible.

WARNING
FREEZING RAIN MUST ALWAYS BE AVOIDED.

Prior to dispatch into Instrument Meteorological Conditions (IMC) in temperatures at 10°C(50°F) and below, Pitot heat, Propeller Heat System, and Airframe De-ice System, if installed, should be functionally checked for proper operation.

W**ARNING**
Stalling airspeeds should be expected to increase due to the effects of ice accumulation on the wing airfoils. Stall warning devices should not be relied upon. With ice on the airplane, an additional margin of 10 knots should be maintained above the normal stall airspeeds. An additional 10 knots above Vref should be maintained during approach.

WARNING
Magnetic Compass may be in error of as much as 15 degrees during deicing operation and is not to be relied upon.

There is a +/- 1-degree fluctuation on the PFD Magnetic Heading Indicator during deicing operation at maximum output.

Airframe De-ice System Check to be conducted during normal engine run-up:

1) Apply power to the avionics bus. With engine speed at 1500 RPM or above (typically during the engine run-up in the Before Takeoff check), engage the Airframe De-ice System Enable switch.

2) The Airframe De-ice System will go into self-test mode. The "Airframe" annunciator will illuminate, and the "On" and "Fail" annunciator will flash alternately for the duration of the power-up test.

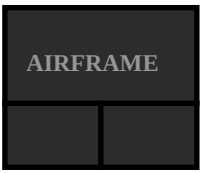
3) OAT and heater temperature sensors, alternator output, and heat production at each surface heater are tested in turn. If adequate engine power is available, the test normally completes within approximately 30 – 45 seconds. If engine power is absent or inadequate, the test will automatically restart after a 15 second delay.

4) After a successful power up test, the "Airframe" annunciator will remain illuminated and the "Fail" annunciator will be extinguished. If a fault is detected during the power-up test, the fault indications previously described are used to indicate system status.

5) After a successful power up test, the system will revert to normal operations. If the temperature is 5°C (41°F) and below, a shed cycle will occur. A soft fault indication should be expected due to low Alternator RPM, as the RPM increases the system will return to normal operation.

6) After a successful power up test on the ground, the system should be turned off until needed.

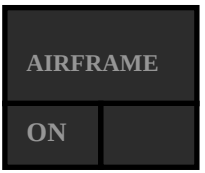
Normal indications after a successful power-up test:



Normal Indication

Temperature 42 F and above

System is in standby



Normal Indication

Temperature 41 F and below

System is active

SECTION 5
PERFORMANCE

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WARNING

ICE ACCUMULATION OF THE UNPROTECTED SURFACES CAN RESULT IN SIGNIFICANT PERFORMANCE LOSS. THE PERFORMANCE OF THIS AIRPLANE IN ICING CONDITIONS HAS NOT BEEN TESTED.

Operation of the system at full power can result in the loss of up to 10 horsepower (or 3.5%), reducing takeoff, climb, and cruise performance significantly. Takeoff distances, rate of climb, and cruise speed should be adjusted accordingly when the system is operating.

The use of Airframe Deice System is prohibited in critical performance situations such as takeoff and initial climb, enroute climb with obstacles and cruise when range is a critical factor.

The colder the outside air temperature is the higher the demand on the alternator is, therefore the greater the airplane performance degradation, up to 3.5% of available engine power.

SECTION 6
LOADING INFORMATION

Factory installed or aftermarket installed optional equipment is listed in the weight and balance section of this Pilots Operating Handbook, or Aircraft Flight Manual.

SECTION 7
DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM

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Airframe De-ice System

Electro thermal surface heaters are bonded to the leading edges of the wings and the horizontal stabilizer. The system is controlled by an ON/OFF type Airframe De-ice switch. Power for the heaterss is supplied from a dedicated engine-driven alternator. When the deice switch is activated, power is supplied to each deicer to prevent ice accumulation on the parting strip while keeping the shed zone below freezing so that any runback water freezes on the shed zone without continuing aft onto unprotected surfaces. Every 60 seconds, the system applies full power to the de-ice system to cause the ice to shed from the aircraft. The Right Inboard Heater will be de-iced first followed by the Left Inboard, Right Tail, Left Tail, Right Outboard and Left Outboard. The system continuously self-tests for any faults and shuts itself down to prevent creating any hazardous condition.

There are three annunciators within the Enable switch:

Airframe: Illuminated green whenever the system is enabled and not in a hard fault condition.

On: Illuminated green whenever the system is active based on OAT. This annunciator also blinks for 3 seconds prior to each shed cycle to alert the aircrew to the impending shed.

Fail: Illuminated amber when a fault is detected. In case of a soft fault, the Airframe annunciator remains illuminated and the system continues at reduced capability or resumes when the fault is cleared. In the case of a hard fault or GFS trip, the Airframe annunciator is extinguished and only interrupting power to the Controller can reset the system.

Note that the Enable switch does not interrupt power to the Controller. (Refer to emergency checklist Hard Fault or GFS trip procedure).

During the power-up test, the On and Fail annunciators flash alternately at one flash per second until the test cycle is complete, duration of power-up test is about 30 – 45 seconds.

A lamp test is done by pressing the Test button on the Trim panel.

Ground Fault Sensor System

A separate Ground Fault Sensor (GFS) system is installed and operates independently of the De-ice controller. It is designed to sense current flow between the airframe De-ice system and the airframe ground. A short to the airframe anywhere in the De-ice system will shut down the alternator by opening the Field Isolation Relay if more than 600 milliamps of current flow is sensed by the GFS system. A GFS trip is indicated in the De-ice annunciator switch. Power to the GFS is supplied by the Airframe Deice (2A) circuit breaker.

Circuit Breakers and Fuses

An Airframe Deice (2A) circuit breaker will be located in the circuit breaker panel when the ice protection system is installed. This circuit is the only link to the normal aircraft buss system. This circuit breaker performs the following functions:

- Provides steady power to the electronics of the de-ice controller. The de-ice controller uses up to 60 ma.

- Excites the field, to start the alternator. Once the alternator output is enough to support itself it does not need anymore from the aircraft bus. This is a momentary load of less than 100 ma.

- Holds the Field Isolation Relay Energized during deice operations. The relay requires about 30 ma to stay energized.

- It also provides power to the Ground Fault Sensor electronics. The sensor requires less than 10 ma.

A Deice Alternator Field (7.5) circuit breaker is located in the circuit breaker panel. The controller has protections built in to prevent alternator over voltage and over current (a run away). This circuit breaker is used to protect against a run away alternator, possibly caused by the field control circuit failure, allowing the full output of the alternator to be routed through to the field. During normal alternator operation and maximum output, the field current is below 5 amps, should the controller field circuit fail and the pilot does not respond to the Fail Light the alternator will be isolated as soon as the 7.5 amp circuit breaker trips.

A 10 amp fuse, located at the De-ice power distribution terminal and provides field power for normal alternator requirements, it protects the entire field circuit.

Two (1.0) amp fuses are located at the De-ice system shunt to protect the shunt circuit.

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Description of hard fault, soft faults and a GFS trip

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 is low engine RPM during taxi or landing rollout and temperatures are at or below freezing. A soft fault condition will occur if the system is left enabled after the engine run-up is complete, and the engine has been returned to idle power, while awaiting takeoff or departure clearance. Another cause would be a slipping belt. Normal operation will resume without operator intervention when alternator operation returns to normal.

A soft fault will revert to a hard fault if alternator power is insufficient to maintain target temps during run-wet operations (OAT below 33 F)

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.

Hard Fault
When a hard fault cannot be reset by using the emergency checklist, the system will be inoperative for the remainder of the flight and will require maintenance.

Ground Fault Sensor trip
If a short occurs between the De-ice system and the airframe, anywhere in the aircraft, The GFS shunt will sense that current and will shut down the alternator by opening the Field Isolation Relay and turning on the FAIL light. The GFS will remain locked out until it is reset. The system is sensitive and will trip if it senses more then 600 ma.