INTRODUCTION

Emergencies caused by airplane or engine malfunctions are rare if proper pre-flight inspections are accomplished and timely and thorough maintenance is performed. Weather associated emergencies are seldom encountered when adequate pre-flight planning and good judgement are used.

The following information is presented to enable the pilot to form, in advance, a definite plan for coping with the most probable emergency situations which could occur in the operation of the airplane. The pilot must have a thorough knowledge of all emergency procedures so that in the event of an emergency, response will be precise and timely. The knowledge and skill required to cope successfully with an emergency can only be acquired by frequent practice and review of the procedures presented in this section.

In those procedures where an immediate response is required, both the "item" and the "condition" are capitalized and enclosed in a box for emphasis. Example: POWER LEVER (item) - GND IDLE (condition). It is recommended that these actions be memorized and practiced frequently, to ensure response to an emergency is prompt and correct. Procedures that normally do not require an immediate action on the part of the pilot, have only the "condition" capitalized. It is recommended that the pilot use the checklist to accomplish these procedures, rather than try to memorize them.

AIRSPEEDS FOR SAFE OPERATION

1.	Air Minimum Control Speed	93 KIAS
2.	Best Single-Engine Angle-of-Climb Speed (Flaps and Gear Up)	97 KIAS
3.	Best Single-Engine Rate-of-Climb Speed (Flaps and Gear Up)	113 KIAS
4.	Intentional One Engine Inoperative Speed (V_{SSE})	105 KIAS

CONDITIONS:
1. Takeoff Weight — 10,325 lbs.
2. Landing Weight — 9,675 lbs.
3. Standard Day, Sea Level

5. SEVERE/EXTREME TURBULENCE Penetration Speed — V_A

ENGINE OUT PROCEDURES

ENGINE SECURING PROCEDURES

NOTE

All actions pertain to inoperative engine.

1. FAILED ENGINE - IDENTIFY

WARNING

Do not retard power for failed engine before propeller is feathered. Identify failed engine by asymmetric power and reference to engine instruments.

2. CONDITION LEVER - EMERGENCY FEATHER

NOTE

Turn FUEL-HYD switch clockwise to EMER OFF position.

3. FUEL-HYDR SWITCH - EMER OFF.
4. Generator Switch - OFF.
5. Engine Inlet Heat - OFF, if applicable.
6. Prop Sync - OFF.
7. Oil Temperature Control Door - CLOSED.
8. Engine Control Switch - ENG OFF.

The propeller is controlled by either the propeller governor or the propeller pitch control mechanism, depending on the mode of engine operation. When the propeller is controlled by the propeller governor (flight mode), its operation is similar to that on a reciprocating engine. The propeller governor either allows oil to be sent to the propeller (lower pitch) or drain from the propeller (higher pitch) to maintain the selected engine speed. When the propeller is being controlled by the propeller pitch control unit, (Beta mode) its operation is somewhat different. A long tube (Beta tube) is attached to the front end of the propeller piston and extends aft through the hollow engine output shaft. The aft end of the Beta tube contains a group of ports around its circumference that mate with a corresponding group of ports on the propeller pitch control unit. When the power lever is moved to a position between REVERSE THRUST and FLT IDLE the propeller pitch control will assume a definite position. This places the ports in such a position that oil will either be allowed to go to the propeller or drain from it. For purposes of illustration, assume that the power lever is moved from REVERSE THRUST to GND IDLE. Oil is allowed to drain from the propeller (a higher pitch is selected) and the propeller piston moves aft; as the piston moves aft, so does the Beta tube. When the propeller moves to the position corresponding to a GND IDLE blade angle, the ports in the propeller pitch control and on the Beta tube will be covered, stopping further pitch change. The blades will now stay in this position until the power lever is moved.

During normal engine shutdown, the power lever is moved to REVERSE after the engine control switch is placed to ENG OFF. As the engine slows down, oil pressure to the propeller dome piston decreases and the blades rotate from the reverse position towards feather, but, since the engine has slowed below the operating speed, the counterweighted start locks are allowed to move in towards the propeller hub. When the blades rotate from reverse to flat pitch, springs force the locks to engage the hub flange, holding the blades in flat pitch, ready for the next start. If the power lever is not moved to REVERSE during engine shutdown, the propeller will feather.

CAUTION

Attempting an engine start with the propeller feathered will damage the starter/generator and may result in a hot start.

After an engine start, the locks are released by centrifugal force when the power lever is moved slightly into the REVERSE position.

FEATHERING/UNFEATHERING

When the condition lever is placed in the EMERGENCY FEATHER position, the feather valve opens and dumps the oil in the prop dome back into the engine gear case. This allows the counterweights, plus the feathering spring in the prop dome, to drive the blades to the feathered position.

NOTE

Propeller may rotate slowly after being feathered if airspeed is too high. Reduce airspeed until prop rotation is less than 5 RPM.

An electrically operated unfeathering pump is used to unfeather the propeller. Placing the engine control switch in AIR START position energizes the unfeathering pump. The pump provides engine oil, under pressure, to the prop dome, displacing the propeller dome piston and driving the propeller blades toward low pitch.

NEGATIVE TORQUE SENSING (NTS) SYSTEM

The NTS system acts to reduce drag caused by a windmilling propeller in the event of a loss of engine power. Even though the engine main shaft will continue to rotate in its normal direction, the NTS sensor will detect negative torque since the propeller is driving the engine, instead of the engine driving the propeller.

When the system senses negative torque, oil flow to the propeller pitch change piston is shut off and propeller oil pressure is relieved into the gear case through the feather valve. This allows spring and counterweight forces to move the propeller blades toward the feathered position, reducing drag caused by a windmilling propeller and significantly reducing yaw.

The NTS system does not dump the propeller oil pressure back to the gear case, as happens when the condition lever is moved to EMERGENCY FEATHER. Rather, the NTS system modulates the feather valve and, in affect, bleeds the oil out of the propeller dome. This results in a characteristic "pulsing" action, which the pilot can feel and recognize, when the NTS system is operating.

The NTS system is a drag reducing system only. It is not an automatic feathering system. The propeller should be feathered to reduce drag to a minimum.

CAUTION

Allowing the engine to windmill in the 18 to 28% RPM range will damage the engine.

The NTS system should be checked prior to the first flight each day. If the check indicates a malfunction in the NTS system, have the malfunction corrected before flight. Two-position, rocker type NTS TEST switches, located in the LEFT and RIGHT ENGINE groups in the overhead switch panel, are used to check the NTS system. The check is accomplished during engine start, as follows:

1. NTS TEST Switch - NTS TEST. NT light, adjacent to the switch, illuminates to indicate switch is in TEST position.
2. Engine Control Switch - AIR START. Observe NTS TEST light, on center instrument panel, illuminates to indicate propeller unfeathering pump has increased propeller governor oil pressure sufficiently to arm the NTS test circuit.
3. Engine Control Switch - GND START. As starter is engaged, the torque sensor interprets the initial high torque developed by the starter as negative torque. NTS TEST light goes out, indicating system has properly sensed negative torque.
4. NTS TEST Switch - OFF when engine start is complete. NTS TEST light will again illuminate as engine accelerates and initial start torque decreases. Light will go out and remain out at approximately 50% RPM. NT light will go out when switch is turned off.

NOTE

NTS test circuit is ineffective when engine is running. Do not place NTS TEST switch in NTS TEST position in flight.

BETA FOLLOWUP

In BETA mode, the propeller pitch control provides a means of selecting propeller blade angle with the power lever. In PROPELLER GOVERNING mode, the propeller governor schedules blade angle to maintain selected RPM, however, the position of the propeller pitch control, as selected by the Power Lever, closely follows the propeller governor. This serves as a backup in the event of propeller governor or NTS system failure by acting as a hydraulic stop to limit minimum blade angle. Minimum blade angle, as set by Beta Followup, is decreased as the Power Lever is retarded. If the Power Lever is retarded on a failed engine with an inoperative NTS system, windmilling drag will be increased significantly. During inflight engine shutdown, do not retard the failed engine Power Lever prior to feathering the propeller. The failed engine should be identified by engine instrument indications and asymmetric thrust.

NTS LOCKOUT AND PROP GOVERNOR RESET

In order to provide the proper propeller response during an aborted takeoff and/or high speed landing reverse, a negative torque sensor lockout and propeller governor reset to maximum low pitch is incorporated. These actions occur when the Power Lever is retarded below the FLT IDLE position.

The system employs a rotary valve on the pitch control input shaft which dumps NTS supply pressure, locking out the NTS system, at Power Lever positions below FLT IDLE. This pressure decrease is sensed by a piston in the propeller governor which resets the governor to 105% engine speed so that maximum pressure is supplied to the propeller. The effect of these two actions is to assure maximum propeller slew rate for emergency takeoff abort and for high speed landing reverse response.

ICE PROTECTION SYSTEMS

The airplane is equipped with deicing and anti-icing systems. The deicer systems include the wing and empennage deicer boots and the propeller deicer system. The function of the deicer systems is to eliminate ice after it accumulates. The anti-icing systems are designed to prevent ice accumulation and should be placed in operation prior to entering flight conditions conducive to the formation of ice. The anti-icing systems include heated stall warning, rudder horn anti-icer, rudder tab anti-icer, generator inlet anti-icer, electrically heated windshield and the pitot-static heaters. These systems utilize electrical heaters, controlled by switches located in the ICE PROTECTION group of the overhead switch panel.

The ice protection systems also include wing ice inspection lights, located in the outboard side of each engine nacelle, iceshields, located on each side of the fuselage in the propeller plane of rotation, and engine inlet heaters. The engine inlet heaters utilize hot engine compressor bleed air to prevent icing, and are controlled by switches in the ICE PROTECTION group of the overhead switch panel.

WING AND EMPENNAGE DEICER BOOTS (Figure 7-25 and 25A)

Pneumatically operated boots, made from fabric reinforced rubber sheet and containing inflatable rubber tubes, are installed on the leading edge of the wing, inboard and outboard of the engine nacelles on airplanes S/N 11600 thru 11718 and outboard and inboard of the engine nacelles on airplanes S/N 11719 thru 11999, and on the leading edge of the horizontal and vertical stabilizer. Regulated bleed air, from the airplane pneumatic system, is used to inflate the boots.

Vacuum (suction) generated by a venturi system in the distribution valve, deflates the boots and holds them tight against the wing and empennage leading edge when system is not in operation.

The BOOTS switch, in the overhead switch panel, controls the solenoid operated distribution valve. The switch is a three-position switch, spring-loaded to the OFF position. Placing the switch in the momentary ONE CYCLE position, activates the distribution valve through the timer, inflating the wing and empennage boots simultaneously, for approximately six seconds. Each activation of the ONE CYCLE position will inflate the boots for approximately six seconds. When the switch is placed in the MANUAL position, the timer is bypassed and the boots will inflate simultaneously and remain inflated until the switch is released. The MANUAL position is normally used only in the event of a timer malfunction.

Operation of the deicer boots should be checked prior to encountering icing conditions, while on the ground or in flight, when the OAT is above –40°C (–40°F).

The deicer boots remove ice by changing the contour of the leading edge, cracking the ice formation, and allowing the airflow to blow the broken ice away. Rapid cycling of the boots may allow an ice "bridge" to build up over the boots in such a manner that the boots are rendered ineffective. It is recommended that the boots not be activated until ice accrues on the wing leading edge to a depth of approximately 1/2 to 3/4 inches.

The boots operate on regulated air pressure from the airplane pneumatic system. If system pressure exceeds the normal operating limits due to a failure of the pneumatic system pressure regulator, a REG AIR annunciator will illuminate to indicate system pressure is too high.

CAUTION

Do not operate deicer boots if REG AIR annunciator is illuminated. Boots may be physically damaged.

The boots should be cleaned regularly with mild soap and water and then be treated with B.F. Goodrich ICEX No. 6 to protect the boots and reduce ice adhesion.

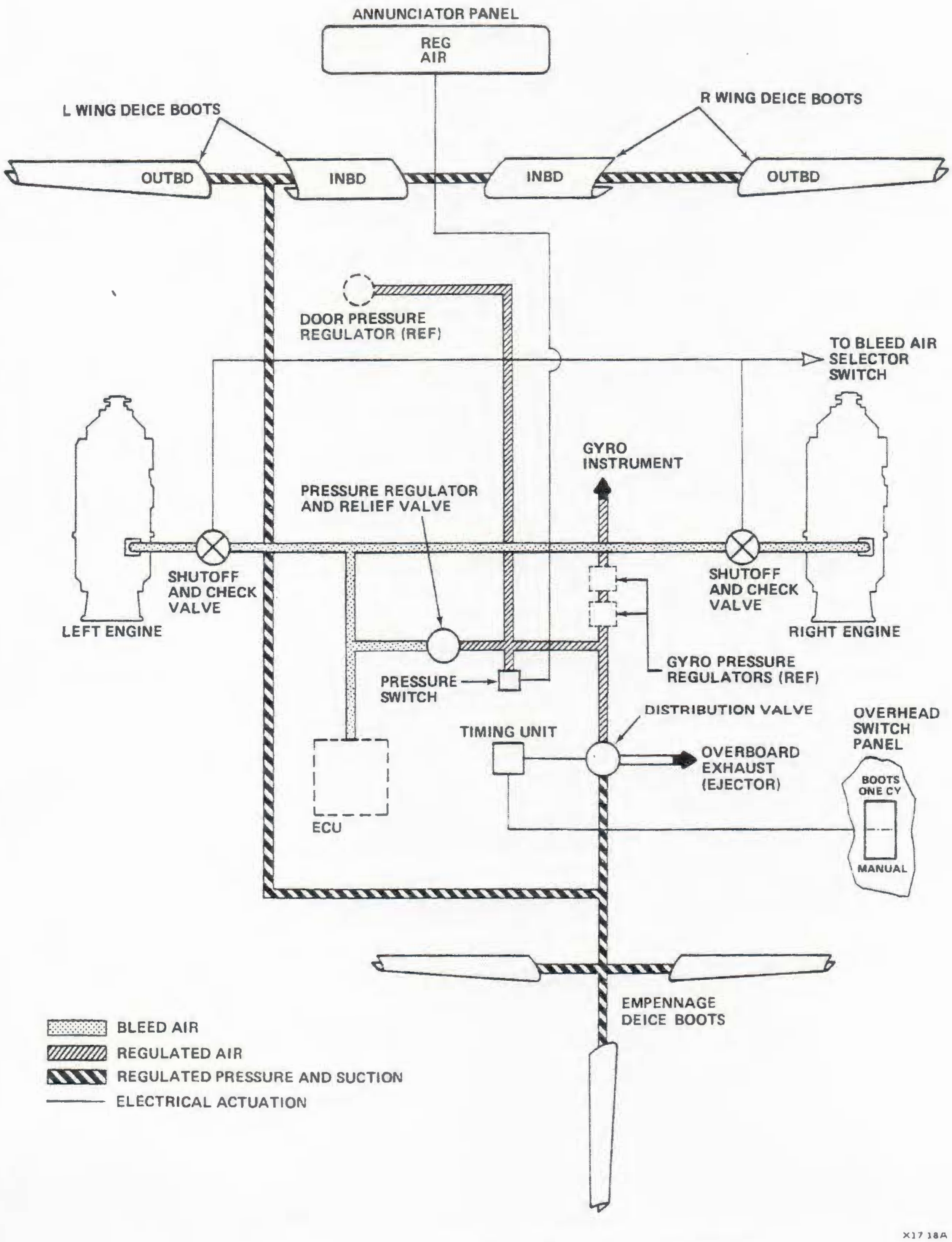


Figure 7-25A. Wing and Empennage Deicer System Schematic (S/N 11719 thru 11999)

Each windshield draws approximately 28-amps when operating in HIGH and approximately 22 amps when operating in LOW. Windshield amperage is indicated on the airplane volt-ammeters.

WARNING

Standby magnetic compass indications are completely unreliable when either windshield anti-icing system is in operation.

WING ICE INSPECTION LIGHTS

Wing ice inspection lights permit the pilot to visually check the wing leading edge at night for indications of ice accumulation. An inspection light is installed in the outboard side of each engine nacelle and are focused on the wing leading edge. A switch labeled WING INSP, located in the UTILITY GROUP in the overhead switch panel, provides 28-volt dc power to the ice inspection lights.

ENGINE INLET ANTI-ICE SYSTEMS

The engine inlet anti-ice systems utilize hot engine compressor bleed air to heat the lower surface of the engine compressor air inlet. A solenoid operated anti-icing valve on each engine furnishes compressor bleed air which is circulated beneath the skin of the lower surface of the inlet to keep it free of ice. The entire upper portion of the compressor air inlet is integral with the gear box and is kept free of ice accretion by heat transfer from engine oil to the inlet surface.

Two switches, labeled ENG INLET, L and R, located in the ICE PROTECTION group, control the anti-icing valves on each engine. Placing the switches in L and R positions will open the anti-icing valves and furnish compressor bleed air for anti-icing. L INLET and R INLET annunciators, located in the annunciator panel, will illuminate when the L and R INLET switches are placed on, and a slight decrease in engine horsepower and fuel flow will be observed. The engine inlet anti-icing system should be turned on any time the OAT is +5°C (40°F), or below, and visible moisture is present.

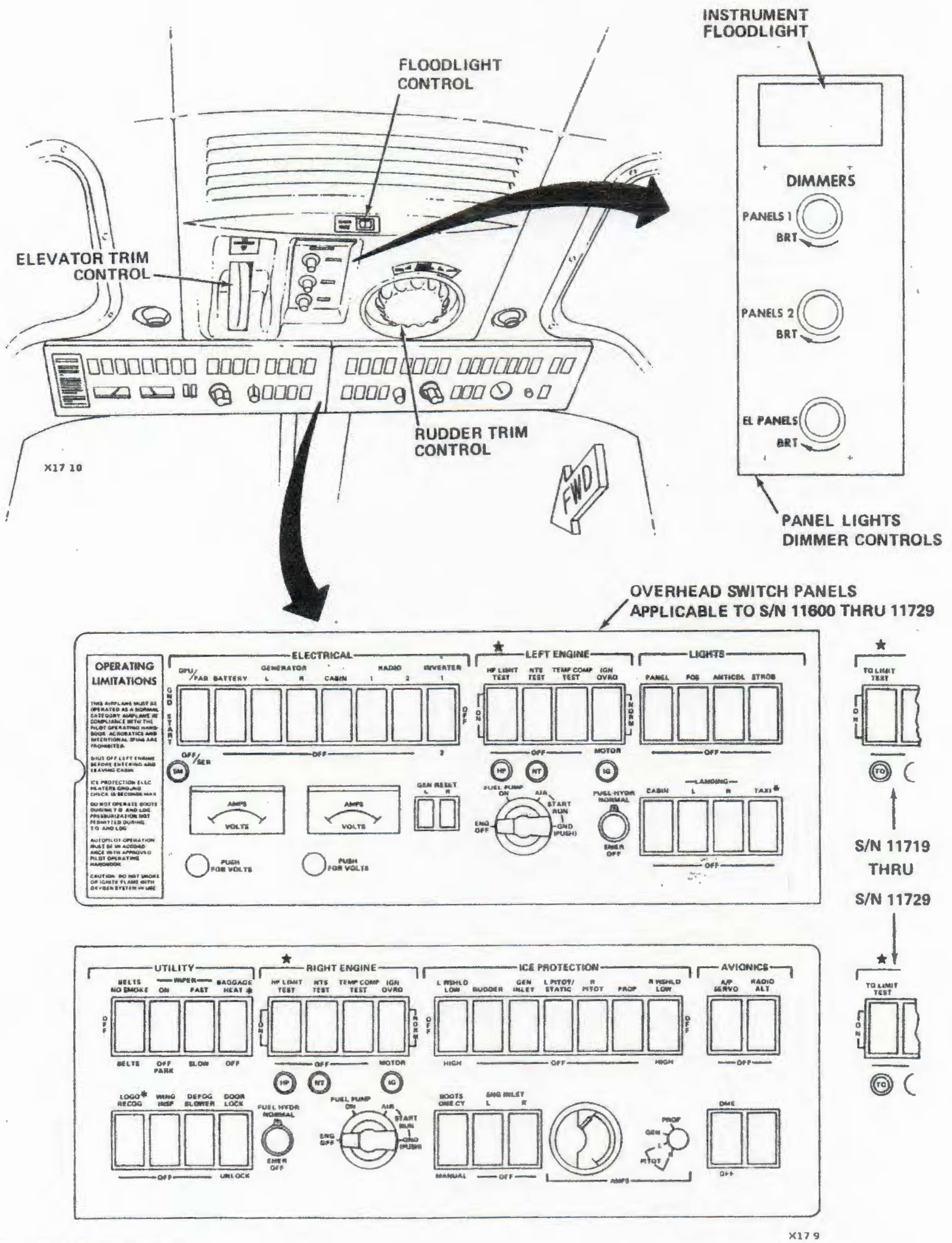
WARNING

When icing conditions may be encountered, do not delay operation of the engine inlet heat systems. Turn the systems on before any ice accumulates. Engine inlet heat must be on if icing conditions exist or are anticipated.

If icing conditions are inadvertently encountered, activate the IGN OVRD switches and turn on engine inlet heat systems one at a time. Ensure proper operation of the first engine before activating the inlet heat system for the second engine. When continued engine operation is assured, return the IGN OVRD switches to OFF.

CAUTION

Do not operate engine inlet heat system longer than 10 seconds if OAT is greater than +5°C (40°F).



* OPTIONAL EQUIPMENT

Figure 7-20. Overhead Control Console (Sheet 1 of 2)