CHAPTER

77

ENGINE INDICATING

Learjet

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Insert Latest Revised Pages; Destroy Superseded or Deleted Pages.

* Asterisk indicates pages revised, added, or deleted by current revision. The portion of the text affected by the current revision is indicated by a vertical line in the outer margin of the page.

RECORD OF TEMPORARY REVISIONS

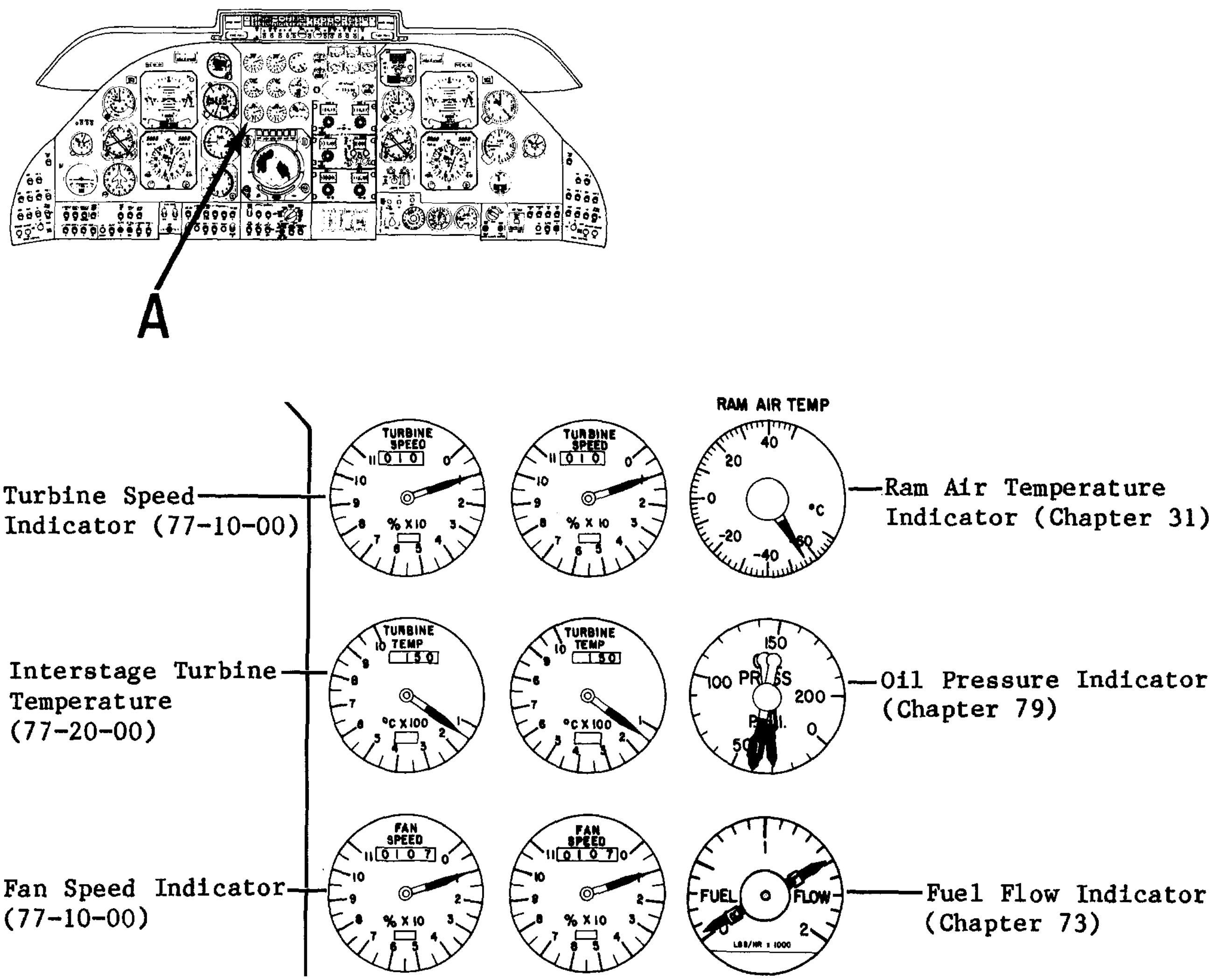
TEMP REV NO	DESCRIPTION	ISSUE DATE	ATP REV DATE	INSERT BY	DATE REMOVED	REV INCOR	REMOVE BY
77-1	REMOVED						

Record of Temporary Revisions

Rev. No.	Date Inserted	Date Removed	Page Number	Rev. No.	Date Inserted	Date Removed	Page Number
77-1	Mar 25/75	Oct 1/75 Rev 4	77-10-00 Page 1				

ENGINE INDICATING - DESCRIPTION AND OPERATION

1. **DESCRIPTION**
   A. Power indicating and temperature indicating systems are installed for each engine to provide the crew with a continuous visual indication of engine operation.
   B. The indicators are located in the engine instrument panel in the upper LH corner of the center instrument panel.
   C. Refer to the Engine Maintenance Manual for maintenance practices for each individual system. Maintenance practices for the indicators are covered in this chapter.



Detail A

Engine Instruments
Figure 1

POWER - DESCRIPTION AND OPERATION

1. **DESCRIPTION**

A. Fan speed (N_1) is measured by a magnetic pickup on the aft end of the fan (low-pressure) rotor shaft. The speed gear is attached to the low-pressure shaft rotating around a stationary transducer.

B. Turbine speed (N_2) sensor is mounted in the transfer gearbox adjacent to the output gear of the transfer gearbox and senses rpm by use of a special gear mounted under the monopole.

C. For maintenance practices on the N_1 and N_2 monopoles refer to Engine Maintenance Manual.

2. **OPERATION**

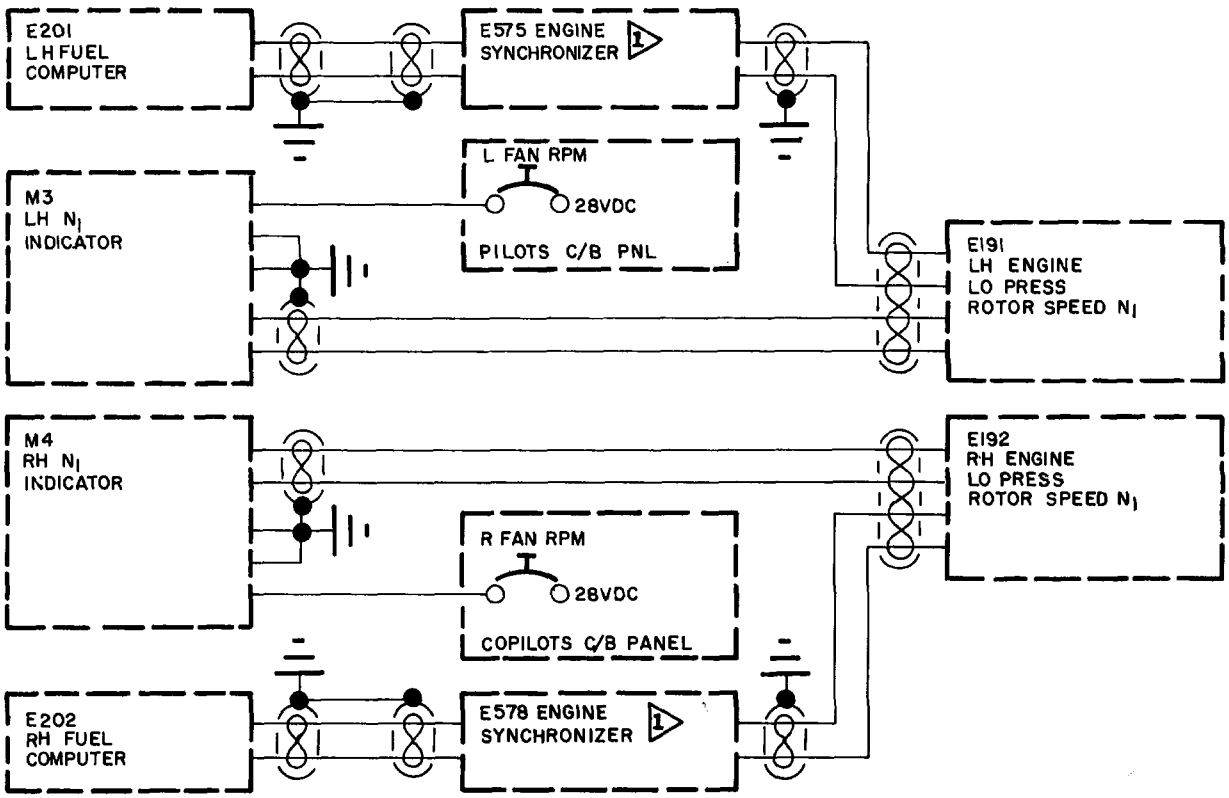
A. Fan Speed (N_1) (See figure 1.)

(1) As the speed gear turns within the N_1 transducer, the teeth cause the mangetic flux path in the air gap to change constantly. The dual output monopole transducer produces two separate and identical electrical signals caused by the changing magnetic path. The frequency of the output signal represents the rotating speed of the N_1 rotating group. One output signal is applied to the N_1 indicator, on the engine instrument panel and the second signal is applied to the fuel computer. On Aircraft 35-067 and Subsequent and 36-018 and Subsequent, the second signal is applied to the engine synchronizer and then to the fuel computer. The indicating system is powered by 28 vdc.

B. Turbine Speed (N_2) (See figure 2.)

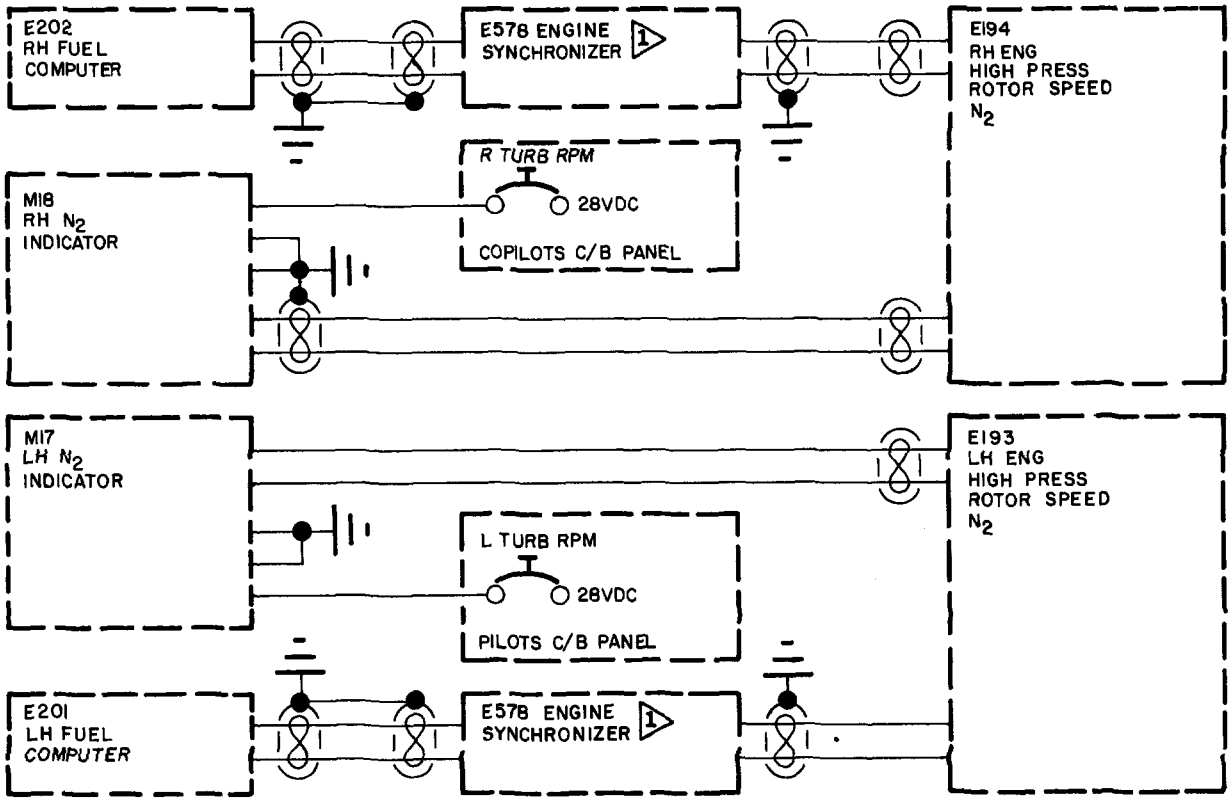
(1) A special gear mounted under the N_2 monopole transducer produces two signals in the N_2 transducer similar to the N_1 signals. One signal is applied to the N_2 indicator and one signal is applied to the fuel computer. On Aircraft 35-067 and Subsequent and 36-018 and Subsequent, the second signal is applied to the engine synchronizer and then to the fuel computer. The system is powered by 28 vdc.

1 Engine Synchronizer effective 35-067 and Subsequent and 36-018 and Subsequent.



Fan Speed (N_1) Electrical Schematic
Figure 1

1 Engine Synchronizer effective 35-067 and Subsequent and 36-018 and Subsequent.



Turbine Speed (N_2) Electrical Schematic
Figure 2

INDICATOR - MAINTENANCE PRACTICES

1. REMOVAL/INSTALLATION

NOTE: Removal and installation procedures for the fan (N_1) and turbine (N_2) indicators are identical.

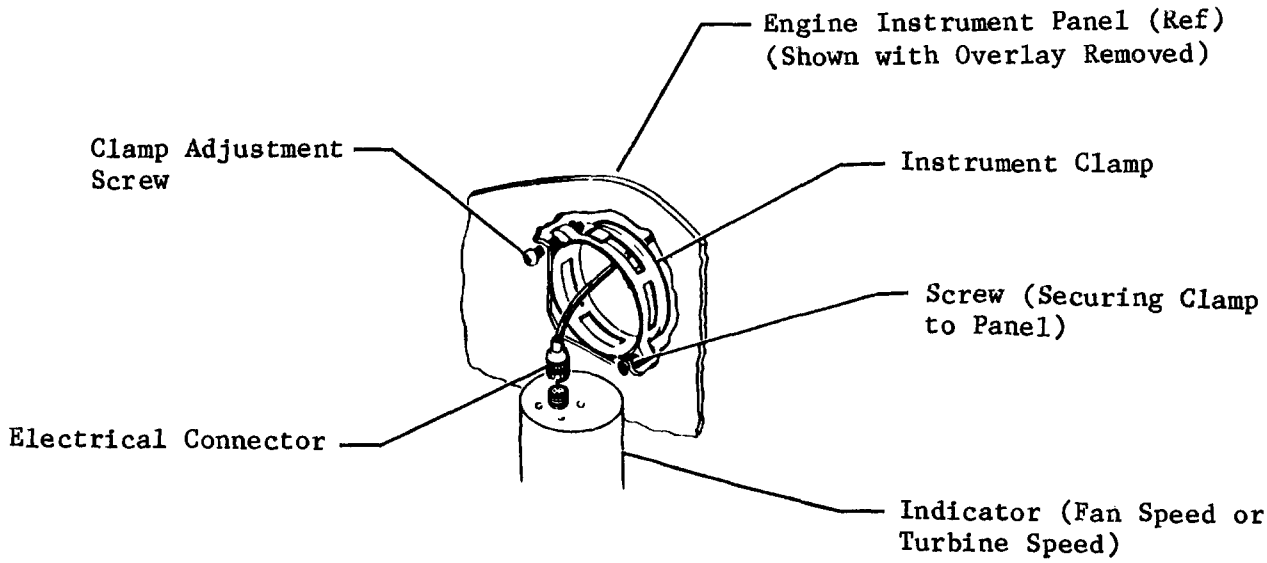
A. Remove Indicator (See figure 201.)

CAUTION: WHEN ATTACHING PARTS FOR OVERLAY ARE REMOVED, SUPPORT OVERLAY TO PREVENT DAMAGE TO OVERLAY ELECTRICAL CONNECTOR.

(1) Remove attaching parts and carefully lower engine instrument panel overlay to gain access to overlay electrical connector. Disconnect electrical connector.
(2) Loosen instrument clamp adjustment screw sufficiently to allow removal of instrument.
(3) Remove instrument from panel sufficiently to gain access to electrical connector.
(4) Disconnect electrical connector from back of instrument and remove instrument from engine instrument panel.

B. Install Indicator (See figure 201.)

(1) Connect electrical connector to instrument.
(2) Position instrument in panel and tighten clamp adjustment screw.
(3) Connect electrical connector to overlay. Position overlay on engine instrument panel and secure with attaching parts.

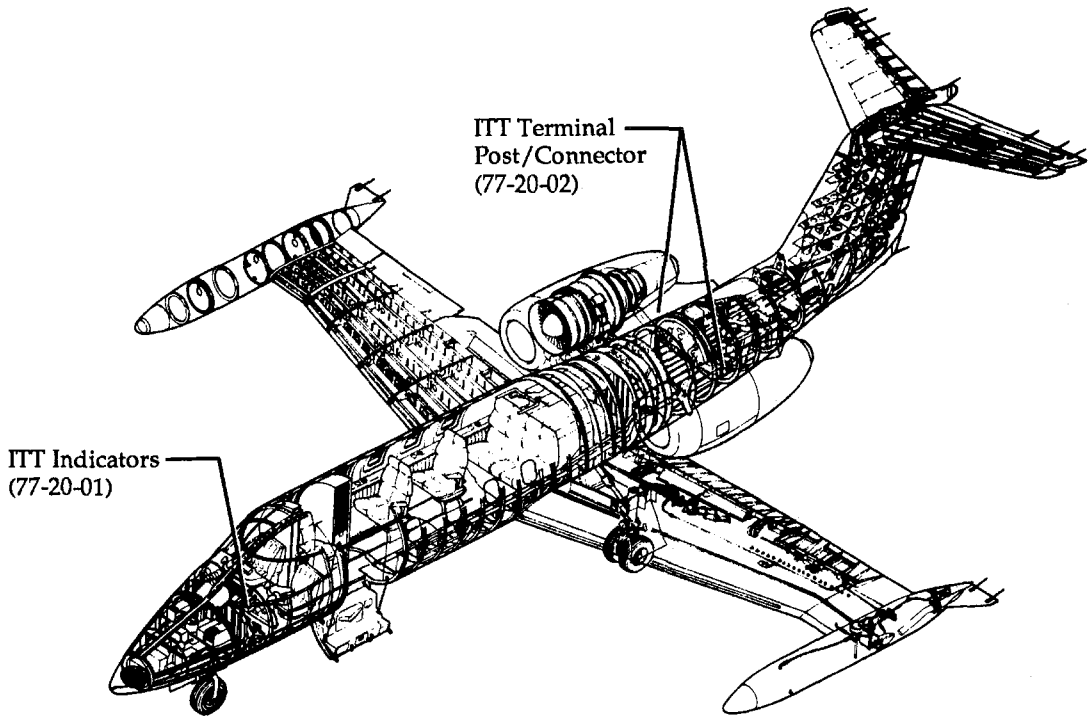


Indicator Installation
Figure 201

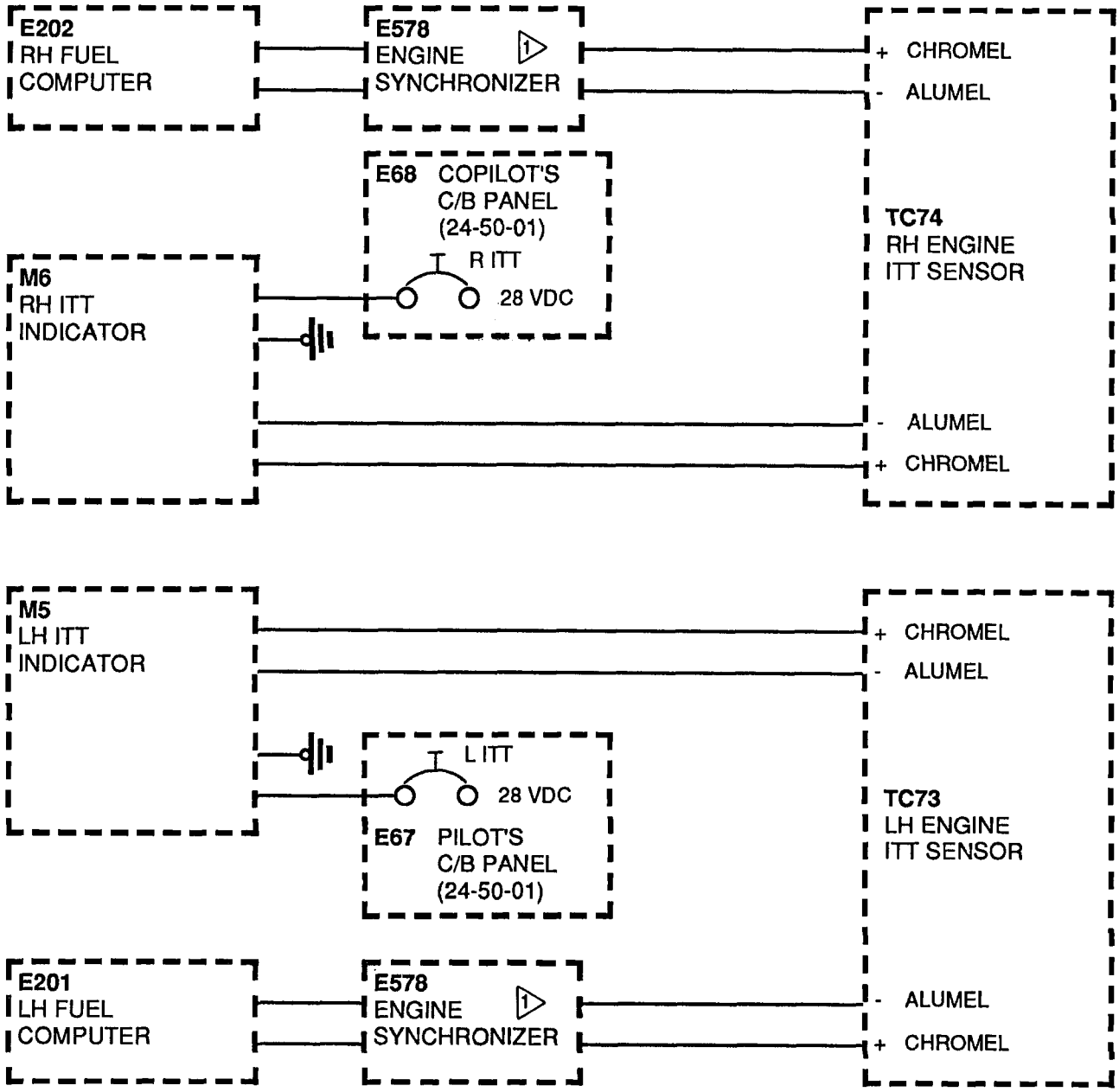
TEMPERATURE - DESCRIPTION AND OPERATION

1. **DESCRIPTION** (See figure 1.)
   A. The interstage turbine temperature (ITT) is measured by chromel-alumel thermocouples mounted on bosses in the turbine interstage transition duct that extends into the gas path between the high and low pressure turbines. Two thermocouple rakes of five probes each are wired in parallel to form an averaging circuit. The ten probes in the assembly present an average sensed temperature. The harness is routed aft through the turbine interstage transition duct and provides connections for the fuel computers and for cockpit indication.
   B. On *Aircraft 35-067 thru 35-640, 36-018 thru 36-057, and prior Aircraft modified by AMK 76-5, "Replacement of Engine ITT Sensing Connectors,"* an ITT terminal post is installed in both LH and RH pylons. The terminal posts provide electrical connections for sending ITT signals to the ITT indicators and the fuel computers. On *Aircraft 35-641 and Subsequent, 36-058 and Subsequent, and prior Aircraft modified per AAK 86-5, "Replacement of Interstage Turbine Temperature (ITT) Harness Connectors,"* electrical connectors are used in place of terminal posts.
   C. For complete maintenance practices on the ITT thermocouples, refer to the applicable Garrett Light Engine Maintenance Manual.

2. **OPERATION** (See figure 2.)
   A. The signal from the averaging circuit is applied to the interstage turbine temperature (ITT) indicator on the engine instrument panel and, on *Aircraft 35-002 thru 35-066 and 36-002 thru 36-017*, to the fuel computer. On *Aircraft 35-067 and Subsequent and 36-018 and Subsequent*, the fuel computer signal is applied via an engine synchronizer. The system is powered by 28 vdc through two circuit breakers.



Interstage Turbine Temperature (ITT) System Component Locator
Figure 1



1 Engine Synchronizer effective 35-067 and Subsequent and 36-018 and Subsequent.

REPRO

Interstage Turbine Temperature (ITT) Electrical Control Schematic
Figure 2

TEMPERATURE INDICATOR - MAINTENANCE PRACTICES

1. REMOVAL/INSTALLATION

CAUTION: WHEN ATTACHING PARTS FOR OVERLAY ARE REMOVED, SUPPORT OVERLAY TO PREVENT DAMAGE TO OVERLAY ELECTRICAL CONNECTOR.

A. Remove Temperature Indicator (See figure 201.)

(1) Remove attaching parts and carefully lower engine instrument panel overlay to gain access to overlay electrical connector. Disconnect electrical connector.

(2) Loosen instrument clamp adjustment screw sufficiently to allow removal of instrument.

(3) Remove instrument from panel sufficiently to gain access to electrical connector.

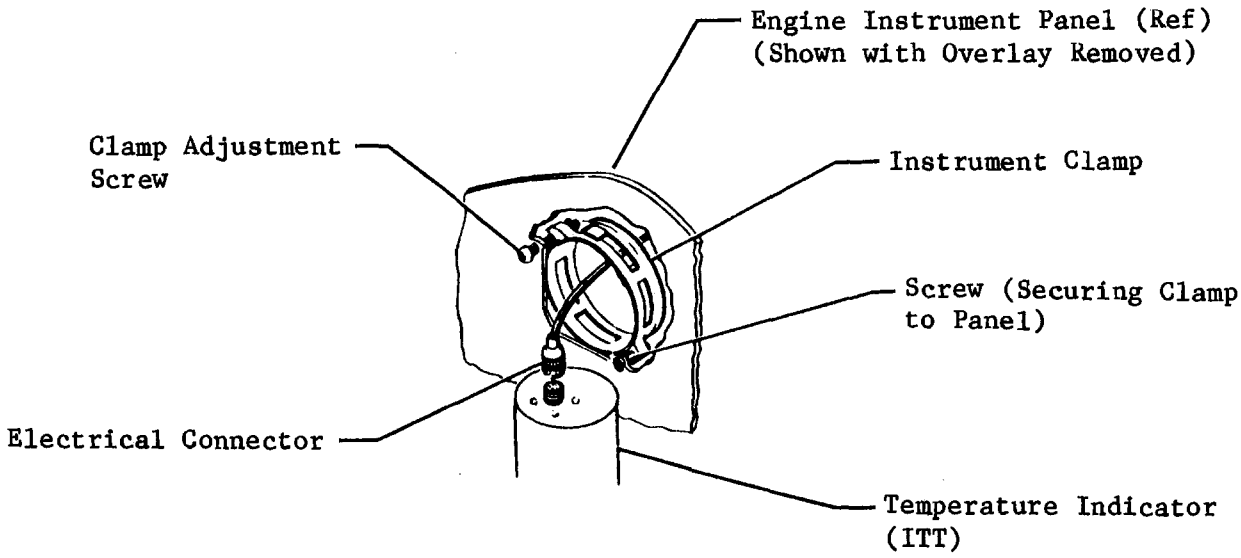
(4) Disconnect electrical connector from back of instrument and remove instrument from engine instrument panel.

B. Install Temperature Indicator (See figure 201.)

(1) Connect electrical connector to instrument.

(2) Position instrument in panel and tighten clamp adjustment screw.

(3) Connect electrical connector to overlay. Position overlay on engine instrument panel and secure with attaching parts.



Temperature Indicator Installation
Figure 201

NOTE: On *Aircraft 35-067 thru 35-640, 36-018 thru 36-057, and prior Aircraft modified by AMK 76-5, "Replacement of Engine ITT Sensing Connectors,"* an ITT terminal post is installed in both LH and RH pylons. On *Aircraft 35-641 and Subsequent, 36-058 and Subsequent, and prior Aircraft modified per AAK 86-5, "Replacement of Interstage Turbine Temperature (ITT) Harness Connectors,"* electrical connectors are used in place of terminal posts. (See figures 201 and 202.)

1. REMOVAL/INSTALLATION

NOTE:
- Removal and installation procedures for both the LH and RH engine ITT terminal posts are identical unless otherwise specified.
- Terminal posts are installed either in a box assembly or in the upper afterbody access panel. The procedures below apply to both types of post installation.

A. Tools and Equipment

NOTE: Equivalent substitutes may be used in lieu of the following items.

NAME	PART NUMBER	MANUFACTURER	USE
Multimeter	Model 260-7	Simpson	Resistance checks.

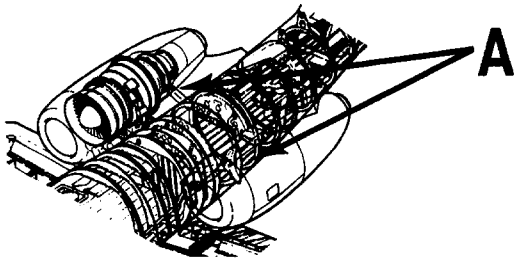
B. Removal ITT Terminal Post (*Aircraft 35-067 thru 35-640, 36-018 thru 36-057, and prior Aircraft modified by AMK 76-5, "Replacement of Engine ITT Sensing Connectors"*) (See figure 201.)
(1) Remove electrical power from aircraft.
(2) Remove lower aft access panel from pylon.
(3) Remove lower access panel from afterbody assembly.
(4) Remove safety wire from nut and terminal post on engine side, and remove nut, washers and terminal from terminal post.
(5) Remove safety wire from nut and terminal post on fuselage side, and remove nut, washers and terminal from terminal post.
(6) Remove remaining nuts, washers and insulating washers from terminal post. Remove terminal post from box assembly or access panel.
(7) Visually inspect all parts, and retain for reinstallation. Replace if damaged.

C. Install ITT Terminal Post (*Aircraft 35-067 thru 35-640, 36-018 thru 36-057, and prior Aircraft modified by AMK 76-5, "Replacement of Engine ITT Sensing Connectors"*) (See figure 201.)

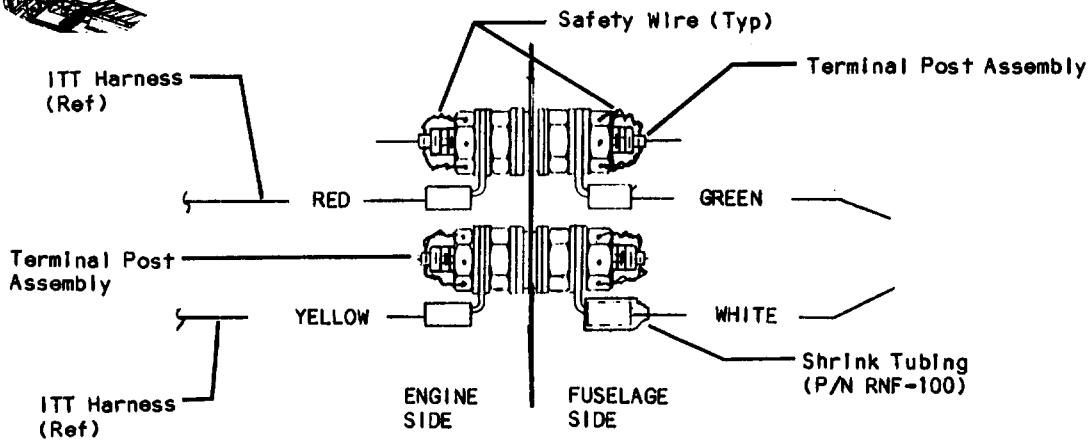
CAUTION: WHEN INSTALLING TERMINAL POST, ENSURE THAT NUTS ON FUSELAGE SIDE ARE TIGHTENED SUFFICIENTLY TO PREVENT ROTATION WHEN NUTS ON ENGINE SIDE ARE TIGHTENED. IF ROTATION OCCURS, TERMINALS MAY CONTACT EACH OTHER OR SIDE OF OUTLET BOX, CAUSING ITT FLUCTUATIONS.

NOTE: If terminals on ITT wire harness are damaged or if wire harness is replaced, use terminal lugs (P/N 54368-2, Amp Inc.) for the yellow and white wires, and terminal lug (P/N 54368-1, Amp Inc.) for the red and green wires. Crimp terminal with number 46673 Amp crimping tool and use RNF-100 shrink tubing over terminals.

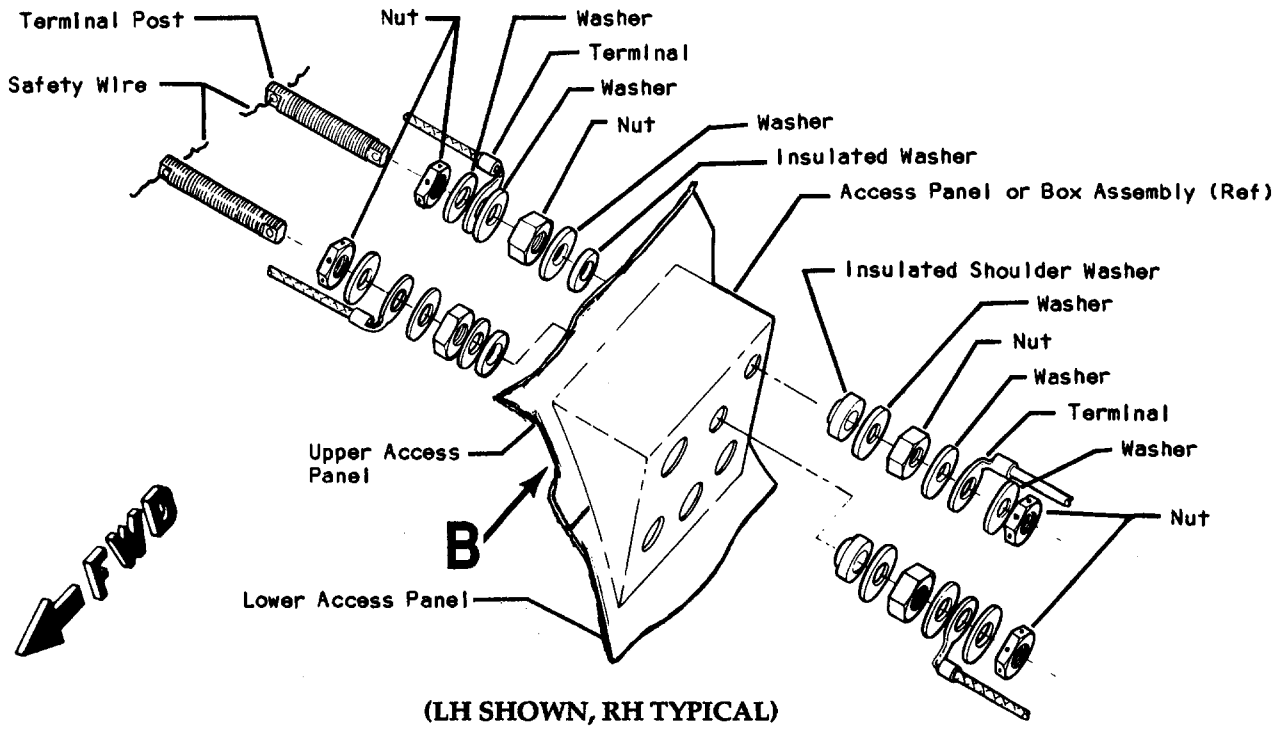
(1) Assemble insulated shoulder washer, washer and nut on terminal post and insert terminal post through fuselage side of box assembly or access panel.
(2) Assemble insulated washer, washer and nut on terminal post from engine side. Tighten nuts sufficiently to prevent rotation of terminal post when remaining nuts are installed.
(3) Assemble remaining washer, terminal, washer and nut on terminal post. Tighten nuts, ensuring that terminal post does not rotate and allow terminals to contact each other or sides of box assembly.
(4) Check resistance between terminal posts. Resistance shall be 3 to 7 ohms.
(5) Apply 100 vdc to terminal post at room temperature. Check for insulation resistance of 100 kilohms minimum between terminal posts and box assembly or access panel.
(6) Safety wire terminal post and nut.
(7) Install access panel on afterbody.
(8) Install lower aft access panel on pylon.
(9) Restore electrical power to aircraft, and restore aircraft to normal.



CAUTION: WHEN INSTALLING TERMINAL POST, ENSURE THAT NUTS ARE TIGHTENED SUFFICIENTLY TO PREVENT ROTATION WHEN REMAINING NUTS ARE TIGHTENED. IF ROTATION OCCURS, TERMINALS MAY CONTACT EACH OTHER OR SIDE OF BOX ASSEMBLY CAUSING ITT FLUCTUATIONS.



Detail B



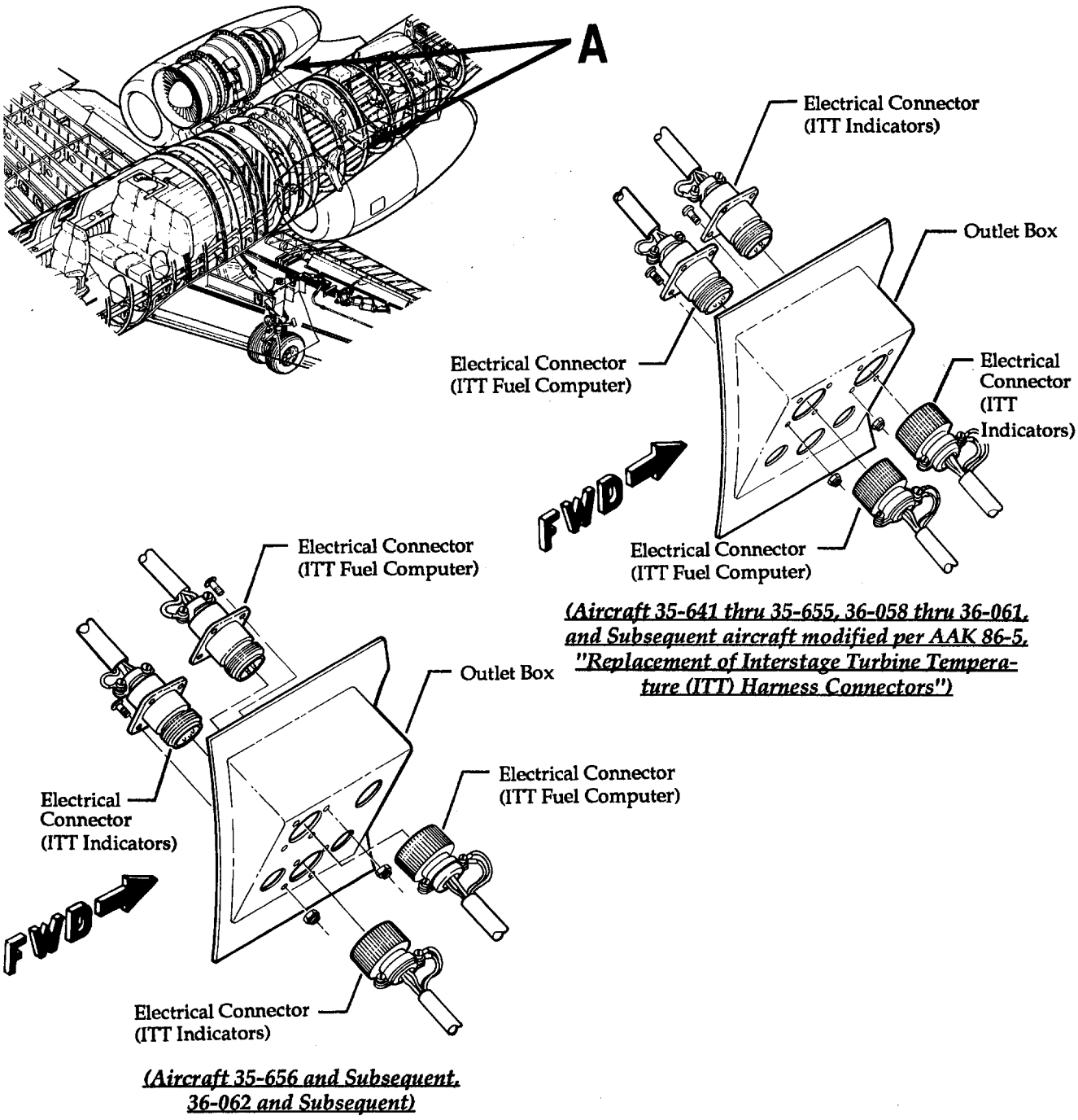
(LH SHOWN, RH TYPICAL)

Detail A

9-332B

ITT Terminal Post Installation
Figure 201

EFFECTIVITY: 35-067 thru 35-640, 36-018 thru 36-057, and prior Aircraft modified by AMK 76-5, "Replacement of Engine ITT Sensing Connectors"



(LH SHOWN, RH TYPICAL)

Detail A

A9-425A
A9-449A

ITT Connector Installation
Figure 202

1. INSPECTION/CHECK

A. ITT Harness Insulation Wrap and Lead Routing

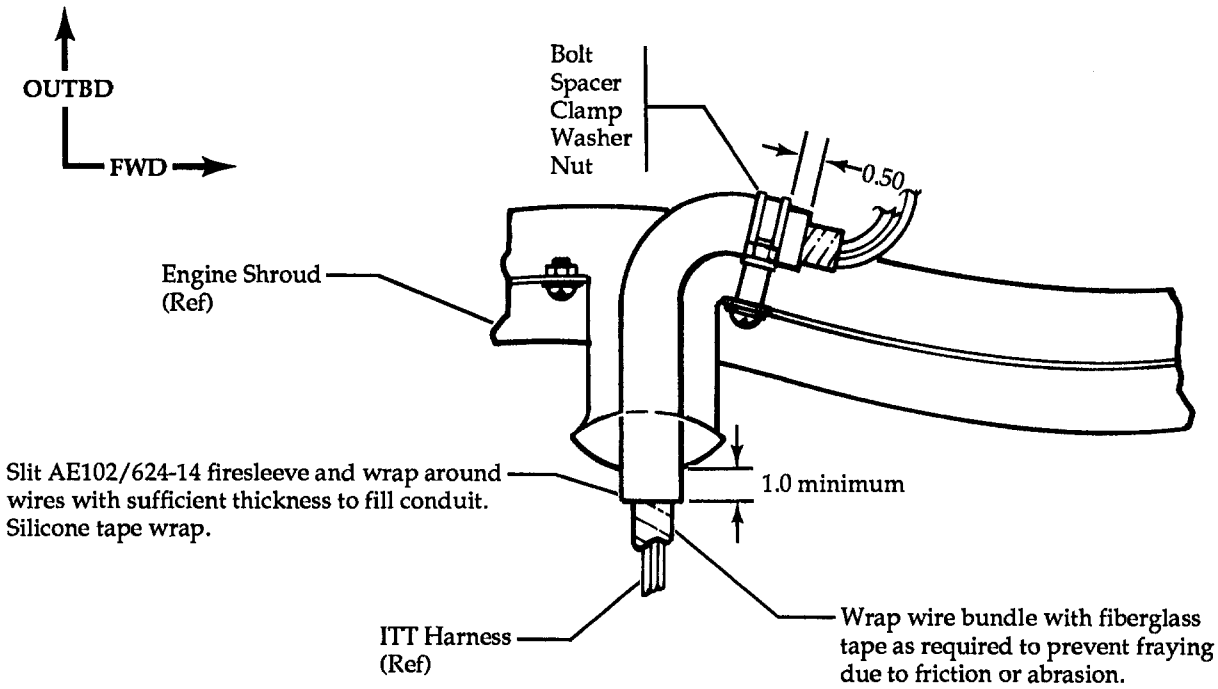
NOTE: ITT fluctuations may be caused by improper lead routing or by damaged lead insulation.

(1) Check that lead is routed and clamped securely to maintain maximum clearance from the engine hot section.

(2) Check insulation for burned spots, and check for loose or damaged insulation. If insulation is burned, loose, or damaged, the old insulation should be replaced.

(3) Wrap flexible portion of ITT lead with Varglas non-fray sleeving, type HO (mfd. by Varglas, Rome, N.Y.) and Temp-R-Tape fiberglass tape, type GV (mfd. by Connecticut Rubber Co., New Haven, Conn.). No. 363 Aluminum foil glasscloth tape (mfd. by 3M Co.) may be used as an alternate to the Temp-R-Tape fiberglass tape. Assure that ITT lead is routed and clamped to maintain maximum clearance from the engine hot section.

(4) On *Aircraft 35-636 and Subsequent and 36-058 and Subsequent*, ensure that chafe prevention and fire protection are provided as shown in figure 201.



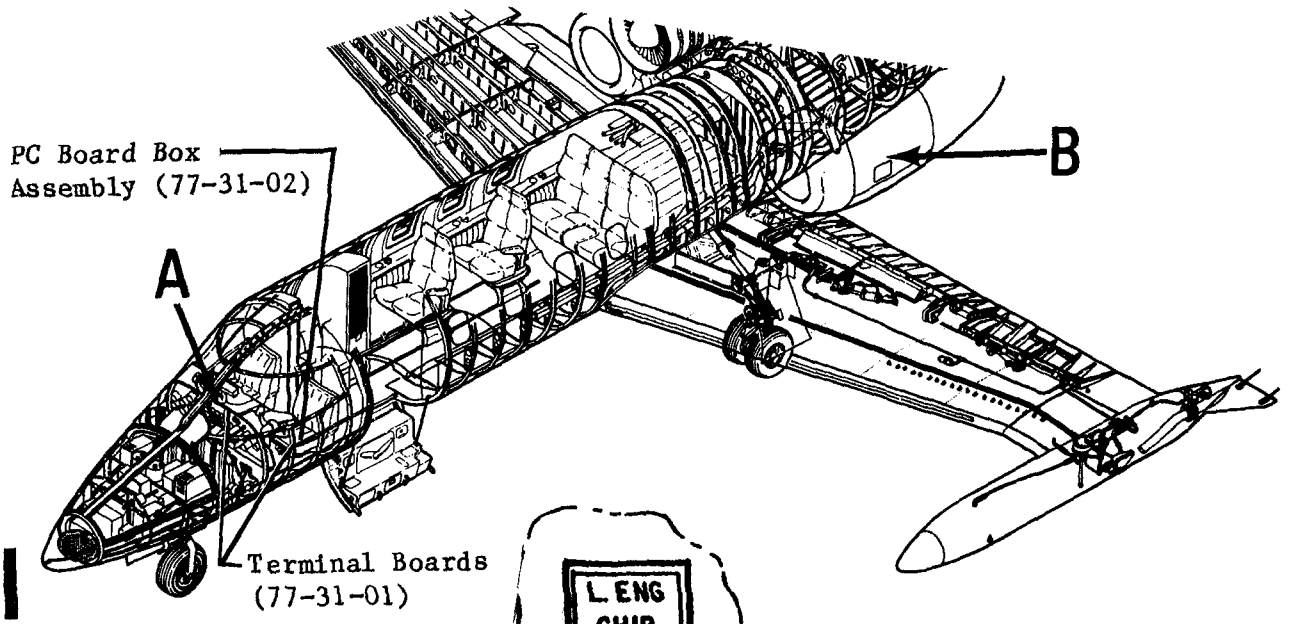
Effective on Aircraft 35-636 and Subsequent, 36-058 and Subsequent

ITT Harness Insulation Wrap and Lead Routing
Figure 201

ENGINE CHIP DETECTOR SYSTEM - DESCRIPTION AND OPERATION

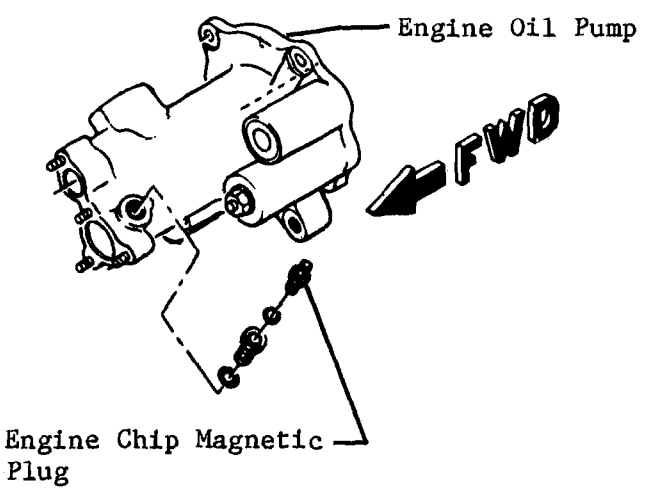
1. **DESCRIPTION** (See figure 1.)
   A. On Aircraft 35-002 thru 35-489 and 36-002 thru 36-050, the engine chip detector system is optional. The LH and RH engine chip detector system consists of two magnetic plugs, one or two terminal boards or a printed circuit board assembly, and two system annunciator lights.
      (1) A magnetic plug is installed on each engine oil pump. Refer to Engine Maintenance Manual, Chapter 79, for maintenance practices for the magnetic plugs.
      (2) Two terminal boards are installed on the copilot's instrument panel tray assembly. On Aircraft modified per AAK 82-4 "Installation of Engine Chip Detector Lights," a printed circuit board box assembly is installed on the LH side of the cockpit, forward of frame 9. On Aircraft 35-490 and Subsequent, 36-051 and Subsequent, a terminal board (TB3) is installed at TBL 2 immediately aft of the glareshield floodlight.
      (3) The system annunciator lights, LH ENG CHIP and RH ENG CHIP, are located on either the pilot's or the copilot's glareshield.

2. **OPERATION** (See figure 2.)
   A. Refer to Engine Maintenance Manual for operation of the engine chip detection system.
   B. On Aircraft 35-002 thru 35-489 and 36-002 thru 36-050 not modified per AAK 82-4, "Installation of Engine Chip Detector Lights," but equipped with the engine chip detector system, refer to the Avionics and Optional Electrical Customization Wiring Manual for wiring of the engine chip detector system.



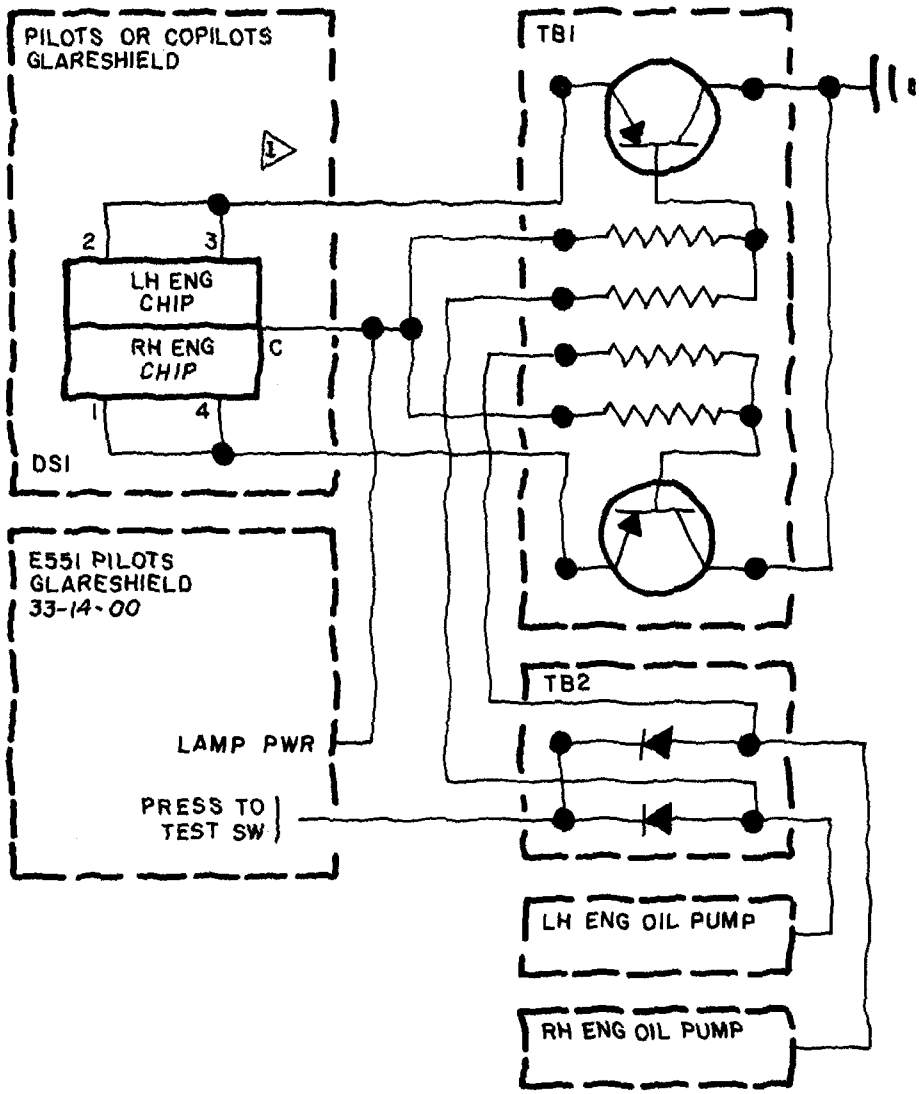
* Annunciators may be located on the copilot's glareshield

Detail A



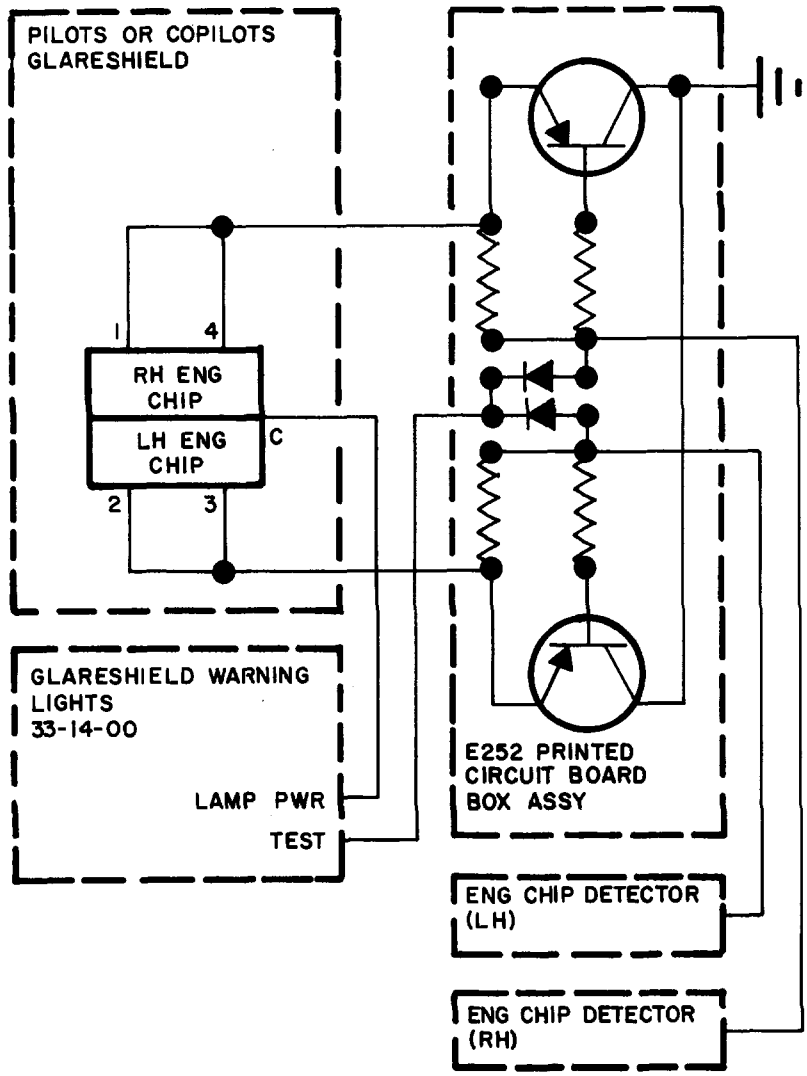
Detail B

Engine Chip Detector System Locator
Figure 1

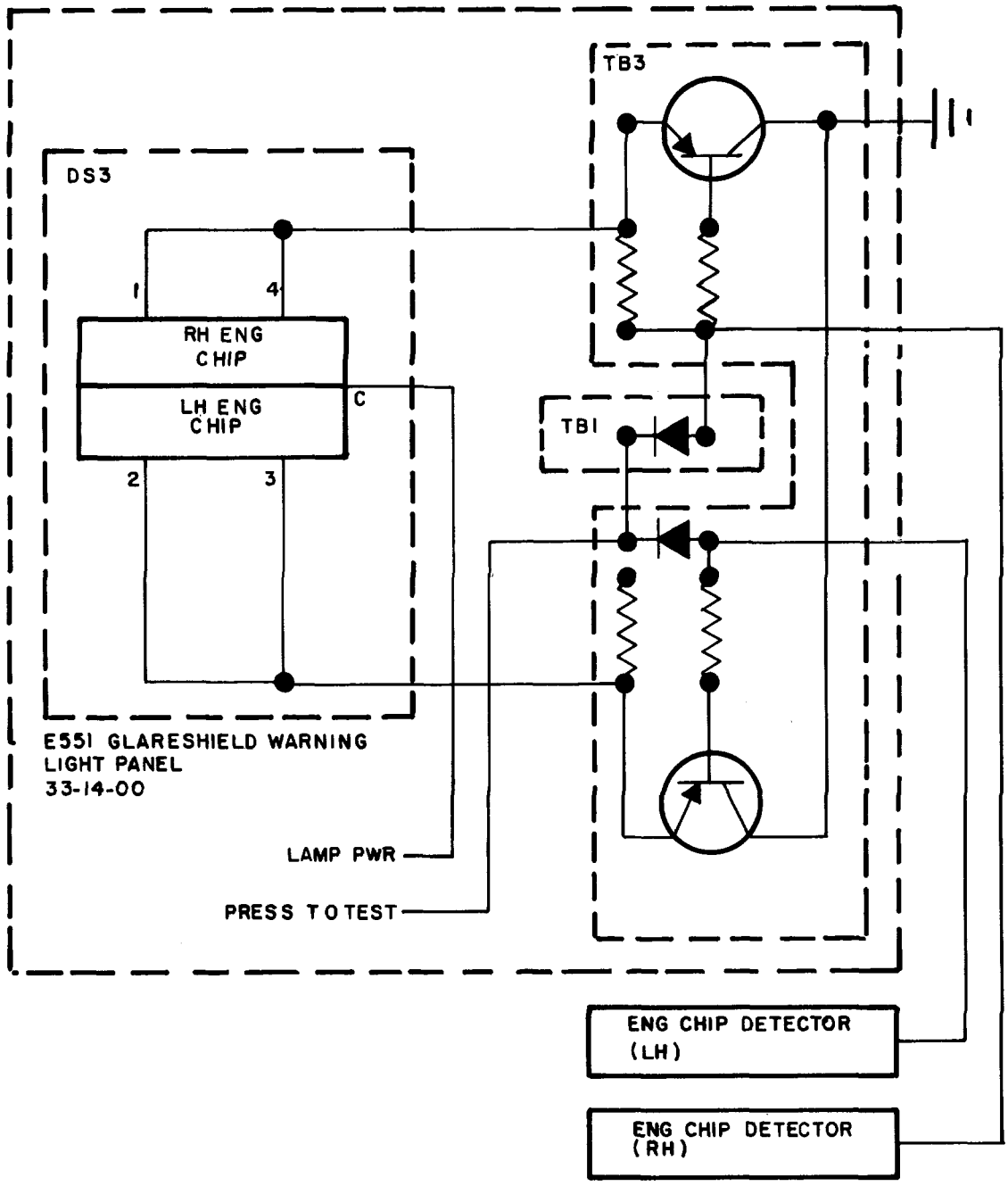


1 Annunciators may be installed on pilot's or copilot's glareshield.

Engine Chip Detector System Electrical Schematic
Figure 2 (Sheet 1 of 3)



Engine Chip Detector System Electrical Schematic
Figure 2 (Sheet 2 of 3)



Engine Chip Detector System Electrical Schematic
Figure 2 (Sheet 3 of 3)

1. REMOVAL/INSTALLATION

A. Remove Terminal Boards (See figure 201.)
   (1) Remove electrical power from aircraft.
   (2) Lower copilot's instrument panel.
   (3) Disconnect terminal board electrical connector.

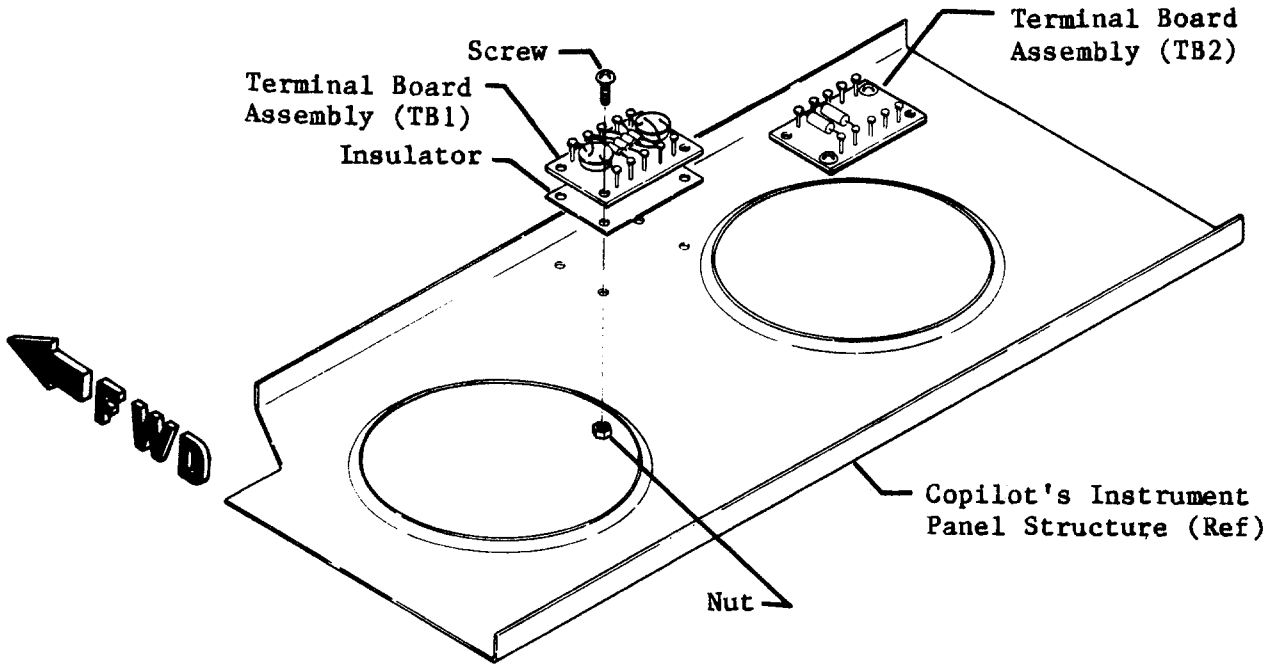
   NOTE: Terminal boards TB1 and TB2 are connected together by jumper wires. If one of the boards is removed, these jumpers must be disconnected. If both boards are removed, leave jumpers intact.

   (4) Disconnect jumper wires if necessary.
   (5) Remove attaching parts and terminal board(s) from instrument panel tray assembly.

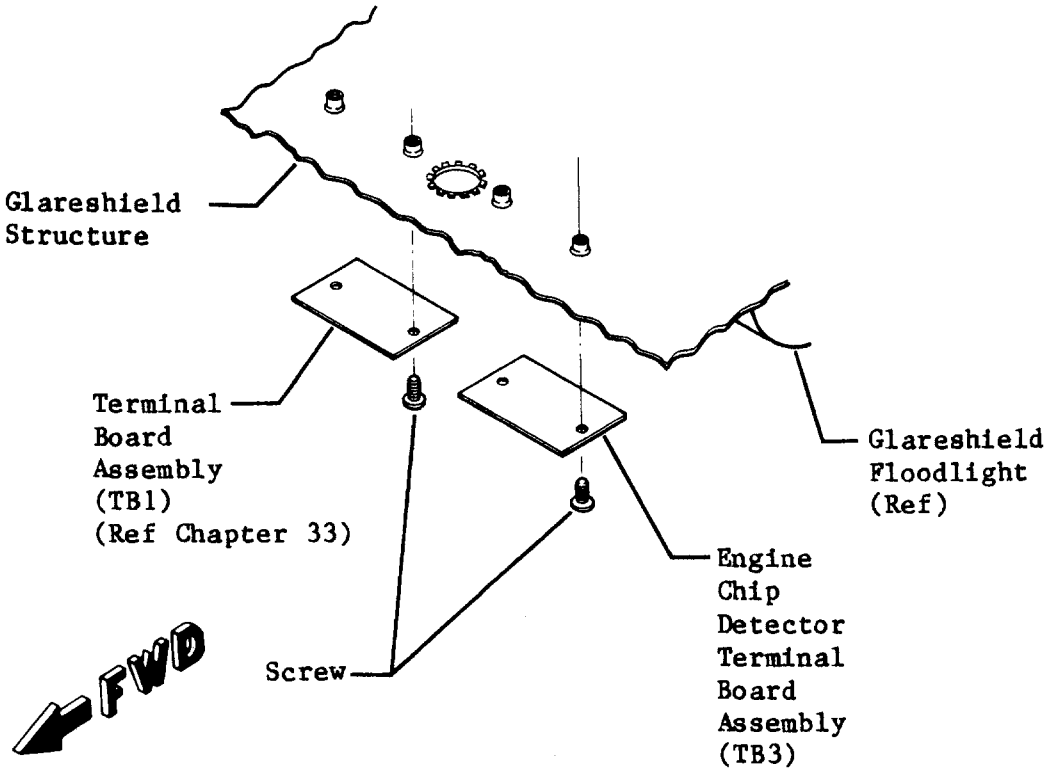
B. Install Terminal Boards (See figure 201.)
   (1) Position insulator and terminal board(s) on instrument panel tray assembly.
   (2) Install attaching parts and secure insulator and terminal board to instrument panel tray assembly.
   (3) Connect jumper wires between terminal boards if previously disconnected.
   (4) Connect terminal board electrical connector
   (5) Raise and secure copilot's instrument panel.

C. Remove Terminal Board (*Aircraft 35-490 and Subsequent, 36-051 and Subsequent*) (See figure 202.)
   (1) Remove electrical power from aircraft.
   (2) Disconnect and identify electrical wiring from terminal board assembly (TB3).
   (3) Remove attaching parts and terminal board from glareshield structure.

D. Install Terminal Board (*Aircraft 35-490 and Subsequent, 36-051 and Subsequent*) (See figure 202.)
   (1) Position terminal board on glareshield structure and secure with attaching parts.
   (2) Identify and connect electrical wiring to terminal board assembly.
   (3) Restore electrical power to aircraft.



Terminal Board Installation
Figure 201



9-356A

Terminal Board Installation
Figure 202

PRINTED CIRCUIT BOARD BOX ASSEMBLY - MAINTENANCE PRACTICES

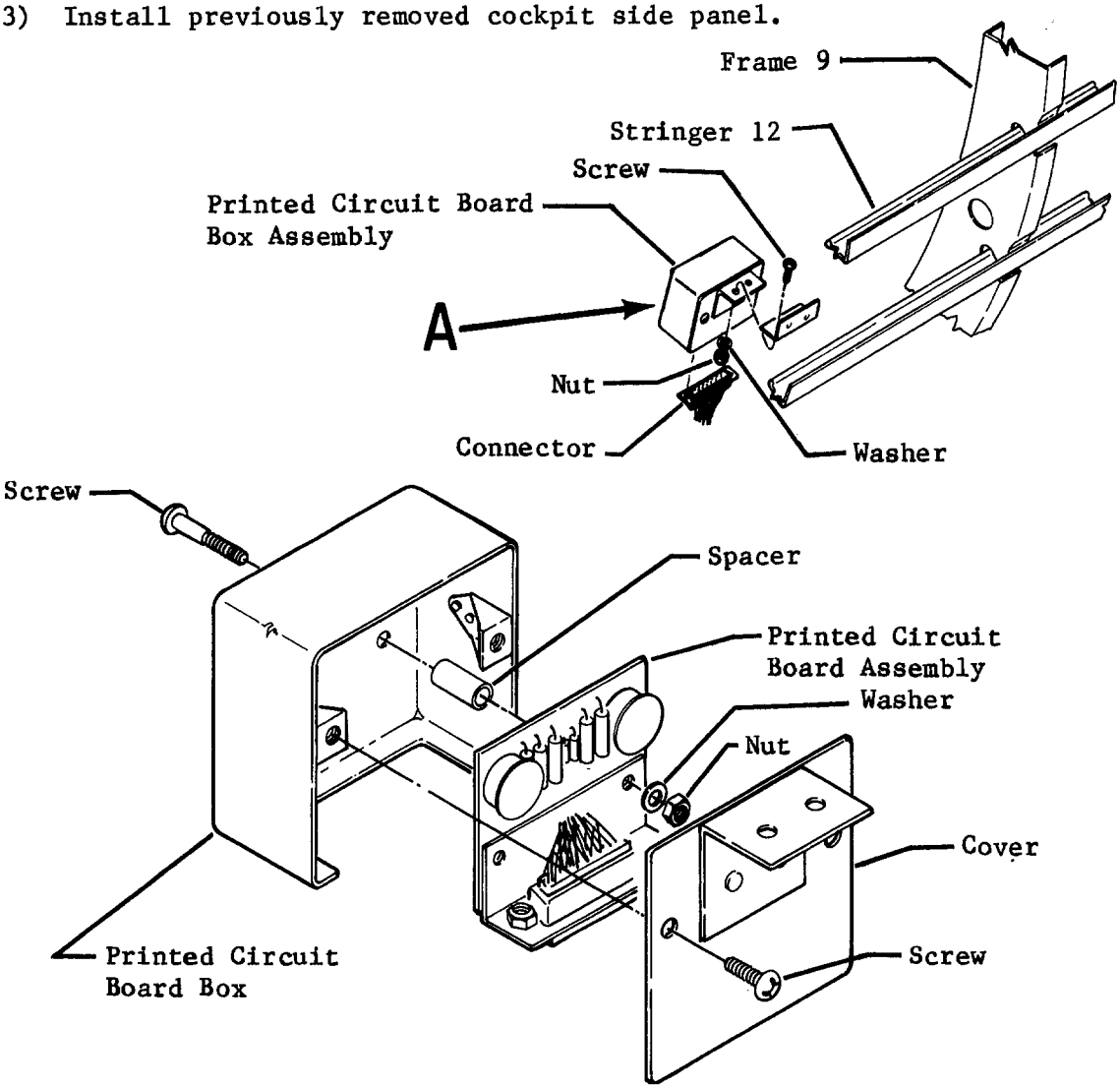
1. REMOVAL/INSTALLATION

A. Remove Printed Circuit Board Box Assembly (See figure 201.)

(1) Remove electrical power from aircraft.
(2) Remove RH cockpit side panel.
(3) Disconect electrical connect from box assembly.
(4) Remove attaching parts and box assembly from bracket.

B. Install Printed Circuit Board Box Assembly (See figure 201.)

(1) Position box assembly on bracket. Install attaching parts and secure box assembly to bracket.
(2) Connect electrical connector to box assembly.
(3) Install previously removed cockpit side panel.



7-53C

Printed Circuit Board Box Assembly Installation
Figure 201