CHAPTER

77

ENGINE INDICATING

MD-80
AIRCRAFT MAINTENANCE MANUAL

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ENGINE PRESSURE RATIO (EPR) INDICATION SYSTEM - MAINTENANCE PRACTICES	77-11-01	2	201	WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887
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ENGINE PRESSURE RATIO (EPR) TRANSMITTER - MAINTENANCE PRACTICES	77-11-02	2	201	WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887
EPR P INLET PRESSURE SENSING PROBE - MAINTENANCE PRACTICES	77-11-03	1	201	WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

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N1 RPM AND N2 RPM TACHOMETER SYSTEMS - TROUBLE SHOOTING	77-12-01	1	101	WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893
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N1 RPM AND N2 RPM TACHOMETER SYSTEMS - MAINTENANCE PRACTICES	77-12-01	1	201	WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893
N1 RPM AND N2 RPM TACHOMETER SYSTEMS - MAINTENANCE PRACTICES	77-12-01	2	201	WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887
N1 TACHOMETER GENERATOR - MAINTENANCE PRACTICES	77-12-02		201	WJE ALL
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TEMPERATURE - DESCRIPTION AND OPERATION	77-20-00	2	1	WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887
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GENERAL - DESCRIPTION AND OPERATION

1. General

WJE 405-411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

A. The engine indicating system utilizes engine pressures, engine high compressor speed (N_2), engine low compressor speed (N_1), and Exhaust Gas Temperature (EGT). Sensing devices located on each engine continuously transmit signals to indicators in the flight compartment providing indications of engine operating conditions.

WJE 401-404, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

B. The engine indicating system utilizes engine pressures, engine high compressor speed (N_2), engine low compressor speed (N_1), and EGT. Sensing devices located on each engine continuously transmit signals to an Engine Display Panel in the flight compartment providing indications of engine operating conditions.

WJE ALL

C. Engine indicating consists of power and temperature subsystems.

2. Power

WJE 405-411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

A. Engine low pressure compressor speed (N_1 RPM indication) and engine high pressure compressor speed (N_2 RPM indication) are displayed on percentage-type indicators in the flight compartment. Low compressor speed is derived from an N_1 tachometer generator mounted on the engine front accessory drive case under the inlet bullet. High compressor speed is derived from an N_2 tachometer generator mounted on the right side of the engine accessory gearbox.

WJE 401-404, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

B. Engine low pressure compressor speed (N_1 RPM indication) and engine high pressure compressor speed (N_2 RPM indication) are displayed in percentage on the Engine Display Panel in the flight compartment. Low compressor speed is derived from an N_1 tachometer generator mounted on the engine front accessory drive case under the inlet bullet. High compressor speed is derived from an N_2 tachometer generator mounted on the right side of the engine accessory gearbox.

WJE 405-411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

C. The Engine Pressure Ratio (EPR) system senses and measures the pressure differential between engine inlet ram air pressure (PT2) and turbine exhaust gas pressure PT7). Pressure ratio is displayed on percentage-type indicators in the flight compartment. For a complete description and operation of power, refer to SUBJECT 77-10-00, Page 1.

WJE 401-404, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

D. The EPR system senses and measures the pressure differential between engine inlet ram air pressure (PT2) and turbine exhaust gas pressure PT7). Pressure ratio is displayed in percentage on the Engine Display Panel in the flight compartment. For a complete description and operation of power, refer to SUBJECT 77-10-00, Page 1.

WJE ALL

3. Temperature

WJE 405-411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

A. Engine EGT is sensed by eight dual-junction, thermocouple probes, mounted in the turbine case around the perimeter of the engine. The EGT, averaged between probes is displayed in degrees Centigrade on indicators in the flight compartment. For a complete description and operation of temperature, refer to SUBJECT 77-20-00, Page 1.

WJE 401-404, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

B. Engine EGT is sensed by eight dual-junction, thermocouple probes, mounted in the turbine case around the perimeter of the engine. The EGT, averaged between probes is displayed in degrees Centigrade on the Engine Display Panel in the flight compartment. For a complete description and operation of temperature, refer to SUBJECT 77-20-00, Page 1.

WJE ALL

4. Analyzers

WJE 401-404, 412, 414-427, 429, 861-866, 868, 869, 871-879, 886, 887, 891-893

A. Provisions are included for the incorporation of an engine vibration monitoring system to provide continuing documentation of engine conditions. Spare wires are installed from the engine pylon firewall to the electrical equipment compartment. Sufficient wire to reach the overhead switch panel will be stowed and available for future use.

WJE 405-411, 880, 881, 883, 884

B. Engine condition is analyzed continuously during operation by a vibration monitoring system. Vibration is sensed by two velocity-type vibration pickups, one installed on the compressor case, the other on the turbine case. Vibration level is displayed on a dc microammeter-type indicator in the flight compartment. For a complete description and operation of analyzers, refer to SUBJECT 77-30-00, Page 1.

GENERAL - MAINTENANCE PRACTICES

1. General Maintenance Features

A. Maintenance Interphone System

(1) The maintenance interphone system provides a means of communication between the flight compartment and maintenance personnel working in the other areas of the aircraft. A maintenance interphone switch, located on the overhead switch panel, is utilized to actuate the system.

(2) Two interphone jacks are accessible to personnel working in the engine areas; one each on the left and right side of fuselage adjacent to the engines.

B. Engine Accessibility

(1) Accessibility is provided to all systems and components within the engine installation and nacelle. Engine cowl doors provide access to all parts of the engine and accessories that require check, maintenance, or servicing. (PAGEBLOCK 71-00-00/201)

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: OPEN UPPER COWL DOOR ONLY AS MUCH AS NECESSARY TO ALLOW HOLD-OPEN RODS TO BE CONNECTED TO ENGINE. OPENING DOOR TOO FAR MAY CAUSE DAMAGE TO PYLON HINGE POINTS.

CAUTION: MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

C. Component Interchangeability

(1) Identical accessories are installed on all engines.

2. Safety and Operating Precautions

A. Circuit Breakers

(1) All circuit breakers opened during maintenance should be tagged to prevent inadvertent operation of affected system.

B. High-Voltage Systems and Components

(1) Prior to performing maintenance on high-voltage system or components, make certain power to system or component has been shut off and all affected circuit breakers are open and tagged.

C. Application of External Power and Pressurization of Fluid Systems

WARNING: INADVERTENT OPERATION OF AN AIRCRAFT SYSTEM COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

WARNING: BEFORE ACTIVATING ANY FUEL, ELECTRICAL, HYDRAULIC, OR PNEUMATIC SYSTEM FOR MAINTENANCE PURPOSES, MAKE CERTAIN THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF OPERATING PORTIONS OF AIRCRAFT.

D. Engine Motoring

CAUTION: FUEL PUMP AND MAIN ENGINE CONTROL ARE FUEL-LUBRICATED. DO NOT MOTOR ENGINE UNLESS A POSITIVE FUEL INLET PRESSURE IS INDICATED.

E. Engine Cowling Wind Restrictions

CAUTION: COWL DOORS, ALL ENGINE LOCATIONS, IN OPEN POSITION SUPPORTED BY HOLD-OPEN RODS WILL SAFELY WITHSTAND GROUND WINDS UP TO 30 KNOTS.

F. Remove/Replace Electrical Connectors

(1) When electrical connectors are disconnected, caps or other protective materials should be used to prevent entry of oil, fuel, hydraulic fluid, moisture, and other foreign material.

3. General Maintenance Practices

A. Engine Access

(1) To open cowl doors for all engines, refer to PAGEBLOCK 71-00-00/201.

B. External Electrical Power

(1) For procedures to connect external electrical power to aircraft, refer to PAGEBLOCK 24-40-00/001.

C. Engine Motoring

(1) For procedures to dry motor or wet motor engine, refer to GENERAL, SUBJECT 71-00-00, Page 501.

D. Cleanup

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN WELL-VENTILATED ATMOSPHERE. EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

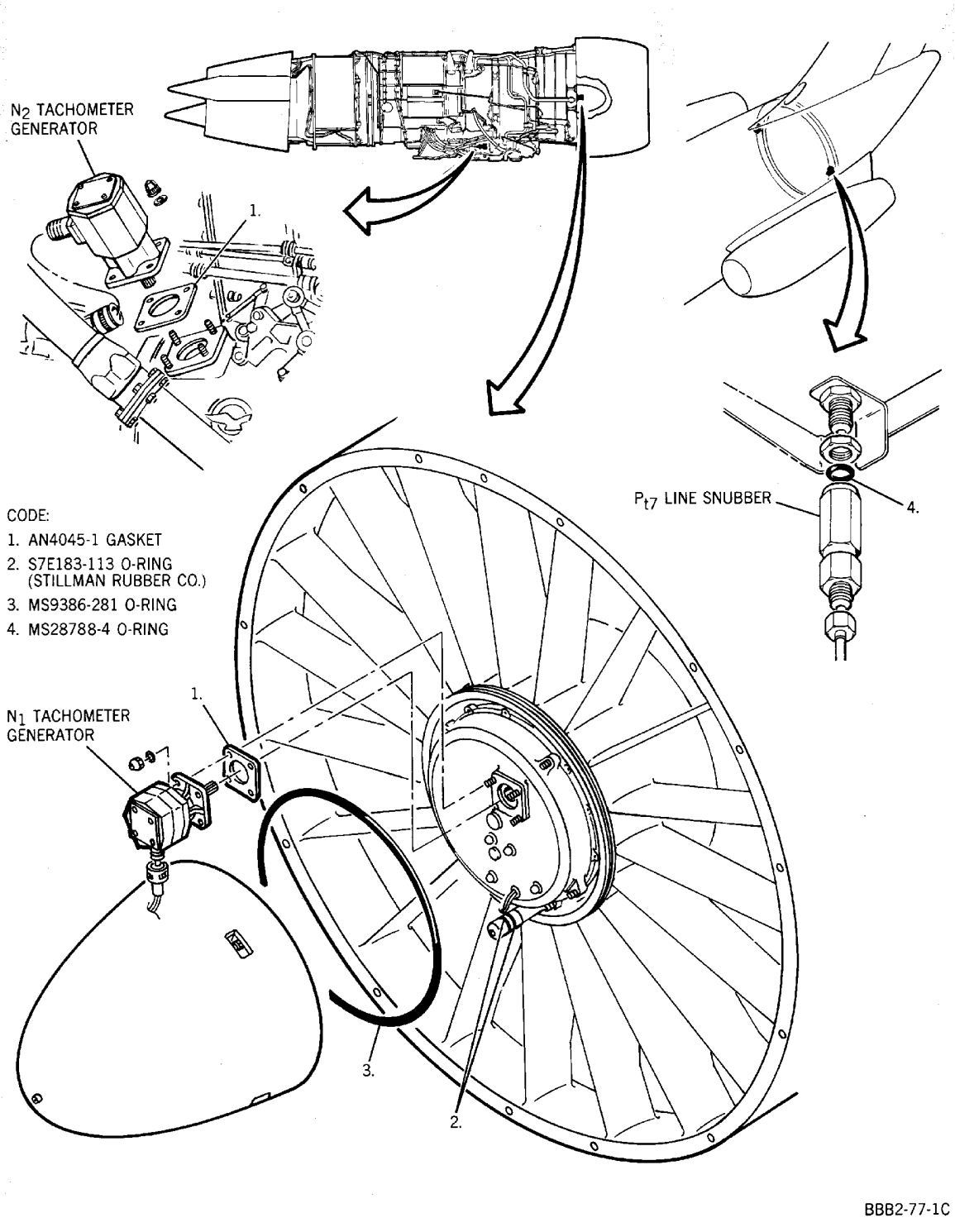
(1) Spilled oil, fuel, or hydraulic fluid should be cleaned up immediately to prevent damage to wiring or other components and to prevent false leak reports.

E. Seals, O-rings, and Gaskets

(1) Seals, O-rings, and gaskets are identified and shown in Figure 201.

F. Used O-rings

(1) Discard all used O-rings.



Seals, O-rings, and Gaskets
Figure 201/77-00-00-990-801

POWER - DESCRIPTION AND OPERATION

1. General

A. Engine indicating power subsystem furnishes a display of fan (low compressor) speed (N_1 RPM indication), core engine (high compressor) speed (N_2 RPM indication), and EPR between engine inlet ram air pressure (Pt_2) and turbine exhaust pressure (Pt_7).

B. The tachometer system for each engine consists of the low-pressure (fan) compressor (N_1) tachometer system and the high-pressure (core) compressor (N_2) tachometer system. Each system consists of an engine-mounted tachometer generator and an indicator mounted on the center instrument panel in the flight compartment. The tachometer generator and indicator for the N_1 and N_2 systems are identical.

C. The EPR system consists of a Pt_2 inlet pressure probe mounted in the engine inlet bullet, eight Pt_7 average pressure probes installed through the engine turbine exhaust case, a pressure ratio transmitter installed in the fuselage aft section, and an indicator mounted on the center instrument panel in the flight compartment.

2. N_1 RPM Indication

A. Description

(1) Fan speed indication is sensed by the N_1 tachometer generator mounted on the engine front accessory drive case under the inlet bullet. The frequency generator (sensor) generates a pulse signal which is transmitted during engine operation to the N_1 RPM indicator on the center instrument panel in the flight compartment (Figure 1).

(2) N_1 Tachometer Generator - The N_1 tachometer generator generates a frequency signal output of 70.00 Hz at 100 percent rpm. The sine wave voltage is approximately 22 V. RMS at 100 percent rpm. The voltage is proportional to speed.

(3) N_1 RPM Indicator - The N_1 RPM indicator is a hermetically sealed unit consisting of a synchronous motor with magnetic coupling to an indicating mechanism. The synchronous motor is driven by the three-phase generator output. A torque proportional to the motor speed is applied to the indicating mechanism through magnetic coupling. The indicator is integrally lighted.

B. Operation

(1) Fan engine rotation drives the front accessory drive gearbox, which in turn drives the N_1 tachometer generator. An electrical signal of varying frequency and voltage is generated and conveyed to the N_1 RPM indicator. The electrical signal causes pointer deflection.

3. N_2 RPM Indication

A. Description

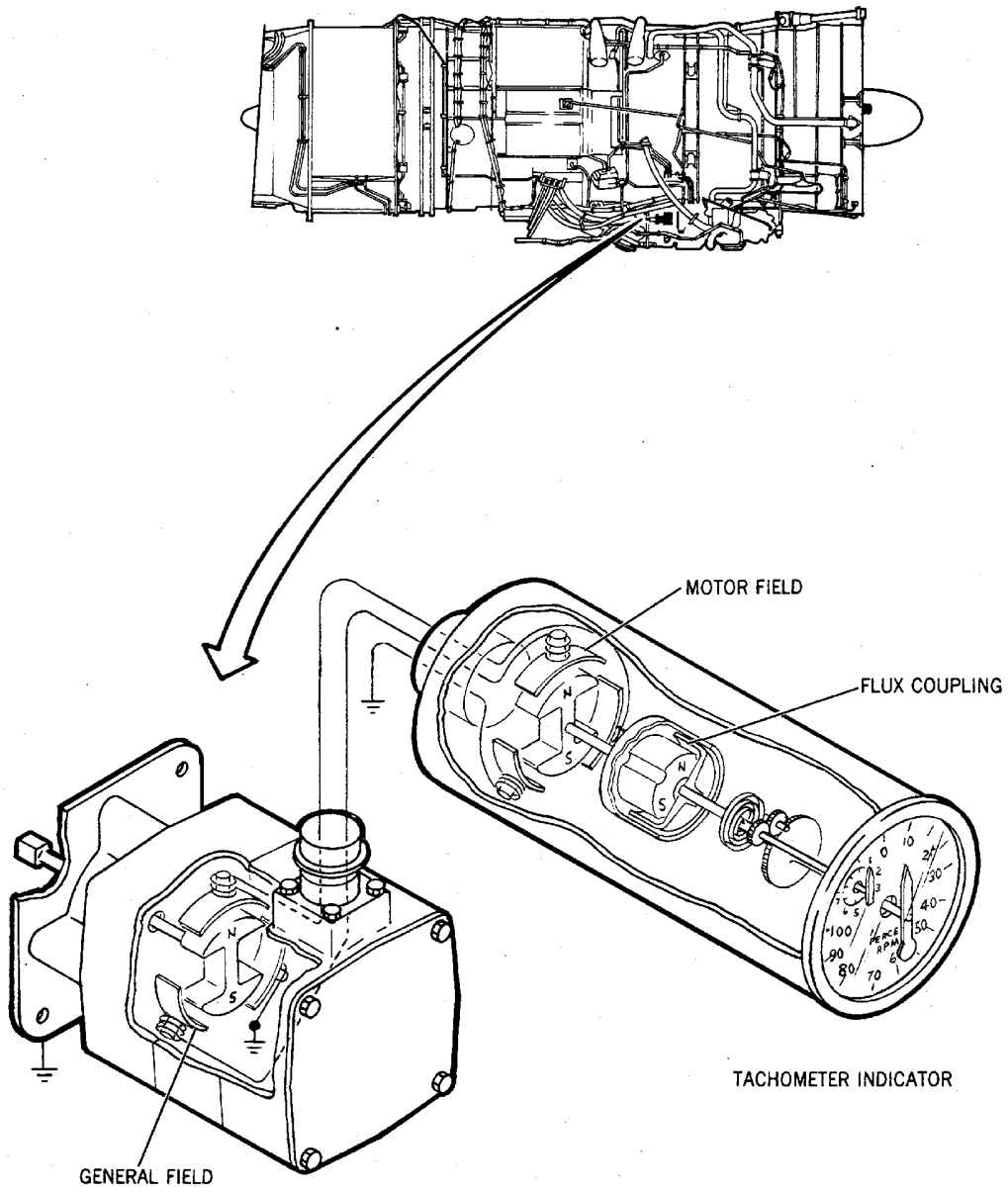
(1) Core engine speed is sensed by the N_2 tachometer generator mounted on the right side of the engine accessory gearbox. The frequency generator (sensor) generates a pulse signal which is transmitted to the N_2 RPM indicator located on the center instrument panel in the flight compartment. (Figure 1)

(2) N_2 Tachometer Generator - The N_2 tachometer generator generates a frequency signal output of 70.00 Hz at 100% rpm. The sine wave voltage is approximately 22 V. RMS at 100 percent rpm. The voltage is proportional to speed.

(3) N_2 RPM Indicator - The N_2 RPM indicator is a hermetically sealed unit consisting of a synchronous motor with magnetic coupling to an indicating mechanism. The synchronous motor is driven by the three-phase generator output. A torque proportional to the motor speed is applied to the indicating mechanism through magnetic coupling. The indicator is integrally lighted.

B. Operation

(1) Core engine rotation drives the accessory gearbox, which in turn drives the N_2 tachometer generator. An electrical signal of varying frequency and voltage is generated and conveyed to the N_2 RPM indicator. The electrical signal causes pointer deflection proportional to the frequency of the signal.



N_1 N_2 TYPICAL TACHOMETER GENERATOR

Tachometer Systems - Schematic
Figure 1/77-10-00-990-805

4. EPR Indication

A. Description

(1) EPR senses the pressure differential between engine inlet ram air pressure (Pt_2) and engine pressure at the turbine exhaust (Pt_7). (Figure 2)

(2) Engine pressure ratio for each engine consists of eight average pressure probes (Pt_7), a Pt_2 probe, an EPR pressure transmitter, and an EPR indicator.

(3) Turbine Exhaust Pressure Probes (Pt_7) - The eight turbine exhaust pressure probes (Pt_7), mounted through the engine turbine discharge case, sense primary exhaust total pressure. The probes are connected together by a manifold. A single external connection for the manifold is provided on the side of the engine. (Figure 4)(Table 1)

(4) Pt_7 Condensation Trap - On later engines incorporating a continuously purging condensation trap, moisture will be continuously purged from the system by extension of the manifold from the upper six probes to a moisture trap at the bottom of the engine. Two small orifices mounted in series at the inlet of the moisture trap maintains the Pt_7 pressure in the manifold while allowing a small continuous outflow. Air pressure in the moisture trap body is maintained at a level just slightly less than Pt_7 to act as a buffer, thus eliminating any Pt_7 error which would result if Pt_7 manifold pressure was vented directly to ambient pressure. Buffer air pressure is provided by the bottom two Pt_7 probes and is controlled by the orifice at the bottom of the moisture trap.

(5) Inlet Pressure Sensing Probe (Pt_2) - The inlet pressure sensing probe (Pt_2) is mounted in the inlet bullet and senses inlet total pressure. The probe protrudes through the forward end of the inlet bullet and is removable as a unit.

(6) Engine Pressure Ratio Transmitter - The pressure ratio transmitter, mounted in the aft accessory compartment of the aircraft, measures inlet and exhaust pressures, and computes a pressure ratio which is utilized to obtain maximum operating efficiency from the engine. The transmitter consists of two aneroid bellows, a force balance sensing unit, a follow up motor and gear train, and three syncro transmitters. These components are contained in a pressure-sealed housing which is provided with external electrical and pressure connections. (Figure 3)

(7) EPR Indicator - The EPR indicator is an electrical/mechanical unit which displays the EPR (ratio of Pt_7 to Pt_2) and has digital and analog displays. The indicator pointer is positioned in response to a servo-driven DC motor. The digital display is provided by three counter wheels gear driven from the pointer. A target bug is servo-driven by a DC motor in response to a signal input from the Digital Fight Guidance Computer (DFGC).

(8) Ram Air Temperature (RAT) System - For detailed information of aircraft equipped with RAT system, refer to RAM AIR TEMPERATURE AND THRUST RATING - DESCRIPTION AND OPERATION, PAGEBLOCK 34-18-00/001.

WJE 407, 408, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 891

(9) For detailed information of aircraft equipped with Static Air Temperature (SAT) system, refer to TRUE AIRSPEED AND STATIC AIR TEMPERATURE - DESCRIPTION AND OPERATION, PAGEBLOCK 34-15-00/001.

WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

B. Operation

(1) Turbine exhaust pressure (Pt_7) and engine inlet ram air pressure (Pt_2) are sampled by the turbine exhaust pressure probes (Pt_7) and the inlet pressure sensing (Pt_2) probe. These pressures are directed to the engine pressure ratio transmitter where they are compared and converted into electrical signals, and conveyed to the EPR indicator to be displayed as engine pressure ratio.

(2) Operation begins when the aircraft electrical buses are energized and pressures are supplied. The inlet and exhaust pressures exert force on the Pt_2 and Pt_7 aneroid bellows. This force, when transmitted through the force balance sensing unit, controls the armature of the differential transformer.

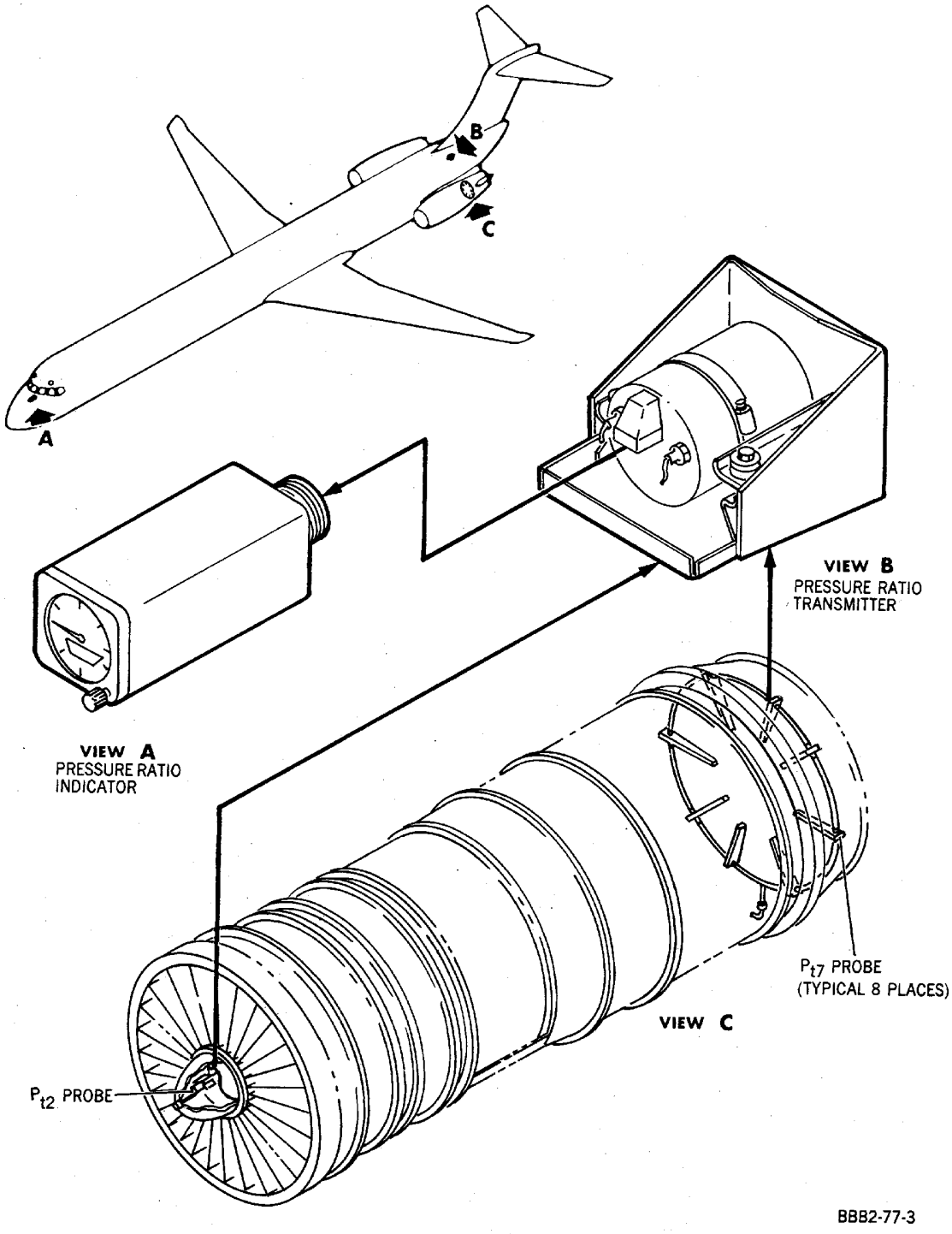
(3) As pressures change, the bellows transmit a variable force changing the position of the armature. This unbalances the transformer which applies a phase sensitive electrical signal to the amplifier input. The amplifier output signal energizes the follow up motor which rotates to a new null by repositioning the field coils of the differential transformer. The null condition or balanced position of the armature exists when the armature is exactly centered electrically between the two field coils.

(4) The follow up motor drives the gear train which in turn rotates the transmitter syncro. When a null exists the follow up motor stops and the syncro electrical signal is relayed to the receiver syncro in the indicator. The receiver syncro drives the pointer to a dial position presenting a numerical value of pressure ratio.

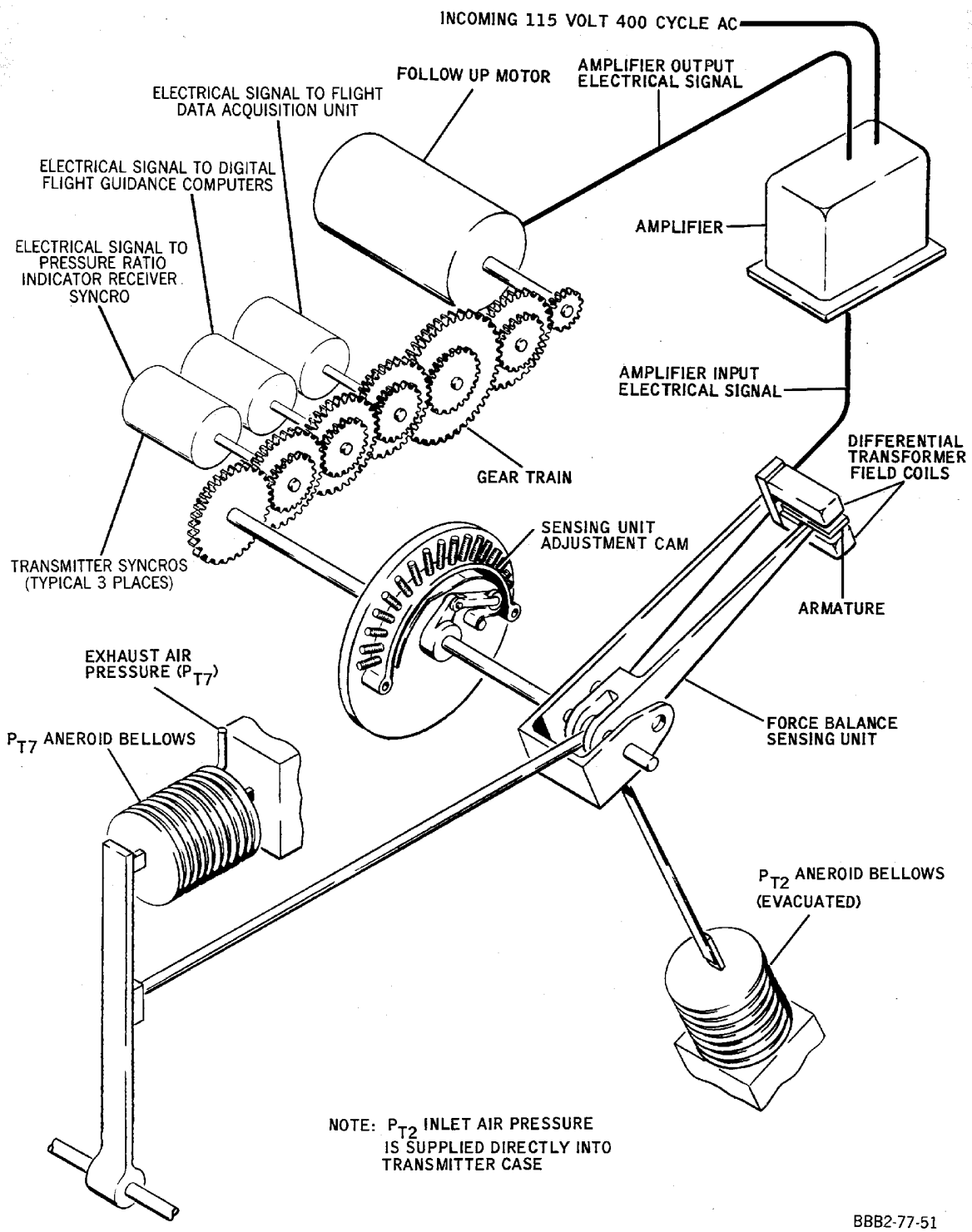
(5) By adjusting the indicator external set knob, the index bug and counter can be positioned to a desired pressure ratio reference setting for visual comparison with the actual indicated pressure ratio.

(6) Electrical power supplies voltages for the amplifier and bridge circuits of the ram air temperature/engine pressure ratio indicator. Ram air sensed by the external portion of the temperature sensor results in a signal which is amplified with the bridge circuit signal and applied to an electromagnetic actuator causing a pointer deflection on the indicator.

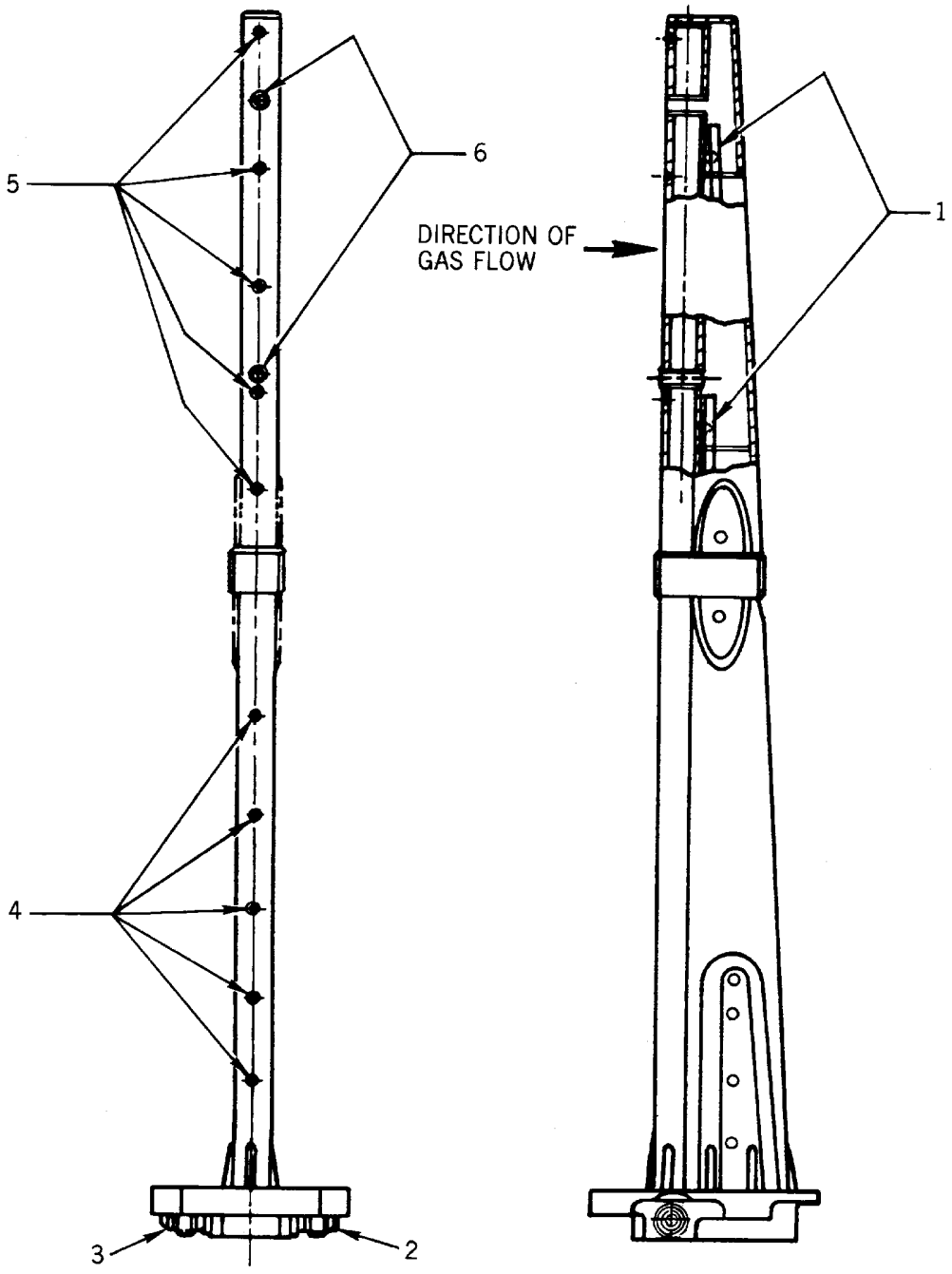
(7) For detailed information of aircraft equipped with RAT system, refer to RAM AIR TEMPERATURE AND THRUST RATING - DESCRIPTION AND OPERATION, PAGEBLOCK 34-18-00/001.



Pressure Ratio System - Schematic
Figure 2/77-10-00-990-806



Engine Pressure Ratio Transmitter - Schematic
Figure 3/77-10-00-990-807



EPR P_{t7} Turbine Exhaust Pressure Probe
Figure 4/77-10-00-990-808

EFFECTIVITY
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

5. The table that follows is the key to Figure 4:

Table 1 EPR Pt_7 Turbine Exhaust Pressure Probe Legend

1. Thermocouple Tubes.
2. Pt_7 Fan Pressure Manifold Connection (Unused).
3. Pt_7 Turbine Exhaust Pressure Manifold Connection.
4. Fan Pressure Sensing Holes (Probe Prior to P&W Service Bulletin (SB) 5204).
5. Turbine Exhaust Pressure Sensing Holes.
6. Thermocouple Temperature Sampling Holes.

POWER - DESCRIPTION AND OPERATION

1. General

A. Engine indicating power subsystem furnishes a display of fan (low compressor) speed (N_1 RPM indication), core engine (high compressor) speed (N_2 RPM indication), and EPR between engine inlet ram air pressure (P_{t2}) and turbine exhaust pressure (P_{t7}).

B. The tachometer system for each engine consists of the low-pressure (fan) compressor (N_1) tachometer system and the high-pressure (core) compressor (N_2) tachometer system. The system consists of engine-mounted tachometer generators and a Engine Display Panel mounted on center instrument panel in the flight compartment. The tachometer generators for the N_1 and N_2 systems are identical.

C. The EPR system consists of a P_{t2} inlet pressure probe mounted in the engine inlet bullet, eight P_{t7} average pressure probes installed through the engine turbine exhaust case, a pressure ratio transmitter installed in the fuselage aft section, and a Engine Display Panel mounted on center instrument panel in the flight compartment.

2. N_1 RPM Indication

A. Description

(1) Fan speed indication is sensed by the N_1 tachometer generator mounted on the engine front accessory drive case under the inlet bullet. The frequency generator (sensor) generates a pulse signal which is transmitted during engine operation to the Engine Display Panel on center instrument panel in the flight compartment. (Figure 1)

(2) N_1 Tachometer Generator - The N_1 tachometer generator generates a frequency signal output of 70.00 Hz at 100 percent rpm. The sine wave voltage is approximately 22 V. RMS at 100 percent rpm. The voltage is proportional to speed.

(3) Engine Display Panel - The Engine Display Panel receives signals from the N_1 tachometer generator. These functions are displayed in digital as well as analog form, and the operating, caution and warning ranges are indicated on face of panel.

B. Operation

(1) Fan engine rotation drives the front accessory drive gearbox, which in turn drives the N_1 tachometer generator. An electrical signal of varying frequency and voltage is generated and conveyed to the Engine Display Panel. These input values are processed and output to the counter/pointer display.

3. N_2 RPM Indication

A. Description

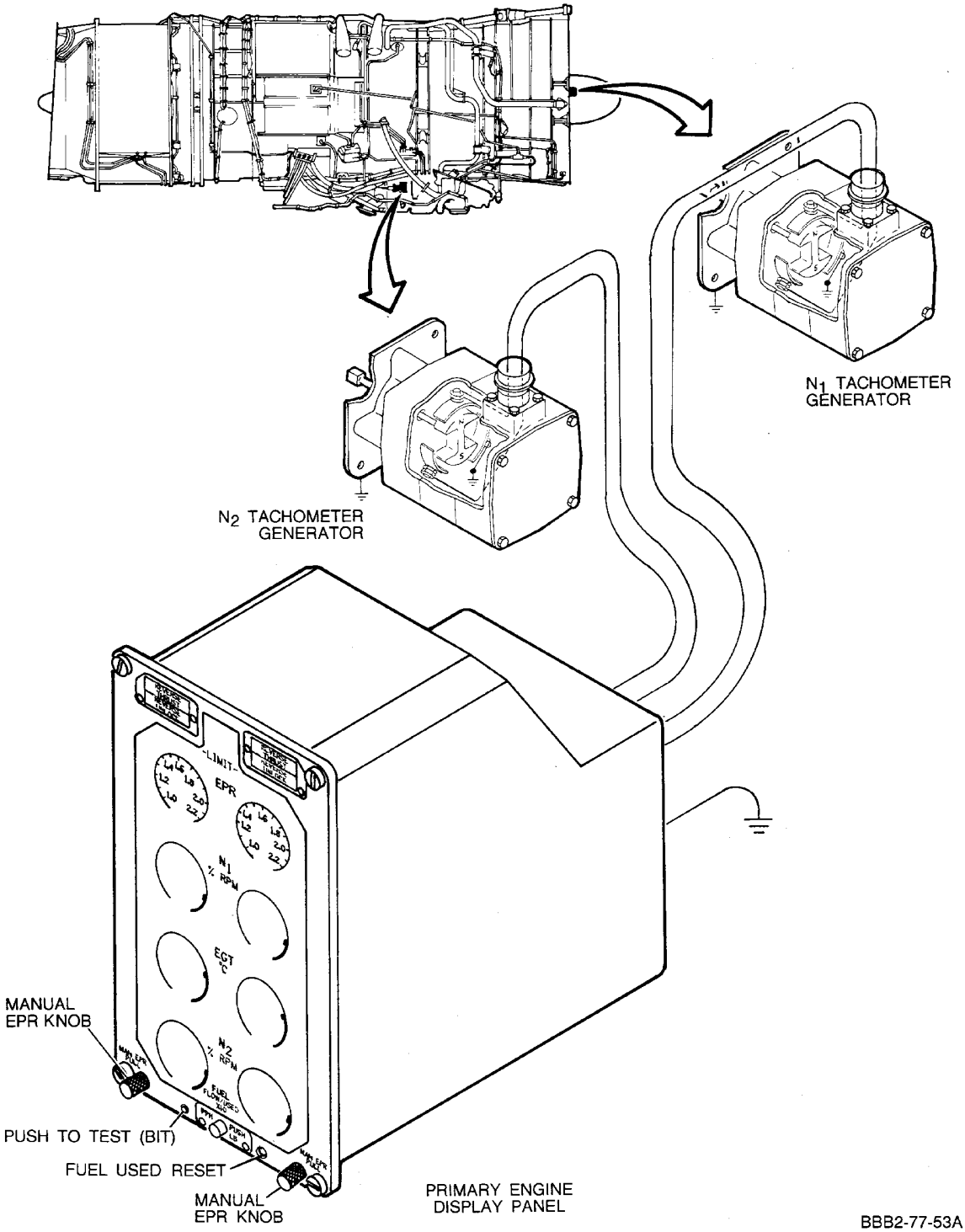
(1) Core engine speed is sensed by the N_2 tachometer generator mounted on the right side of the engine accessory gearbox. The frequency generator (sensor) generates a pulse signal which is transmitted to the Engine Display Panel located on the center instrument panel in the flight compartment. (Figure 1)

(2) N_2 Tachometer Generator - The N_2 tachometer generator generates a frequency signal output of 70.00 Hz at 100 percent rpm. The sine wave voltage is approximately 22 V. RMS at 100 percent rpm. The voltage is proportional to speed.

(3) Engine Display Panel - The Engine Display Panel receives signals from the N_2 tachometer generator. These functions are displayed in digital as well as analog form, and operating, caution and warning ranges are indicated on face of panel.

B. Operation

(1) Core engine rotation drives the accessory gearbox, which in turn drives the N_2 tachometer generator. An electrical signal of varying frequency and voltage is generated and conveyed to the Engine Display Panel. These input values are processed and output to the counter/pointer display.



Tachometer Systems - Schematic
Figure 1/77-10-00-990-801

4. EPR Indication

A. Description

(1) EPR senses the pressure differential between engine inlet ram air pressure (P_{t2}) and engine pressure at the turbine exhaust (P_{t7}). (Figure 2)

(2) EPR for each engine consists of eight average pressure probes (P_{t7}), a P_{t2} probe, an EPR pressure transmitter, and an Engine Display Panel.

(3) Turbine Exhaust Pressure Probes (P_{t7}) - The eight turbine exhaust pressure probes (P_{t7}), mounted through the engine turbine discharge case, sense primary exhaust total pressure. The probes are connected together by a manifold. A single external connection for the manifold is provided on the side of the engine. (Figure 4) (Table 1)

(4) P_{t7} Condensation Trap - On later engines incorporating a continuously purging condensation trap, moisture will be continuously purged from the system by extension of the manifold from the upper six probes to a moisture trap at the bottom of the engine. Two small orifices mounted in series at the inlet of the moisture trap maintains the P_{t7} pressure in the manifold while allowing a small continuous outflow. Air pressure in the moisture trap body is maintained at a level just slightly less than P_{t7} to act as a buffer, thus eliminating any P_{t7} error which would result if P_{t7} manifold pressure was vented directly to ambient pressure. Buffer air pressure is provided by the bottom two P_{t7} probes and is controlled by the orifice at the bottom of the moisture trap.

(5) Inlet Pressure Sensing Probe (P_{t2}) - The inlet pressure sensing probe (P_{t2}) is mounted in the inlet bullet and senses inlet total pressure. The probe protrudes through the forward end of the inlet bullet and is removable as a unit.

(6) Engine Pressure Ratio Transmitter - The pressure ratio transmitter, mounted in the aft accessory compartment of the aircraft, measures inlet and exhaust pressures, and computes a pressure ratio which is utilized to obtain maximum operating efficiency from the engine. The transmitter consists of two aneroid bellows, a force balance sensing unit, a follow-up motor and gear train, and three syncro transmitters. These components are contained in a pressure-sealed housing which is provided with external electrical and pressure connections. (Figure 3)

(7) Engine Display Panel - The Engine Display Panel receives signals from the EPR transmitter and displays the information in digital as well as analog form. The orange bug, when in the manual mode, is set with the MAN EPR knobs located at the bottom of panel. When in the automatic mode, these bugs are set by the Digital Fight Guidance Computer (DFGC).

(8) RAT System - For detailed information of aircraft equipped with RAT system, refer to RAM AIR TEMPERATURE AND THRUST RATING - DESCRIPTION AND OPERATION, PAGEBLOCK 34-18-00/001.

WJE 401-404, 406, 412, 414, 415, 418, 863, 864, 866

(9) For detailed information of aircraft equipped with SAT system, refer to TRUE AIRSPEED AND STATIC AIR TEMPERATURE - DESCRIPTION AND OPERATION, PAGEBLOCK 34-15-00/001.

WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

B. Operation

(1) Turbine exhaust pressure (P_{t7}) and engine inlet ram air pressure (P_{t2}) are sampled by the turbine exhaust pressure probes (P_{t7}) and the inlet pressure sensing (P_{t2}) probe. These pressures are directed to the engine pressure ratio transmitter where they are compared and converted into electrical signals, and conveyed to the Engine Display Panel to be displayed as EPR.

(2) Operation begins when the aircraft electrical buses are energized and pressures are supplied. The inlet and exhaust pressures exert force on the P_{t2} and P_{t7} aneroid bellows. This force, when transmitted through the force balance sensing unit, controls the armature of the differential transformer.

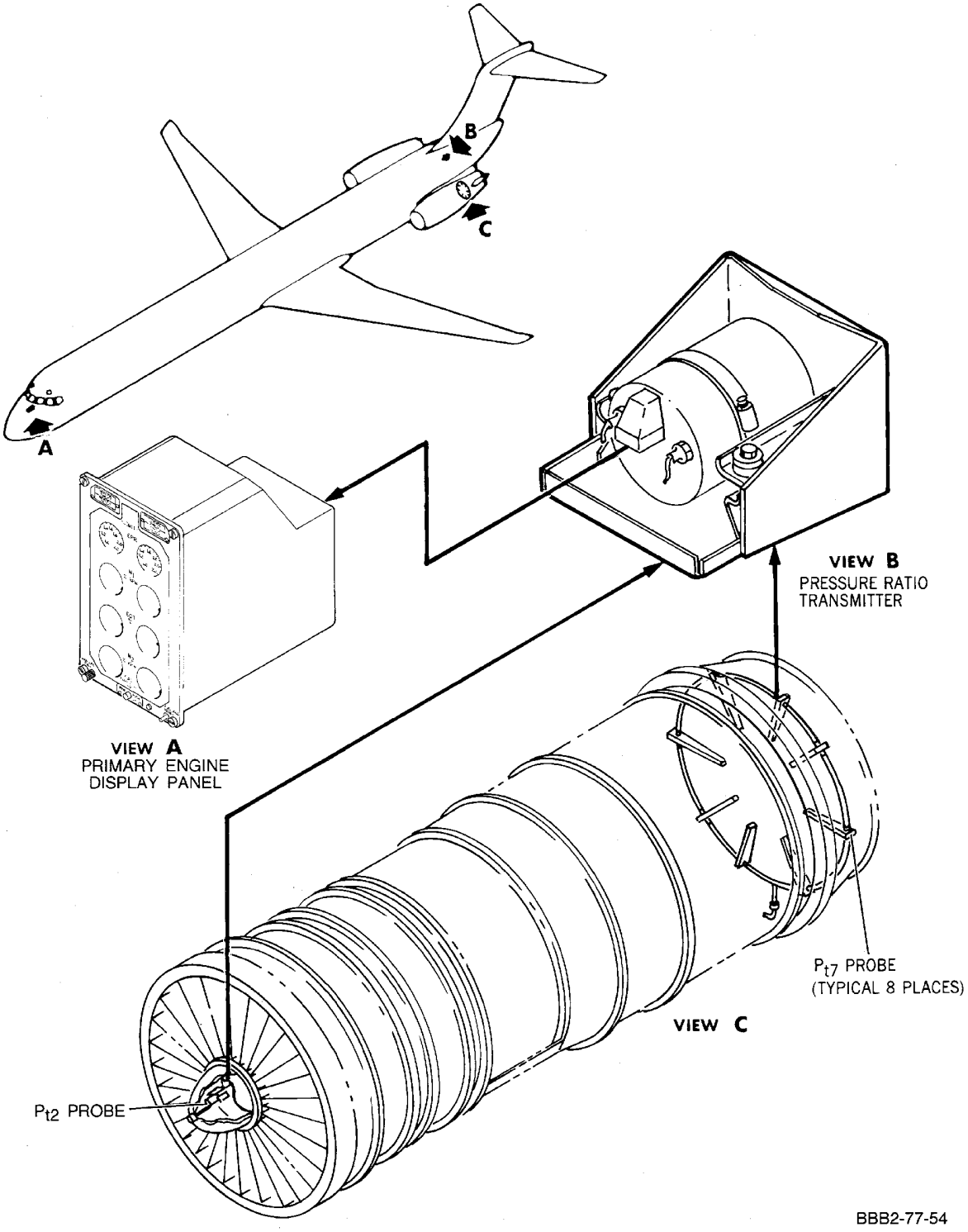
(3) As pressures change, the bellows transmit a variable force changing the position of the armature. This unbalances the transformer which applies a phase sensitive electrical signal to the amplifier input. The amplifier output signal energizes the follow up motor which rotates to a new null by repositioning the field coils of the differential transformer. The null condition or balanced position of the armature exists when the armature is exactly centered electrically between the two field coils.

(4) The follow up motor drives the gear train which in turn rotates the transmitter syncro. When a null exists the follow up motor stops and the syncro electrical signal is relayed to the Engine Display Panel. These inputs are buffered and digitized by the interface hardware and accessed by the processor. From these input values, actual EPR value is computed. The value after filtering is formatted and output to actual EPR counter/pointer display.

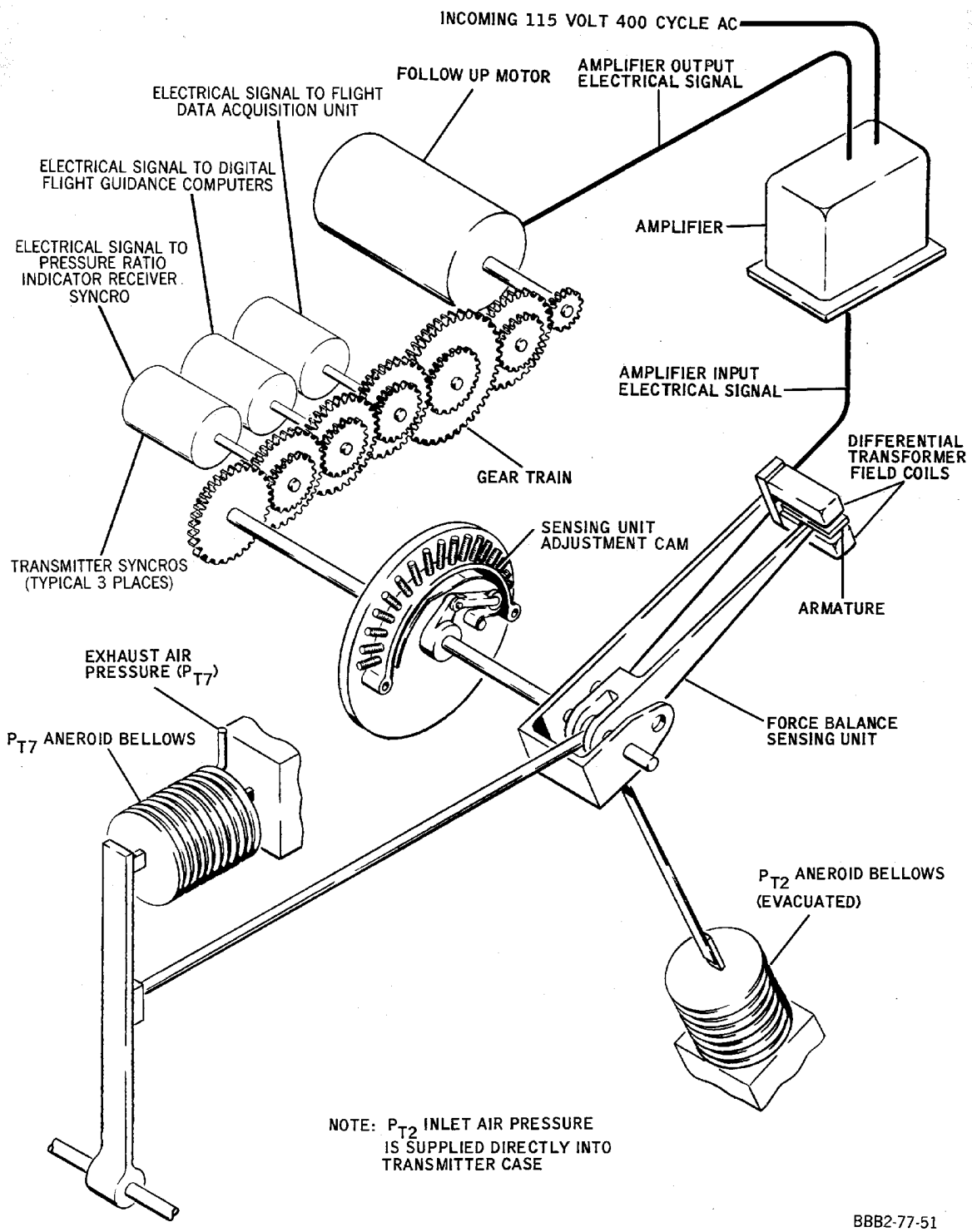
(5) The orange bug, when in the manual mode, is set with the MAN EPR knobs located at the bottom of panel. When in the automatic mode, these bugs are set by the Digital Fight Guidance Computer (DFGC).

(6) EPR Limit Test-A test value (depending upon engine installed) is display for the digital EPR LIMIT when the TEST button is pushed on the Thrust Rating Panel.

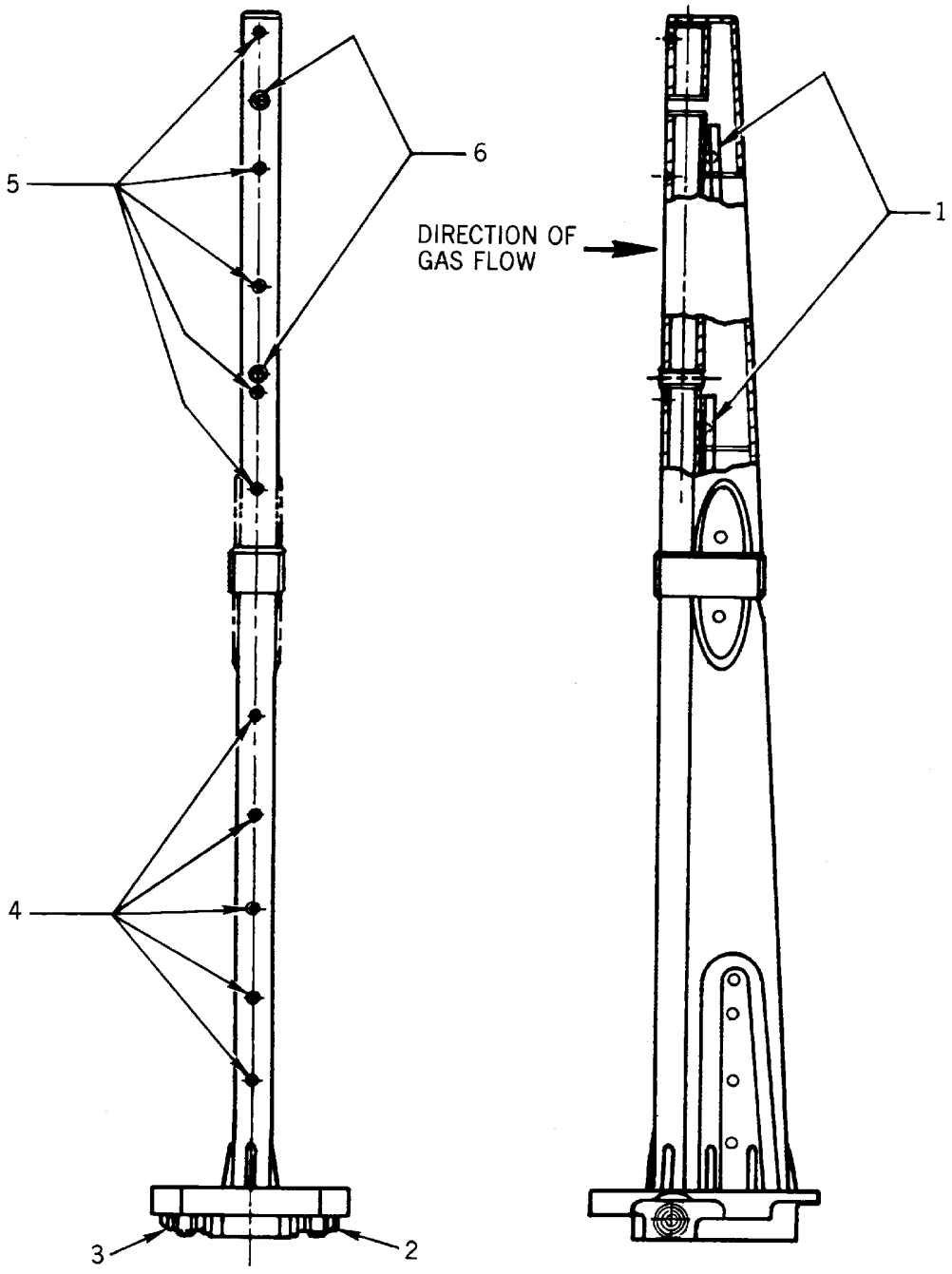
(7) The EPR Limit signal is provided by the Digital Fight Guidance Computer (DFGC) for detailed information, refer to DIGITAL FLIGHT GUIDANCE COMPUTER (DFGC) - DESCRIPTION AND OPERATION, PAGEBLOCK 22-01-01/001.



Engine Pressure Ratio System - Schematic
Figure 2/77-10-00-990-802



Engine Pressure Ratio Transmitter - Schematic
Figure 3/77-10-00-990-803



EPR P_{t7} Turbine Exhaust Pressure Probe
Figure 4/77-10-00-990-804

EFFECTIVITY
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

5. The table that follows is the key to Figure 4:

Table 1 EPR P_{t7} Turbine Exhaust Pressure Probe

1. Thermocouple Tubes. (Figure 4)
2. P_{t7} Fan Pressure Manifold Connection (Unused). (Figure 4)
3. P_{t7} Turbine Exhaust Pressure Manifold Connection. (Figure 4)
4. Fan Pressure Sensing Holes (Probe Prior to P&W SB 5204). (Figure 4)
5. Turbine Exhaust Pressure Sensing Holes. (Figure 4)
6. Thermocouple Temperature Sampling Holes. (Figure 4)

POWER - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the N_1 RPM (fan speed), N_2 RPM (core speed), and EPR indicators. The indicators are mounted in the center instrument panel in the flight compartment.

B. Maintenance of the indicators is limited to removal/installation.

C. Except where noted and for circuit breaker callout, removal/installation procedures for the N_1 RPM, N_2 RPM, and EPR indicators are identical. Instructions for a typical indicator removal/installation are given.

D. Access to the indicators and connectors is at the center instrument panel in the flight compartment.

2. Removal/Installation N_1 RPM, N_2 RPM and EPR Indicators

A. Remove Indicator (Figure 201) (Figure 202)

(1) Open these circuit breakers and install safety tags:

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
WJE ALL			

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO

CAUTION: BE CAREFUL WHEN YOU MOVE THE INDICATORS. DO NOT LET THE INDICATORS FALL. THIS WILL PREVENT INTERNAL DAMAGE TO THE INDICATORS.

(2) For the EPR indicator, loosen the two clamp adjustment screws on the front of the indicator until the indicator can be removed without binding, and remove the indicator from the panel.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT PLUG.

(3) For the N_1 and N_2 RPM indicator, loosen the clamp adjustment screw on the front of the indicator until the indicator can be removed without binding, and remove the indicator from the panel.

(4) Disconnect electrical connector.

B. Install Indicator (Figure 201) (Figure 202)

WARNING: TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Make sure that these circuit breakers are open and have safety tags:

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			

WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893 (Continued)

(Continued)

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	25	B1-805	LEFT PRESSURE RATIO

WJE ALL

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO

(2) Check indicator for dents, cracked glass, or damaged electrical connector pins.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO CONNECT PLUG. WHEN CONNECTING PLUG, DO NOT OVERTIGHTEN.

(3) Connect electrical connector.

NOTE: Connector plug is properly installed when no relative motion exists between plug backshell and coupling ring.

CAUTION: EXERCISE CARE WHEN HANDLING INDICATORS. DO NOT DROP INDICATOR. INTERNAL DAMAGE COULD RESULT.

CAUTION: TO PREVENT INSTRUMENT INTERNAL AND OUTER CASE DAMAGE, DO NOT OVER-TORQUE ADJUSTMENT SCREWS WHEN TIGHTENING CLAMP AROUND INSTRUMENT HOUSING.

(4) For the EPR indicator, install indicator in panel. Tighten the two clamp adjustment screws.

(5) For the N_1 and N_2 RPM indicator, install indicator in panel. Tighten the clamp adjustment screw.

(6) Remove the safety tags and close these circuit breakers:

UPPER EPC, ENGINE - LEFT AC BUS

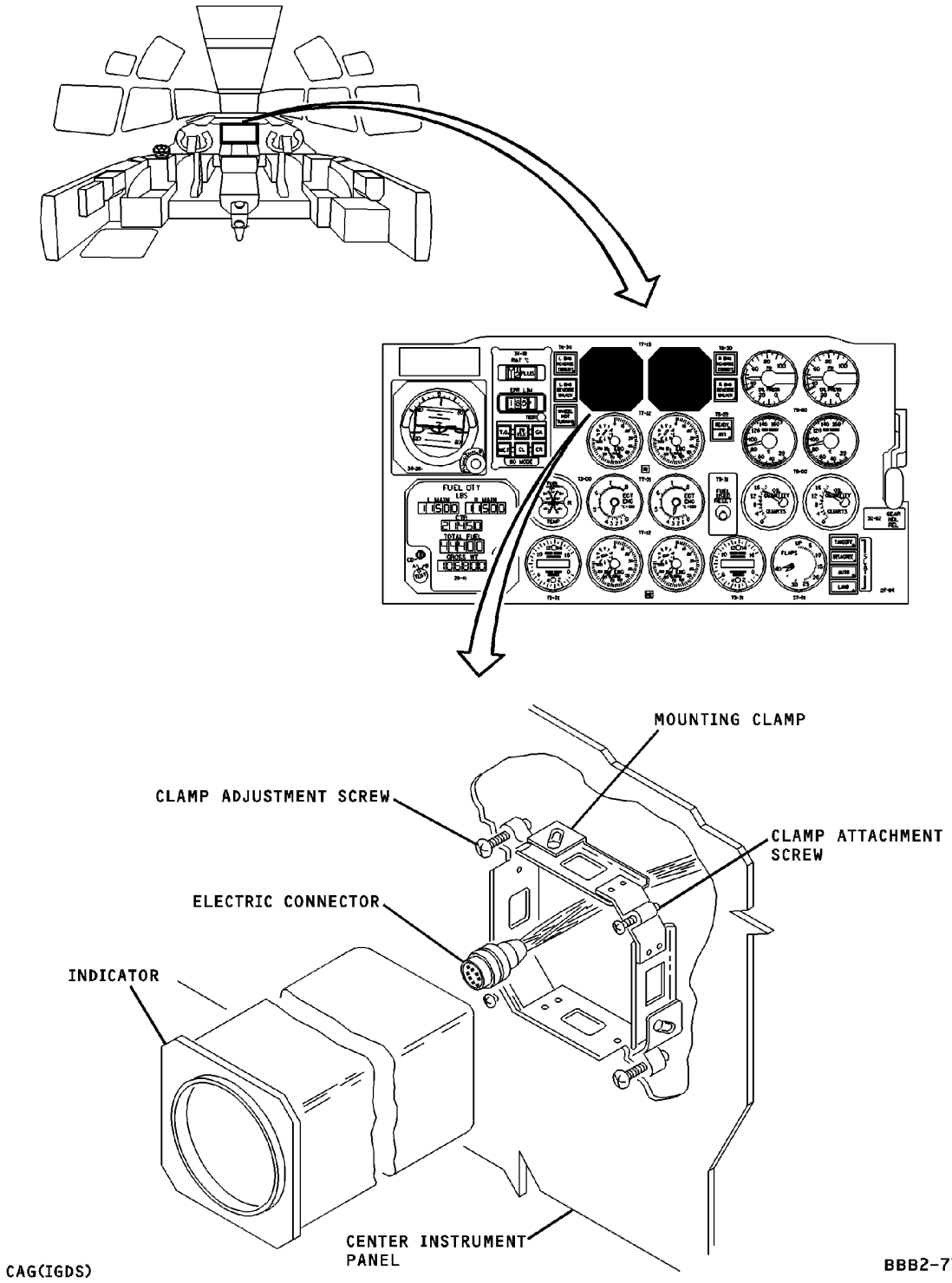
Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO

WJE ALL

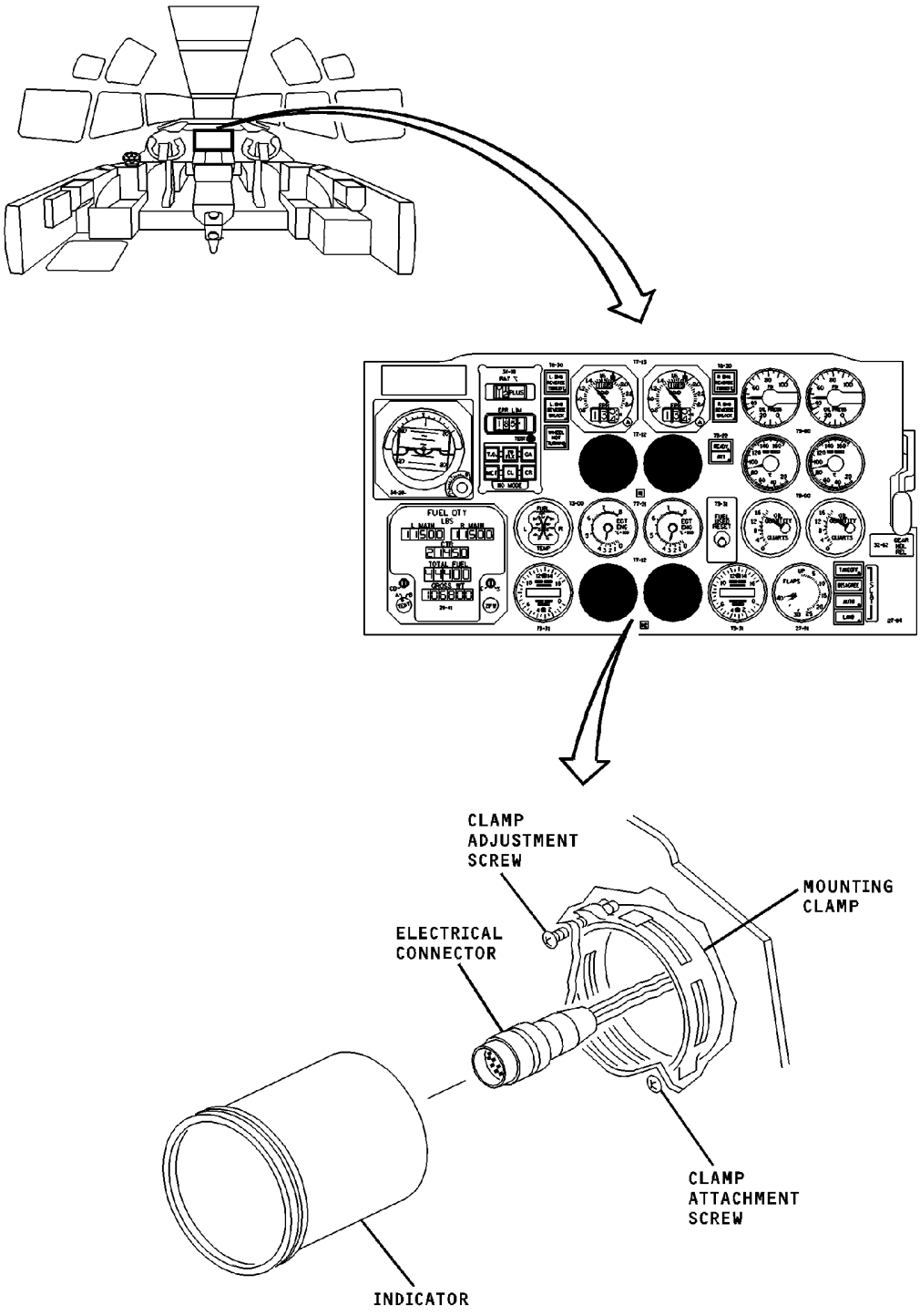
UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO

(7) Remove tools, equipment, loose hardware, and debris from maintenance area.



EPR Indicators - Removal/Installation
Figure 201/77-10-00-990-809



N_1 and N_2 Indicator - Removal/Installation
Figure 202/77-10-00-990-810

ENGINE PRESSURE RATIO (EPR) INDICATION SYSTEM - TROUBLE SHOOTING

1. General

A. This maintenance practice provides trouble shooting procedures for the EPR indication system.

B. The engine pressure ratio system is powered by 115-volt, 400-cycle AC, supplied through a circuit breaker located on the upper main circuit breaker panel.

C. The position of the circuit breaker should be checked before beginning trouble shooting procedures.

2. Trouble Shooting Engine Pressure Ratio (EPR) Indication System

	Possible Causes	Isolation Procedure	Correction
A. ENGINE PRESSURE RATIO SYSTEM NOT FUNCTIONING			
CAUTION: ENSURE ELECTRICAL CONNECTORS ARE CONNECTED TO PROPER INDICATORS UPON COMPLETION OF TROUBLE SHOOTING PROCEDURES.			
(1)	Defective pressure ratio indicator	Interchange left and right pressure ratio indicator electrical connectors and operate engine.	If opposite indicator operates, replace defective indicator. If opposite indicator does not operate, refer to step (3).
NOTE: If engine operation is not possible, begin trouble shooting with step (2) as follows:			
(2)	Pressure ratio indicator defective	Disconnect indicator electrical connector. Connect test light between connector power pin C and ground. Test light should come on, indicating power available.	If test light comes on and system ground checks, replace indicator. If test light does not come on, refer to step (4).
(3)	Defective pressure ratio transmitter, or wiring	Disconnect transmitter electrical connector. Connect test light between connector power pin A and ground. Test light should come on, indicating power available.	If light comes on, transmitter is defective. Replace transmitter. If light does not come on, refer to, step (4).
(4)	Pressure ratio system wiring faulty	Disconnect indicator electrical connector. Disconnect transmitter electrical connector. Disconnect wire at engine pressure ratio circuit breaker. Check system wiring for open or shorted circuits.	Repair wiring as necessary.
B. ENGINE PRESSURE RATIO READS LOW IN COMPARISON TO EGT, N_1 AND N_2			
(1)	Exhaust pressure (P_{T7}) line obstructed or damaged	Disconnect exhaust pressure (P_{T7}) line from transmitter and P_{T7} engine fitting. Check for obstruction or damage.	Clear line or replace as necessary.
(2)	P_{T7} exhaust line leakage	Perform P_{T7} exhaust line leakage test.	If leaking, repair or replace line.
(3)	Exhaust probe or manifold leakage	Perform P_{T7} exhaust line leakage test.	If leaking, repair or replace line.
(4)	Loose or damaged connection to transmitter (P_{T7})	Check connection. Check for crossthreading.	If leaking, tighten or replace fitting.

(Continued)

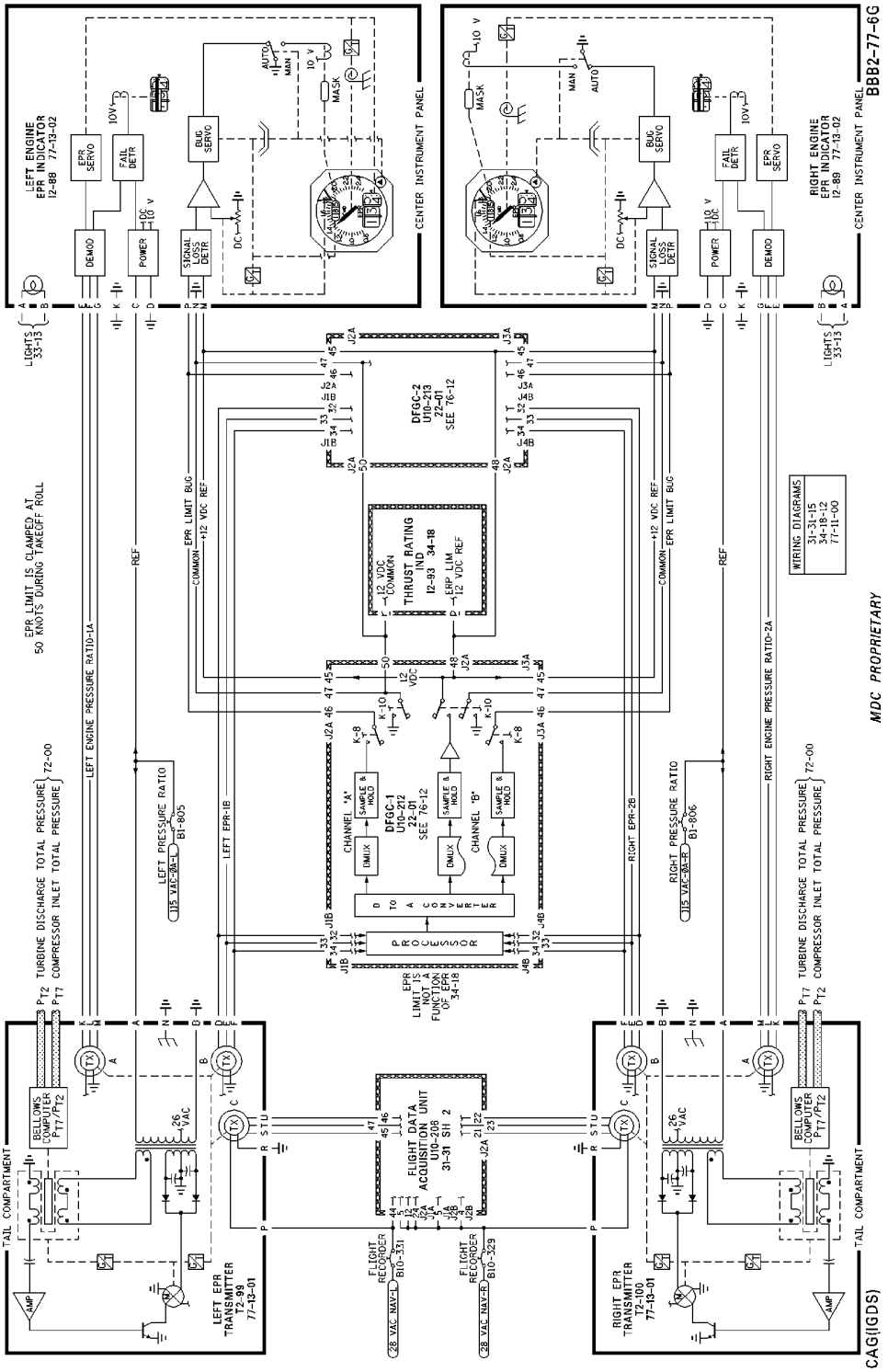
	Possible Causes	Isolation Procedure	Correction
(5)	Loose electrical connections	Check electrical connectors	Replace broken or damaged connectors.
(6)	Broken or damaged wiring	Check continuity between indicator and transmitter.	Repair or replace wiring.
(7)	Pressure ratio indicator defective	Disconnect electrical connector from indicator and perform test outlined in paragraph 2.A. step (1).	Replace defective indicator.
(8)	Pressure ratio transmitter defective	Replace with transmitter known to be good and perform test.	Replace defective transmitter.
(9)	Inlet lines at transmitter reversed	Trace lines.	Correct position of lines.
C. ONLY RIGHT ENGINE PRESSURE RATIO INDICATOR READS LOW IN COMPARISON TO EGT, N_1 AND N_2, FLUCTUATES, OR FAILS TO REGISTER			
(1)	Exhaust pressure (P_{T7}) crossover line obstructed or damaged. Line occasionally collects moisture and freezes	Disconnect exhaust pressure (P_{T7}) crossover line. Check for obstruction or damage.	Clear line or replace as necessary.
D. ENGINE PRESSURE RATIO READS LOW WITH ENGINE ANTI-ICE ON. ENGINE PRESSURE RATIO NORMAL WITH ANTI-ICE OFF.			
(1)	Inlet guide vane case (P_{T2}) coupler defective seals	Check condition of seals.	Replace seals as required.
E. ENGINE PRESSURE RATIO INDICATOR READS HIGH IN COMPARISON TO EGT, N_1 AND N_2			
(1)	Inlet pressure (P_{T2}) line obstructed or damaged	Disconnect inlet pressure (P_{T2}) line from transmitter and P_{T2} engine fitting. Check for obstruction or damage.	Clear line or replace as necessary.
(2)	P_{T2} inlet probe leakage	Perform P_{T2} inlet line leakage test.	If leaking, replace O-rings.
(3)	P_{T2} inlet line leakage	Perform P_{T2} inlet line leakage test.	If leaking repair or replace line.
(4)	Loose or damaged connection to transmitter P_{T2}	Check connection for tightness or for crossthreading.	If leaking, tighten or replace fitting.
(5)	Loose electrical connections	Check electrical connectors.	Repair or replace broken or damaged connectors.
(6)	Broken or damaged wiring	Check continuity between indicator and transmitter.	Repair or replace wiring.
(7)	Pressure ratio transmitter defective	Replace with transmitter known to be good.	If satisfactory with test transmitter replace transmitter.
(8)	Pressure ratio indicator defective	Disconnect electrical connector from indicator and perform test out lined in paragraph 2.A. step (1).	Replace defective indicator.
F. ENGINE PRESSURE RATIO READS HIGH WITH ENGINE ANTI-ICE ON. ENGINE PRESSURE RATIO NORMAL WITH ANTI-ICE OFF.			

(Continued)

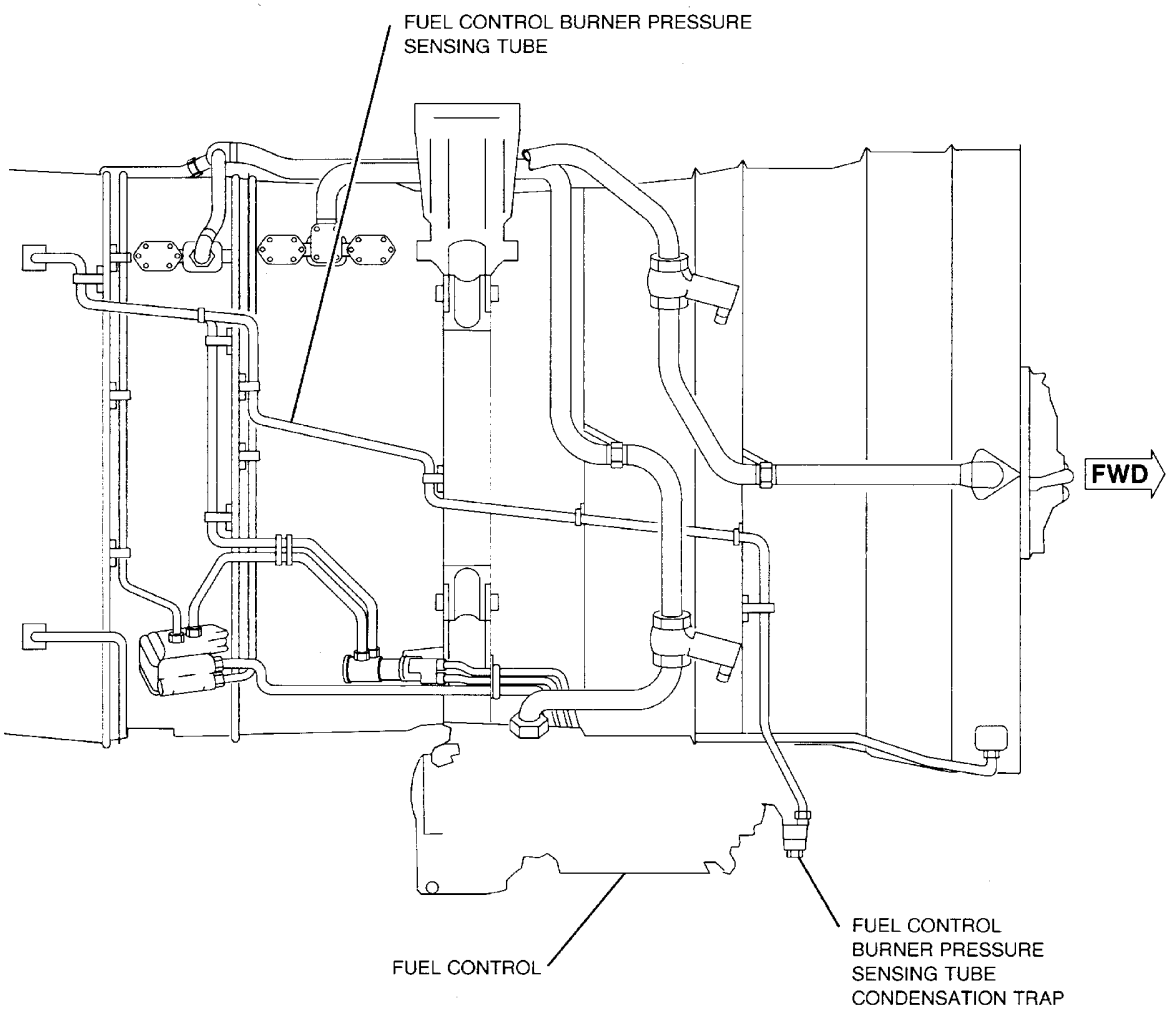
	Possible Causes	Isolation Procedure	Correction
(1)	P_{T2} inlet probe leakage at sensor line grommet	Inspect for condition.	Replace leaking grommet or repair or replace defective parts as necessary.
G. ENGINE PRESSURE RATIO INDICATOR FLUCTUATES			
NOTE: EPR variations greater than 0.04 peak-to-peak (±0.02) and lasting more than 2 minutes should be evaluated to determine what corrective action is required.			
(1)	Electrical connections loose or corroded	Check for loose connections or corrosion.	Clean and tighten connections as necessary.
(2)	Pressure ratio indicator defective	Disconnect electrical connector from indicator and perform test outlined in paragraph 2.A. step (1).	Replace defective indicator.
(3)	Pressure ratio transmitter defective	Replace with transmitter known to be good.	Replace defective transmitter.
(4)	Leakage in P_{T2} or P_{T7} inlet lines	Perform P_{T2} and P_{T7} inlet line tests.	Repair or replace leaking lines.
(5)	P_{T2} inlet probe leakage or obstruction	(a) Perform P_{T2} inlet line leakage test. (b) Disconnect inlet pressure (P_{T2}) line from transmitter and P_{T7} engine fitting. Check for obstruction or damage.	(a) If leaking replace O-rings. (b) Clear line or replace as necessary.
(6)	Leakage in burner pressure (Pb) to fuel control sense line	Check for loose fittings or damaged line. (Figure 102)	Repair or replace line as necessary.
(7)	Chafed or broken Ps4 lines to bleed control	Check line for damage. (Figure 103)	Repair or replace lines as necessary.
(8)	Bleed system malfunctioning	Check bleed valve operation. (ENGINE GENERAL - SERVICING, PAGEBLOCK 72-00-00/301)	Replace or repair as necessary.
(9)	Engine fuel filters contaminated	Check engine fuel filters. (FUEL PUMP, SUBJECT 73-12-01) and (FUEL CONTROL MAIN FILTER, SUBJECT 73-20-02)	Clean or replace contaminated filters as necessary.
(10)	Water in fuel control moisture trap	Check for water. (FUEL CONTROL PRESSURE SENSE LINE MOISTURE TRAP, SUBJECT 73-20-03)	Correct as necessary.
(11)	Abnormal fuel pump discharge pressure.	Check fuel pump discharge pressure. (ENGINE GENERAL - REMOVAL/INSTALLATION-01, PAGEBLOCK 72-00-00/401)	Correct as necessary.
H. INDICATOR POINTER STICKING OR STUCK			

(Continued)

	Possible Causes	Isolation Procedure	Correction
(1)	Power failure	Indicator pointer remains at last indicated position before power failure.	Restore power.
(2)	Defective indicator	Disconnect electrical connector from indicator and perform test outlined in paragraph 2.A. step (1).	Replace defective indicator.



EPR Indication - Schematic
Figure 101/77-11-01-990-804



RIGHT SIDE VIEW

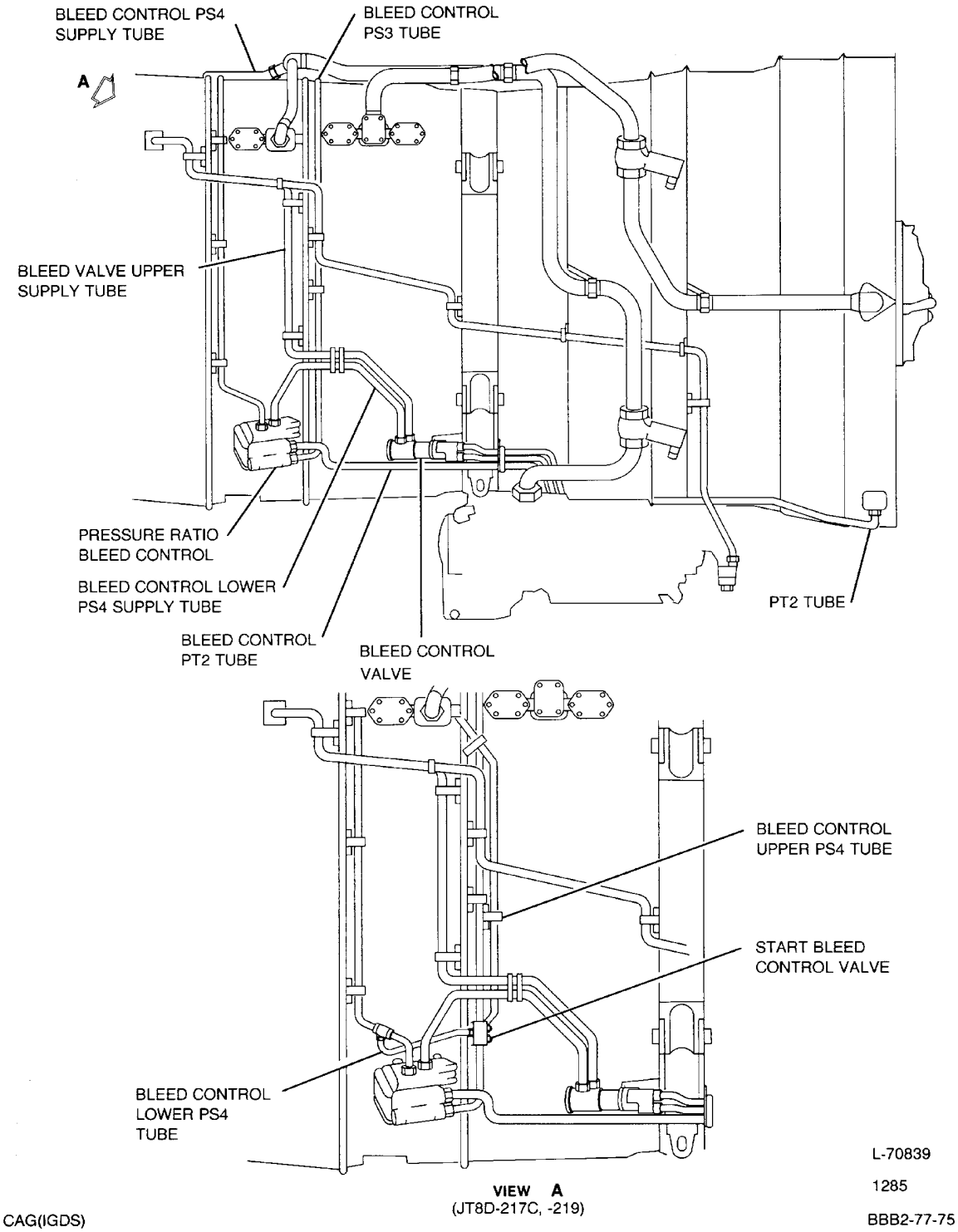
L-70942

CAG(IGDS)

BBB2-77-76

Burner Pressure to Fuel Control Sensing Line
Figure 102/77-11-01-990-805

EFFECTIVITY
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893



Pressure Ratio Bleed Control, Control Valve and Ps4 Lines
Figure 103/77-11-01-990-806

ENGINE PRESSURE RATIO (EPR) INDICATION SYSTEM - TROUBLE SHOOTING

1. General

A. This maintenance practice provides trouble shooting procedures for the EPR indication system.

B. The EPR system is powered by 115-volt, 400-cycle AC, supplied through a circuit breakers located on the upper EPC, Lower EPC and Overhead circuit breaker panels.

C. The position of the circuit breaker should be checked before beginning trouble shooting procedures.

2. Trouble Shooting Engine Pressure Ratio (EPR) Indication System

Table 101

	Possible Causes	Isolation Procedure	Correction
A. ENGINE PRESSURE RATIO SYSTEM NOT FUNCTIONING			
CAUTION: ENSURE ELECTRICAL CONNECTORS ARE CONNECTED TO PROPER INDICATORS UPON COMPLETION OF TROUBLE SHOOTING PROCEDURES.			
(1)	Defective pressure ratio display on Engine Display Panel (EDP)	Perform Built-In-Test (BIT). (SUBJECT 77-42-00, Page 1) If no failure displayed, replace (EDP) with known good (EDP).	If failure is displayed, replace Engine Display Panel (EDP) If failure corrected, replace (EDP).
NOTE: If engine operation is not possible, begin trouble shooting with step (2) as follows:			
(2)	Pressure ratio display on (EDP) defective	Disconnect (EDP) electrical connector. Connect test light between connector power pin EE and ground. Test light should come on, indicating power available.	If test light comes on and system ground checks, replace indicator. If test light does not come on, refer to step (4).
(3)	Defective pressure ratio transmitter, or wiring	Disconnect transmitter electrical connector. Connect test light between connector power pin A and ground. Test light should come on, indicating power available.	If light comes on, transmitter is defective. Replace transmitter. If light does not come on, refer to step (4).
(4)	Pressure ratio system wiring faulty	Disconnect (EDP) electrical connector. Disconnect transmitter electrical connector. Disconnect wire at engine pressure ratio circuit breaker. Check system wiring for open or shorted circuits.	Repair wiring as necessary.
B. ENGINE PRESSURE RATIO READS LOW IN COMPARISON TO EGT, N_1 AND N_2			
(1)	Exhaust pressure (P_{T7}) line obstructed or damaged	Disconnect exhaust pressure (P_{T7}) line from transmitter and P_{T7} engine fitting. Check for obstruction or damage.	Clear line or replace as necessary.
(2)	P_{T7} exhaust line leakage	Perform P_{T7} exhaust line leakage test.	If leaking, repair or replace line.
(3)	(3) Exhaust probe or manifold leakage	Perform P_{T7} exhaust line leakage test.	If leaking, repair or replace line.

Table 101 (Continued)

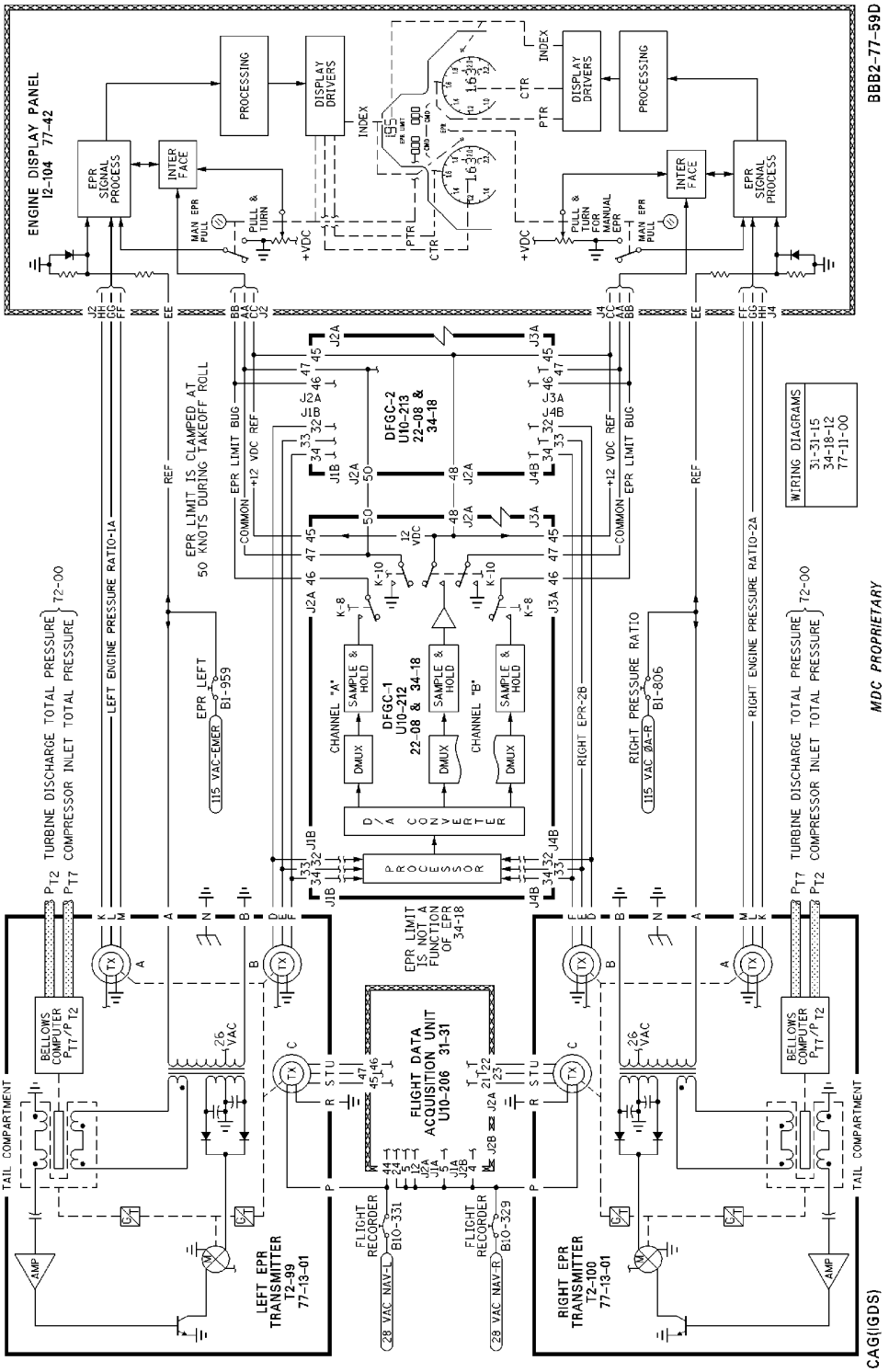
	Possible Causes	Isolation Procedure	Correction
(4)	Loose or damaged connection to transmitter (P_{T7})	Check connection. Check for crossthreading.	If leaking, tighten or replace fitting.
(5)	Loose electrical connections	Check electrical connectors.	Replace broken or damaged connectors.
(6)	Broken or damaged wiring	Check continuity between indicator and transmitter.	Repair or replace wiring.
(7)	Pressure ratio display on (EDP) defective	Disconnect (EDP) electrical connector from indicator and perform test outlined in paragraph 2.A. step (1).	Replace defective (EDP).
(8)	Pressure ratio transmitter defective	Replace with transmitter known to be good and perform test.	Replace defective transmitter.
(9)	Inlet lines at transmitter reversed	Trace lines.	Correct position of lines.
C. ONLY RIGHT ENGINE PRESSURE RATIO INDICATOR READS LOW IN COMPARISON TO EGT, N_1 AND N_2, FLUCTUATES, OR FAILS TO REGISTER			
(1)	Exhaust pressure (P_{T7}) crossover line obstructed or damaged. Line occasionally collects moisture and freezes	Disconnect exhaust pressure (P_{T7}) crossover line. Check for obstruction or damage.	Clear line or replace as necessary.
D. ENGINE PRESSURE RATIO READS LOW WITH ENGINE ANTI-ICE ON. ENGINE PRESSURE RATIO NORMAL WITH ANTI-ICE OFF.			
(1)	Inlet guide vane case (P_{T2}) coupler defective seals	Check condition of seals.	Replace seals as required.
E. ENGINE PRESSURE RATIO INDICATOR READS HIGH IN COMPARISON TO EGT, N_1 AND N_2			
(1)	Inlet pressure (P_{T2}) line obstructed or damaged	Disconnect inlet pressure (P_{T2}) line from transmitter and P_{T2} engine fitting. Check for obstruction or damage.	Clear line or replace as necessary.
(2)	P_{T2} inlet probe leakage	Perform P_{T2} inlet line leakage test.	If leaking, replace O-rings.
(3)	P_{T2} inlet line leakage	Perform P_{T2} inlet line leakage test.	If leaking repair or replace line.
(4)	Loose or damaged connection to transmitter P_{T2}	Check connection for tightness or for crossthreading.	If leaking, tighten or replace fitting.
(5)	Loose electrical connections	Check electrical connectors.	Repair or replace broken or damaged connectors.
(6)	Broken or damaged wiring	Check continuity between (EDP) and transmitter.	Repair or replace wiring.
(7)	Pressure ratio transmitter defective	Replace with transmitter known to be good.	If satisfactory with test transmitter replace transmitter.
(8)	Pressure ratio display on (EDP) defective	Disconnect electrical connector from (EDP) and perform test out lined in paragraph 2.A. step (1).	Replace defective indicator.

Table 101 (Continued)

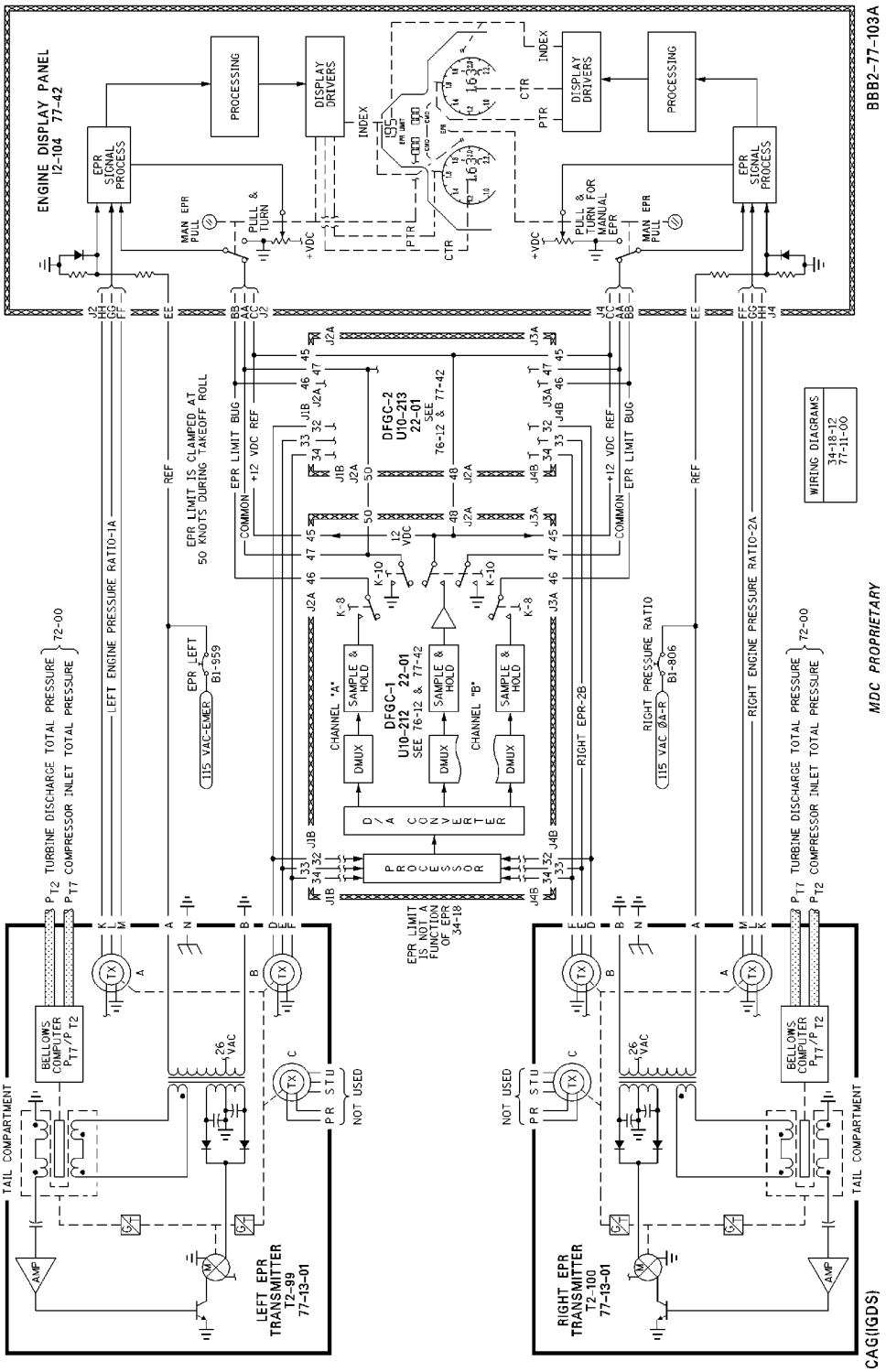
	Possible Causes	Isolation Procedure	Correction
F. ENGINE PRESSURE RATIO READS HIGH WITH ENGINE ANTI-ICE ON. ENGINE PRESSURE RATIO NORMAL WITH ANTI-ICE OFF.			
(1)	P_{T2} inlet probe leakage at sensor line grommet	Inspect for condition.	Replace leaking grommet or repair or replace defective parts as necessary.
G. ENGINE PRESSURE RATIO INDICATOR FLUCTUATES			
NOTE: EPR variations greater than 0.04 peak-to-peak (±0.02) and lasting more than 2 minutes should be evaluated to determine what corrective action is required.			
(1)	Electrical connections loose or corroded	Check for loose connections or corrosion.	Clean and tighten connections as necessary.
(2)	Pressure ratio display on (EDP) defective	Disconnect electrical connector from (EDP) and perform test outlined in paragraph 2.A. step (1).	Replace defective (EDP).
(3)	Pressure ratio transmitter defective	Replace with transmitter known to be good.	Replace defective transmitter.
(4)	Leakage in P_{T2} or P_{T7} inlet lines	Perform P_{T2} and P_{T7} inlet line tests.	Repair or replace leaking lines.
(5)	P_{T2} inlet probe leakage or obstruction	(a) Perform P_{T2} inlet line leakage test. (b) Disconnect inlet pressure (P_{T2}) line from transmitter and P_{T7} engine fitting. Check for obstruction or damage.	(a) If leaking replace O-rings. (b) Clear line or replace as necessary.
(6)	Leakage in burner pressure (Pb) to fuel control sense line.	Check for loose fittings or damaged line.	Repair or replace line as necessary.
WJE 401-405, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
			(Figure 102)
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
(7)	Chafed or broken Ps4 lines to bleed control	Check line for damage.	Repair or replace lines as necessary.
WJE 401-405, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
			(Figure 103)
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
(8)	Bleed system malfunctioning	Check bleed valve operation. (ENGINE GENERAL, SUBJECT 72-00-00)	Replace or repair as necessary.
(9)	Engine fuel filters contaminated	Check engine fuel filters. (FUEL PUMP, SUBJECT 73-12-01) and (FUEL CONTROL MAIN FILTER, SUBJECT 73-20-02)	Clean or replace contaminated filters as necessary.
(10)	Water in fuel control moisture trap	Check for water. (PAGEBLOCK 73-20-03/201)	Correct as necessary.

Table 101 (Continued)

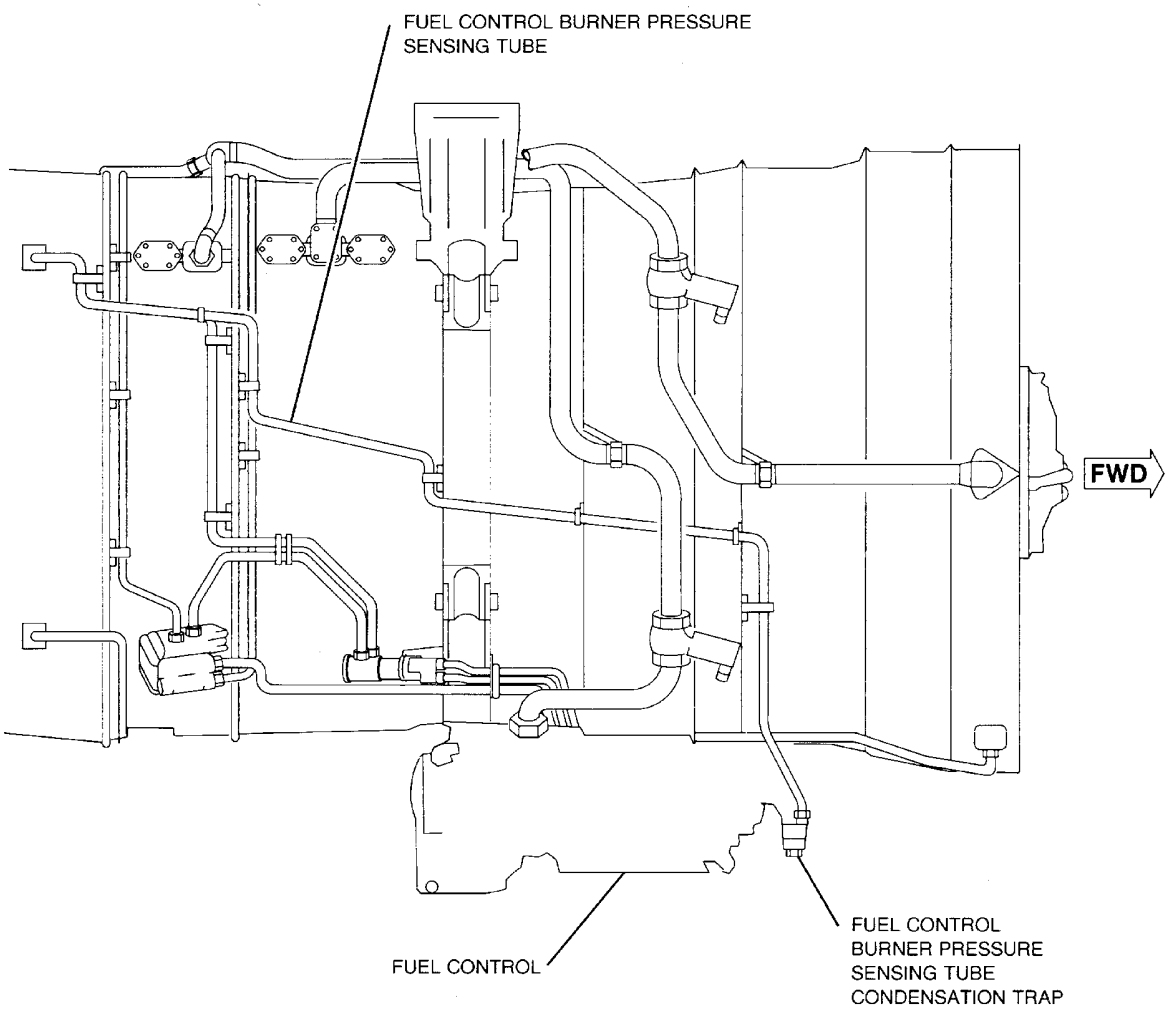
	Possible Causes	Isolation Procedure	Correction
(11)	Abnormal fuel pump discharge pressure.	Check fuel pump discharge pressure. (ENGINE GENERAL, SUBJECT 72-00-00)	Correct as necessary.
H. INDICATOR POINTER STICKING OR STUCK			
(1)	Power failure	Indicator pointer runs down to zero.	Restore power.
(2)	Defective (EDP)	Disconnect (EDP) electrical connector and perform test outlined in paragraph 2.A. step (1).	Replace defective (EDP).



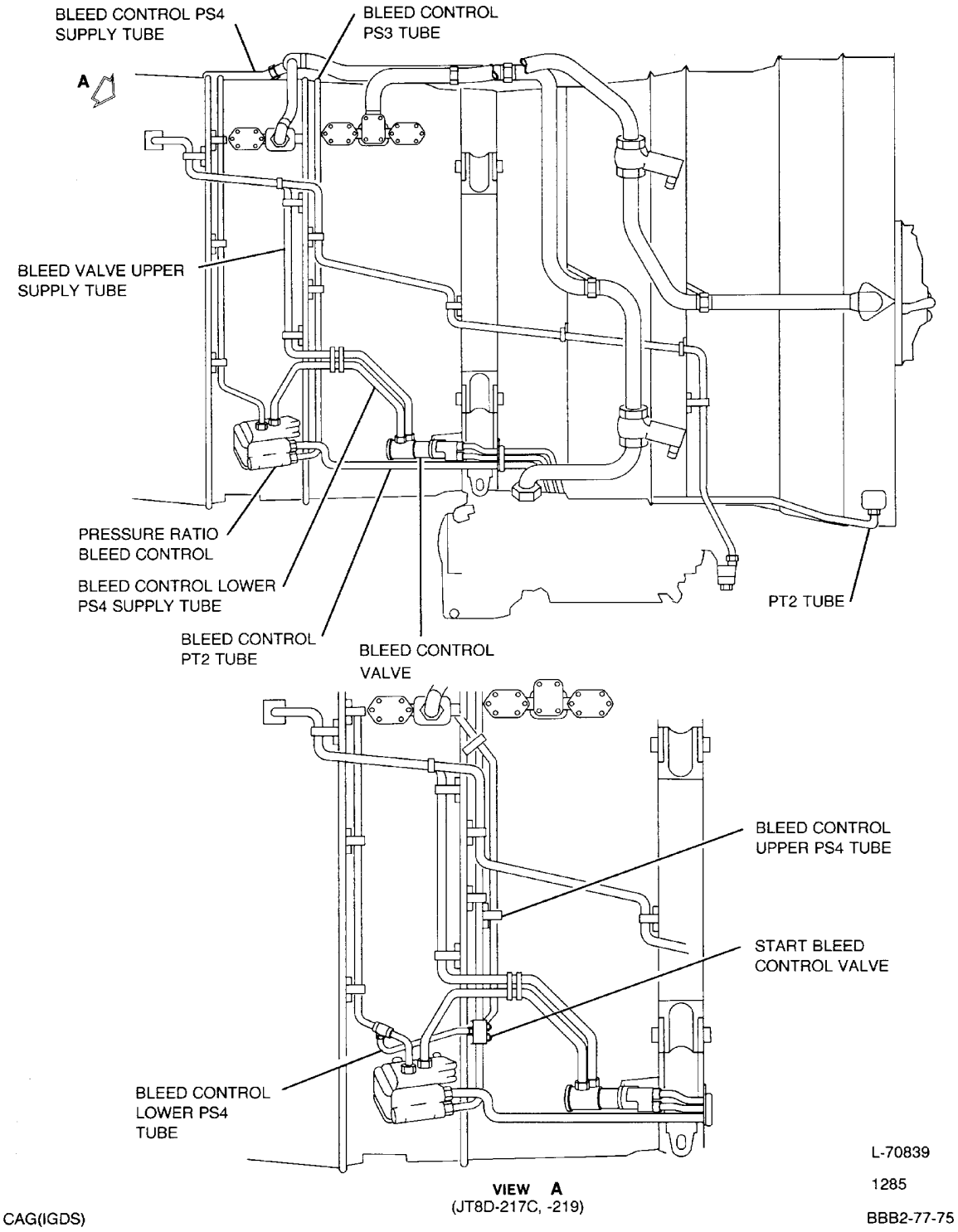
EPR Indication - Schematic
Figure 101/77-11-01-990-801 (Sheet 1 of 2)



EPR Indication - Schematic
Figure 101/77-11-01-990-801 (Sheet 2 of 2)



Burner Pressure to Fuel Control Sensing Line
Figure 102/77-11-01-990-802



Pressure Ratio Bleed Control, Control Valve and Ps4 Lines
Figure 103/77-11-01-990-803

ENGINE PRESSURE RATIO (EPR) INDICATION SYSTEM - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides adjustment/test procedures to verify the accuracy of the EPR indication system. (Figure 201)

B. The adjustment/test procedures for the EPR systems on all engines are identical. Test is performed with engine stopped.

C. Access for installation of the test tubing is through the forward and aft lower cowl doors.

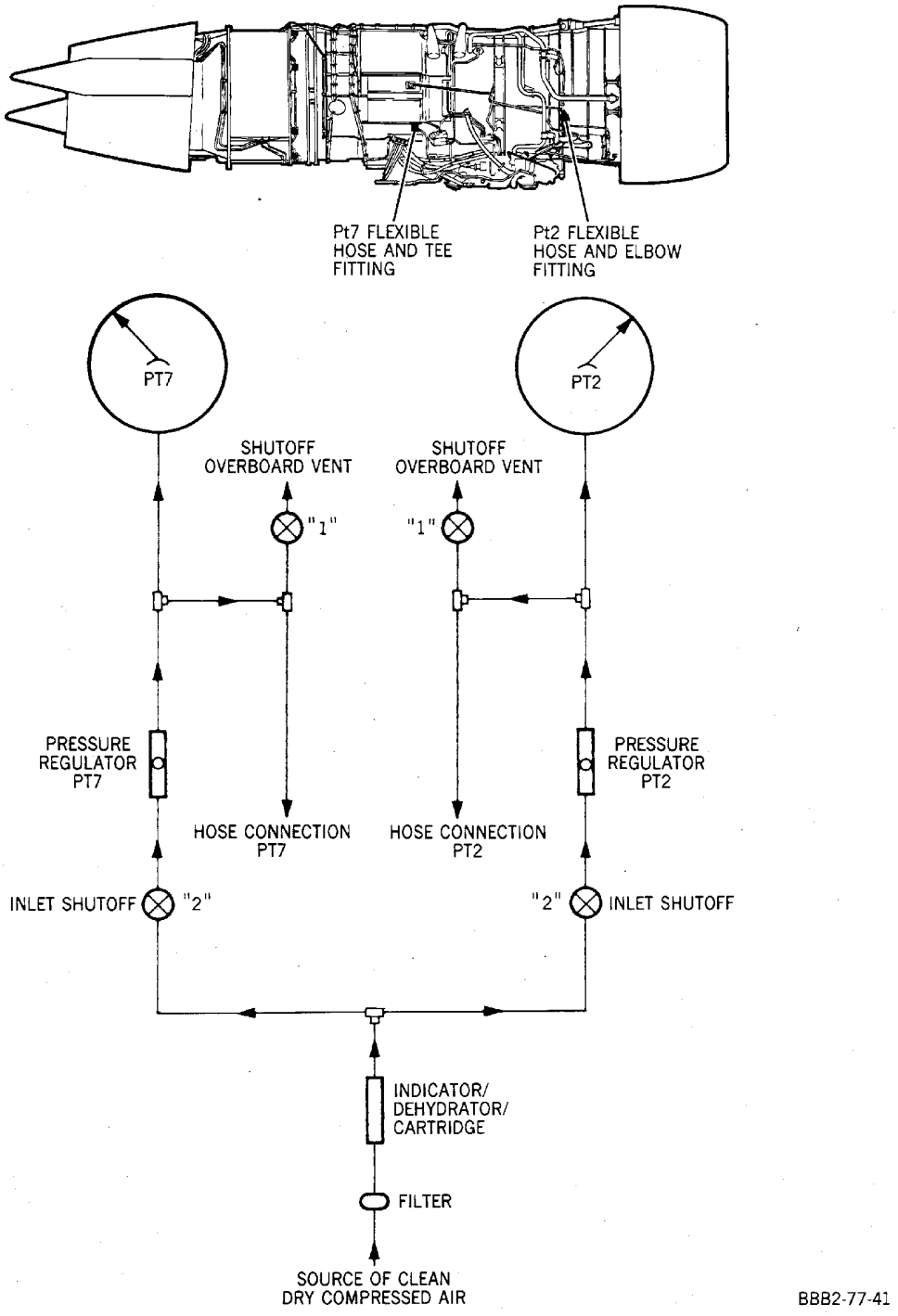
NOTE: Lower forward cowl doors overlap aft lower cowl doors and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: IF APU IS USED, MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

D. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.



Engine Pressure Ratio (EPR) Setup - Schematic
Figure 201/77-11-01-990-810

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Setup, Engine pressure ratio	
NOTE: Use WIKA high precision absolute pressure gauges, part number 61A-1B-0100, range 0-100 in. hg.	
Source of clean, dry compressed air	

3. Adjustment/Test Engine Pressure Ratio (EPR) Indication System

A. Test Engine Inlet Pressure (P_{t2}) Leakage

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

CAUTION: DO NOT EXCEED 53 INCHES (179.5 KPA) OF MERCURY ABSOLUTE ON INLET PRESSURE LINE, OR 130 INCHES (440.2 KPA) OF MERCURY ABSOLUTE ON EXHAUST PRESSURE LINE WHILE LINES ARE CONNECTED TO TRANSMITTER. MAXIMUM PRESSURE DIFFERENTIAL SHALL NOT EXCEED 80 INCHES (270.9 KPA) OF MERCURY AT ANY TIME DURING THIS TESTS AS PERMANENT DAMAGE TO TRANSMITTER MAY RESULT.

(4) Check that EPR indicator OFF flag is in view when power is off.

(5) Position EPR setup next to engine being tested and connect source of clean, dry compressed air.

(6) Disconnect flexible hose from P_{t2} elbow fitting located on inboard side of engine at flange D, approximately 8:00 o'clock position.

(7) Connect P_{t2} tubing from intake P_{t2} fitting on EPR setup to P_{t2} flexible hose disconnected in Paragraph 3.A.(6).

(8) Check that P_{t2} and P_{t7} indicators on EPR setup reads ambient barometric pressure.

NOTE: Ambient barometric pressure can be obtained from station control tower.

(9) Shut EPR setup P_{t2} vent valve "1". Slowly open inlet valve "2" for P_{t2} and adjust P_{t2} pressure regulator to 22.1 psia (45 in. hg. (152.4 kPa)) absolute.

(10) Shut off P_{t2} inlet valve "2". Allow EPR setup P_{t2} indication to stabilize for 5 minutes.

(11) With your hand, move/displace the flexible hose.

NOTE: Moving or displacing the flexible hose while the manifold is pressurezed can allow pressure loss to be seen (if hose is defective) that would otherwise go undetected.

(12) Check that pressure leakage does not exceed 0.25 inch (0.85 kPa) of mercury gage pressure during 5 minute period.

(13) Relieve P_{t2} test pressure slowly by opening P_{t2} vent valve "1".

B. Test Engine Exhaust Pressure (P_{t7}) Leakage

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverse lever is tagged, and the following circuit breakers are opened and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891

U	41	B1-2	ENGINE IGNITION RIGHT

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

CAUTION: DO NOT EXCEED 53 INCHES (179.5 KPA) OF MERCURY ABSOLUTE ON INLET PRESSURE LINE, OR 130 INCHES (440.2 KPA) OF MERCURY ABSOLUTE ON EXHAUST PRESSURE LINE WHILE LINES ARE CONNECTED TO TRANSMITTER. MAXIMUM PRESSURE DIFFERENTIAL SHALL NOT EXCEED 80 INCHES (270.9 KPA) OF MERCURY AT ANY TIME DURING THIS TESTS AS PERMANENT DAMAGE TO TRANSMITTER MAY RESULT.

(3) Disconnect flexible hose from P_{t7} tee fitting located on inboard side of engine between flanges J and J1, approximately 8:00 O'clock position.

(4) Connect P_{t7} tubing from exhaust P_{t7} fitting on EPR setup to P_{t7} flexible hose disconnected in Paragraph 3.B.(3).

(5) Shut EPR setup P_{t7} vent valve "1". Slowly open inlet valve "2" for P_{t7} and adjust P_{t7} pressure regulator to 29.5 psia (60 in. hg. (203.2 kPa)) absolute.

(6) Shut off P_{t7} inlet valve "2". Allow EPR setup P_{t7} indicator to stabilize for 5 minutes.

(7) With your hand, move/displace the flexible hose.

NOTE: Moving or displacing the flexible hose while the manifold is pressurezed can allow pressure loss to be seen (if hose is defective) that would otherwise go undetected.

(8) Check that pressure leakage does not exceed 0.25 inch (0.85 kPa) of mercury gage pressure during a 5 minute period.

(9) Relieve test pressure slowly by opening P_{t7} shutoff overboard vent valve "1".

C. Test EPR Indication System Operation

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverse lever is tagged, and the following circuit breakers are opened and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Close these circuit breakers:

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	25	B1-805	LEFT PRESSURE RATIO

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO

(4) Energize aircraft electrical buses. (PAGEBLOCK 24-40-00/101)

(5) Check that EPR indicator OFF flag is not in view when power is applied.

CAUTION: ALLOW SYSTEM TO WARM UP FOR 2 MINUTES BEFORE CONDUCTING TEST TO PREVENT DAMAGE TO PRESSURE RATIO TRANSMITTER.

(6) Warm up system for 2 minutes.

NOTE: Absolute pressure is the sum of gage pressure and barometric pressure. For example, if the specified absolute pressure is 40 inches (135.5 kPa) of mercury and the barometric pressure is 29.60 inches (100.2 kPa) of mercury, the gage pressure should be 40 minus 29.60 or 10.40 inches (135.5 minus 100.2 or 35.2 kPa) of mercury.

CAUTION: DO NOT PERMIT EXHAUST PRESSURE (PT7) TO BE LESS THAN INLET PRESSURE (PT2) WHEN PERFORMING TEST.

(7) Shut EPR setup P_{t7} vent valve "1". Slowly open inlet valve "2" for P_{t7} and adjust P_{t7} pressure regulator to 15.7 psia (32 in. hg. (108.4 kPa)) absolute.

(8) Shut EPR setup P_{t2} vent valve "1". Slowly open inlet valve "2" for P_{t2} and adjust P_{t2} pressure regulator to 15.7 psia (32 in. hg. (108.4 kPa)) absolute.

(9) Check EPR indicator located on center instrument panel in flight compartment for counter display of 1.000 (±0.010) EPR.

(10) Slowly open inlet valve "2" for P_{t7} and adjust P_{t7} pressure regulator to 23.6 psia (48 in. hg. (162.6 kPa)) absolute.

(11) Check EPR indicator located on center instrument panel in flight compartment for counter display of 1.500 (±0.010) EPR.

(12) Slowly open inlet valve "2" for P_{t7} and adjust P_{t7} pressure regulator to 31.4 psia (64 in. hg. (216.7 kPa)) absolute.

(13) Check EPR indicator located on center instrument panel in flight compartment for counter display of 2.000 (±0.010) EPR.

(14) Shut off P_{t2} and P_{t7} inlet valves.

CAUTION: DO NOT ALLOW PT2 PRESSURE TO EXCEED PT7 PRESSURE DURING SHUTDOWN PROCEDURE TO PREVENT DAMAGE TO PRESSURE RATIO TRANSMITTER.

(15) Relieve P_{t2} test pressure slowly by opening P_{t2} vent valve "1".

(16) Relieve P_{t7} test pressure slowly by opening P_{t7} vent valve "1".

(17) Disconnect P_{t2} and P_{t7} EPR setup tubing from flexible hoses on engine.

(18) Connect P_{t2} flexible hose to elbow fitting located on inboard side of engine at flange D.

(19) Connect P_{t7} flexible hose to tee fitting located on inboard side of engine between flanges J and J1.

(20) Check that both connections are securely and properly installed to preclude damage on subsequent leakage.

(21) Remove tools, equipment, loose hardware, and debris from maintenance area.

(22) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891

U	41	B1-2	ENGINE IGNITION RIGHT

WJE 407, 408, 411, 880, 884, 892, 893

U	41	B1-423	ENGINE START VALVE RIGHT

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891

U	42	B1-1	ENGINE IGNITION LEFT

WJE 407, 408, 411, 880, 884, 892, 893

U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name

WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(23) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(24) Close access door (5901C) for left engine or (5902C) for right engine.

ENGINE PRESSURE RATIO (EPR) INDICATION SYSTEM - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides adjustment/test procedures to verify the accuracy of the EPR indication system. (Figure 201)

B. The adjustment/test procedures for the EPR systems on all engines are identical. Test is performed with engine stopped.

C. Access for installation of the test tubing is through the forward and aft lower cowl doors.

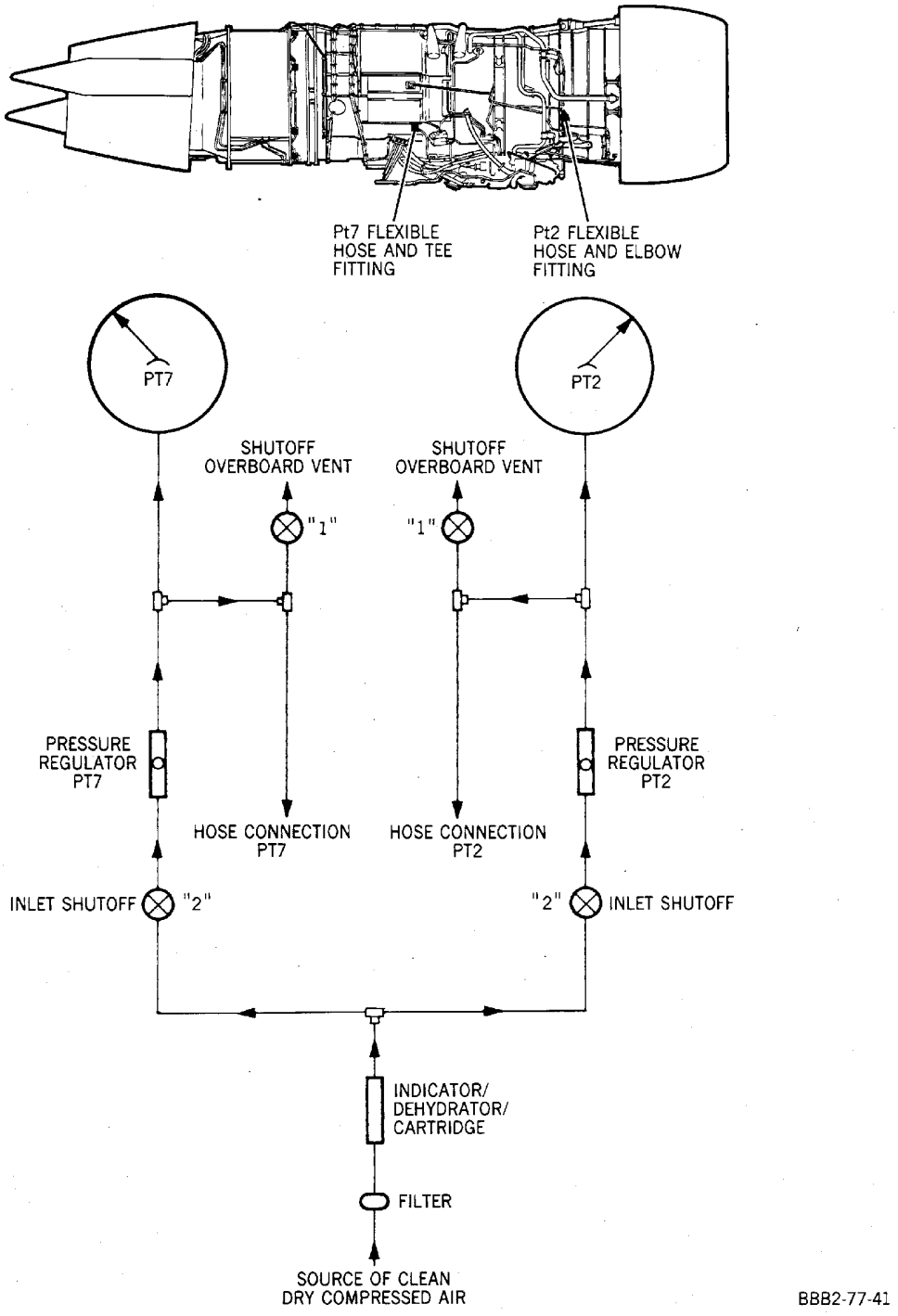
NOTE: Lower forward cowl doors overlap aft lower cowl doors and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: IF APU IS USED, MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

D. For procedures to open cowl doors on all engines, PAGEBLOCK 71-00-00/201.



Engine Pressure Ratio (EPR) Setup - Schematic
Figure 201/77-11-01-990-809

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Setup, Engine pressure ratio	
NOTE: Use WIKA high precision absolute pressure gauges, part number 61A-1B-0100, range 0-100 in. hg.	
Source of clean, dry compressed air	

3. Adjustment/Test Engine Pressure Ratio (EPR) Indication System

A. Test Engine Inlet Pressure (P_{t2}) Leakage

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	41	B1-2	ENGINE IGNITION RIGHT

WJE 405, 406, 410, 877, 886, 887

U	41	B1-423	ENGINE START VALVE RIGHT

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	42	B1-1	ENGINE IGNITION LEFT

WJE 405, 406, 410, 877, 886, 887

U	42	B1-422	ENGINE START VALVE LEFT

WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

X	36	B1-964	EPR, FF DISPLAY LEFT

OVERHEAD EMERGENCY AC BUS

Row	Col	Number	Name
C	8	B1-959	EPR LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
C	15	B1-968	EPR, FF DISPLAY RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 405			
K	25	B1-805	LEFT PRESSURE RATIO
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin (PAGEBLOCK 78-00-00/201).

CAUTION: DO NOT EXCEED 53 INCHES (179.5 KPA) OF MERCURY ABSOLUTE ON INLET PRESSURE LINE, OR 130 INCHES (440.2 KPA) OF MERCURY ABSOLUTE ON EXHAUST PRESSURE LINE WHILE LINES ARE CONNECTED TO TRANSMITTER. MAXIMUM PRESSURE DIFFERENTIAL SHALL NOT EXCEED 80 INCHES (270.9 KPA) OF MERCURY AT ANY TIME DURING THIS TESTS AS PERMANENT DAMAGE TO TRANSMITTER MAY RESULT.

(4) Position EPR setup next to engine being tested and connect source of clean, dry compressed air.

(5) Disconnect flexible hose from P_{t2} elbow fitting located on inboard side of engine at flange D, approximately 8:00 o'clock position.

(6) Connect P_{t2} tubing from intake P_{t2} fitting on EPR setup to P_{t2} flexible hose disconnected in Paragraph 3.A.(5).

(7) Check that P_{t2} and P_{t7} indicators on EPR setup reads ambient barometric pressure.

NOTE: Ambient barometric pressure can be obtained from station control tower.

(8) Shut EPR setup P_{t2} vent valve "1". Slowly open inlet valve "2" for P_{t2} and adjust P_{t2} pressure regulator to 22.1 psia (45 in. hg. (152.4 kPa)) absolute.

(9) Shut off P_{t2} inlet valve "2". Allow EPR setup P_{t2} indication to stabilize for 5 minutes.

(10) With your hand, move/displace the flexible hose.

NOTE: Moving or displacing the flexible hose while the manifold is pressurizied can allow pressure loss to be seen (if hose is defective) that would otherwise go undetected.

(11) Check that pressure leakage does not exceed 0.25 inch (0.85 kPa) of mercury gage pressure during 5 minute period.

(12) Relieve P_{t2} test pressure slowly by opening P_{t2} vent valve "1".

B. Test Engine Exhaust Pressure (P_{t7}) Leakage

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverse lever is tagged, and the following circuit breakers are opened and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	41	B1-2	ENGINE IGNITION RIGHT

WJE 405, 406, 410, 877, 886, 887

U	41	B1-423	ENGINE START VALVE RIGHT

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	42	B1-1	ENGINE IGNITION LEFT

WJE 405, 406, 410, 877, 886, 887

U	42	B1-422	ENGINE START VALVE LEFT

WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

X	36	B1-964	EPR, FF DISPLAY LEFT

OVERHEAD EMERGENCY AC BUS

Row	Col	Number	Name
C	8	B1-959	EPR LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
C	15	B1-968	EPR, FF DISPLAY RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name

WJE 405

K	25	B1-805	LEFT PRESSURE RATIO

WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

CAUTION: DO NOT EXCEED 53 INCHES (179.5 KPA) OF MERCURY ABSOLUTE ON INLET PRESSURE LINE, OR 130 INCHES (440.2 KPA) OF MERCURY ABSOLUTE ON EXHAUST PRESSURE LINE WHILE LINES ARE CONNECTED TO TRANSMITTER. MAXIMUM PRESSURE DIFFERENTIAL SHALL NOT EXCEED 80 INCHES (270.9 KPA) OF MERCURY AT ANY TIME DURING THIS TESTS AS PERMANENT DAMAGE TO TRANSMITTER MAY RESULT.

(3) Disconnect flexible hose from P_{t7} tee fitting located on inboard side of engine between flanges J and J1, approximately 8:00 O'clock position.

(4) Connect P_{t7} tubing from exhaust P_{t7} fitting on EPR setup to P_{t7} flexible hose disconnected in Paragraph 3.B.(3).

(5) Shut EPR setup P_{t7} vent valve "1". Slowly open inlet valve "2" for P_{t7} and adjust P_{t7} pressure regulator to 29.5 psia (60 in. hg. (203.2 kPa)) absolute.

(6) Shut off P_{t7} inlet valve "2". Allow EPR setup P_{t7} indicator to stabilize for 5 minutes.

(7) With your hand, move/displace the flexible hose.

NOTE: Moving or displacing the flexible hose while the manifold is pressurizied can allow pressure loss to be seen (if hose id defective) that would otherwise go undetected.

(8) Check that pressure leakage does not exceed 0.25 inch (0.85 kPa) of mercury gage pressure during a 5 minute period.

(9) Relieve test pressure slowly by opening P_{t7} shutoff overboard vent valve "1".

C. Test EPR Indication System Operation

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverse lever is tagged, and the following circuit breakers are opened and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

WJE 405, 406, 410, 877, 886, 887 (Continued)

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 405			
K	25	B1-805	LEFT PRESSURE RATIO
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Close these circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
X	36	B1-964	EPR, FF DISPLAY LEFT

OVERHEAD EMERGENCY AC BUS

Row	Col	Number	Name
C	8	B1-959	EPR LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
C	15	B1-968	EPR, FF DISPLAY RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 405			
K	25	B1-805	LEFT PRESSURE RATIO
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO

(4) Energize aircraft electrical buses. (PAGEBLOCK 24-40-00/101)

(5) Check Engine Display Panel for no failure code being displayed after power up.

CAUTION: ALLOW SYSTEM TO WARM UP FOR 2 MINUTES BEFORE CONDUCTING TEST TO PREVENT DAMAGE TO PRESSURE RATIO TRANSMITTER.

(6) Warm up system for 2 minutes.

NOTE: Absolute pressure is the sum of gage pressure and barometric pressure. For example, if the specified absolute pressure is 40 inches (135.5 kPa) of mercury and the barometric pressure is 29.60 inches (100.2 kPa) of mercury, the gage pressure should be 40 minus 29.60 or 10.40 inches (135.5 minus 100.2 or 35.2 kPa) of mercury.

CAUTION: DO NOT PERMIT EXHAUST PRESSURE (PT7) TO BE LESS THAN INLET PRESSURE (PT2) WHEN PERFORMING TEST.

(7) Shut EPR setup P_{t7} vent valve "1". Slowly open inlet valve "2" for P_{t7} and adjust P_{t7} pressure regulator to 15.7 psia (32 in. hg. (108.4 kPa)) absolute.

(8) Shut EPR setup P_{t2} vent valve "1". Slowly open inlet valve "2" for P_{t2} and adjust P_{t2} pressure regulator to 15.7 psia (32 in. hg. (108.4 kPa)) absolute.

(9) Check EPR indication on center instrument panel in flight compartment for counter display of 1.000 (±0.010) EPR.

(10) Slowly open inlet valve "2" for P_{t7} and adjust P_{t7} pressure regulator to 23.6 psia (48 in. hg. (162.6 kPa)) absolute.

(11) Check EPR indication on center instrument panel in flight compartment for counter display of 1.500 (±0.010) EPR.

(12) Slowly open inlet valve "2" for P_{t7} and adjust P_{t7} pressure regulator to 31.4 psia (64 in. hg. (216.7 kPa)) absolute.

(13) Check EPR indication on center instrument panel in flight compartment for counter display of 2.000 (±0.010) EPR.

(14) Shut off P_{t2} and P_{t7} inlet valves.

CAUTION: DO NOT ALLOW PT2 PRESSURE TO EXCEED PT7 PRESSURE DURING SHUTDOWN PROCEDURE TO PREVENT DAMAGE TO PRESSURE RATIO TRANSMITTER.

(15) Relieve P_{t2} test pressure slowly by opening P_{t2} vent valve "1".

(16) Relieve P_{t7} test pressure slowly by opening P_{t7} vent valve "1".

(17) Disconnect P_{t2} and P_{t7} EPR setup tubing from flexible hoses on engine.

(18) Connect P_{t2} flexible hose to elbow fitting located on inboard side of engine at flange D.

(19) Connect P_{t7} flexible hose to tee fitting located on inboard side of engine between flanges J and J1.

(20) Check that both connections are securely and properly installed to preclude damage on subsequent leakage.

(21) Remove tools, equipment, loose hardware, and debris from maintenance area.

(22) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	41	B1-2	ENGINE IGNITION RIGHT

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(23) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201).

(24) Close access door (5901C) for left engine or (5902C) for right engine.

ENGINE PRESSURE RATIO (EPR) TRANSMITTER - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the EPR transmitters mounted in the fuselage aft section.

B. Access to the EPR transmitters is through the aft entrance access door.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Petrolatum VV-P-236 DPM 675	
Ammonium hydroxide, Tech grade DPM 950-21	

3. Removal/Installation Engine Pressure Ratio (EPR) Transmitter

A. Remove Transmitter (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

UPPER EPC, LIGHTS - LEFT AC BUS

Row	Col	Number	Name
K	18	B1-306	INTEGRAL LIGHTS CENTER INST PANEL

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT OR CONNECT PLUG. WHEN CONNECTING PLUG, DO NOT OVERTIGHTEN.

(4) Disconnect electrical connector.

(5) Disconnect inlet pressure (P_{t2}) line from transmitter.

(6) Disconnect engine exhaust pressure (P_{t7}) line from snubber located at transmitter mount base.

NOTE: EPR transmitter and snubber are to be replaced as a unit.

(7) Loosen transmitter mount retaining bolts.

(8) Remove transmitter and mount.

CAUTION: TO PREVENT RECALIBRATION OF UNIT, DO NOT LOOSEN MOUNTING CLAMP OR BREAK CALIBRATION DECAL.

(9) Do not loosen mounting clamp.

(10) Remove transmitter.

NOTE: In some cases, to eliminate erratic EPR indication, dry out moisture in disconnected engine inlet pressure (Pt2) line and exhaust pressure (Pt7) line with clean dry compressed air.

(11) Check the vibration isolators spring action.

WARNING: AMMONIUM HYDROXIDE IS AN AGENT THAT IS POISONOUS, AN IRRITANT, AN ASPHYXIANT, AND CORROSIVE. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN AMMONIUM HYDROXIDE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET AMMONIUM HYDROXIDE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(12) If necessary, clean the shock mount base including the vibration isolators with a solution of household ammonia and water.

NOTE: If the vibration isolators remain in a flat non-functioning condition after cleaning, they should be replaced.

B. Install Transmitter (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverse lever is tagged, and the following circuit breakers are opened and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

UPPER EPC, LIGHTS - LEFT AC BUS

Row	Col	Number	Name
K	18	B1-306	INTEGRAL LIGHTS CENTER INST PANEL

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Place transmitter and mount on retaining bolts.

(4) Install jam nut on transmitter fitting.

WARNING: WHITE PETROLATUM IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN WHITE PETROLATUM IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT BREATHE THE MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(5) Lightly lubricate new O-ring with petrolatum (VV-P-236) and install on transmitter fitting.

(6) Install snubber on EPR transmitter.

(7) Connect engine exhaust pressure (P_{t7}) line to snubber.

(8) Tighten mount retaining bolts.

(9) Tighten exhaust and inlet pressure line connections.

CAUTION: TO PREVENT RECALIBRATION OF UNIT, DO NOT TIGHTEN MOUNTING CLAMP OR BREAK CALIBRATION TOOL.

(10) Do not tighten mounting clamp.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT OR CONNECT PLUG. WHEN CONNECTING PLUG, DO NOT OVERTIGHTEN.

(11) Connect electrical connector.

(12) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891

U	41	B1-2	ENGINE IGNITION RIGHT

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

UPPER EPC, LIGHTS - LEFT AC BUS

Row	Col	Number	Name
K	18	B1-306	INTEGRAL LIGHTS CENTER INST PANEL

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(13) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(14) Close access door (5901C) for left engine or (5902C) for right engine.

(15) Perform pressure ratio system test. (PAGEBLOCK 77-11-01/201 Config 1)

NOTE: If test equipment is not available, perform a power assurance check (SUBJECT 71-00-00, Part Power Trim Procedure) on the applicable engine. Verify that the EPR indication is normal using the part power trim charts. If indication is zero or erratic, additional troubleshooting is required.

(16) Perform status test panel Return-to-Service (RTS) for Digital Flight Guidance Computer (DFGC). (DFGS STATUS/TEST, SUBJECT 22-01-05, Page 201)

C. Remove Snubber (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

UPPER EPC, LIGHTS - LEFT AC BUS

Row	Col	Number	Name
K	18	B1-306	INTEGRAL LIGHTS CENTER INST PANEL

CAUTION: MAKE CERTAIN WRENCHING IS ACCOMPLISHED ON HEX SURFACE OF SNUBBER ADJACENT TO TRANSMITTER TO PREVENT POSSIBLE DAMAGE TO SNUBBER BODY.

(2) Disconnect engine exhaust pressure (P_{t7}) line from snubber.

(3) Remove snubber from EPR transmitter. Remove and discard O-ring.

D. Install Snubber (Figure 201)

(1) Make certain throttle/thrust reverse lever is tagged, and the following circuit breakers are opened and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

UPPER EPC, LIGHTS - LEFT AC BUS

Row	Col	Number	Name
K	18	B1-306	INTEGRAL LIGHTS CENTER INST PANEL

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201).

(3) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

UPPER EPC, LIGHTS - LEFT AC BUS

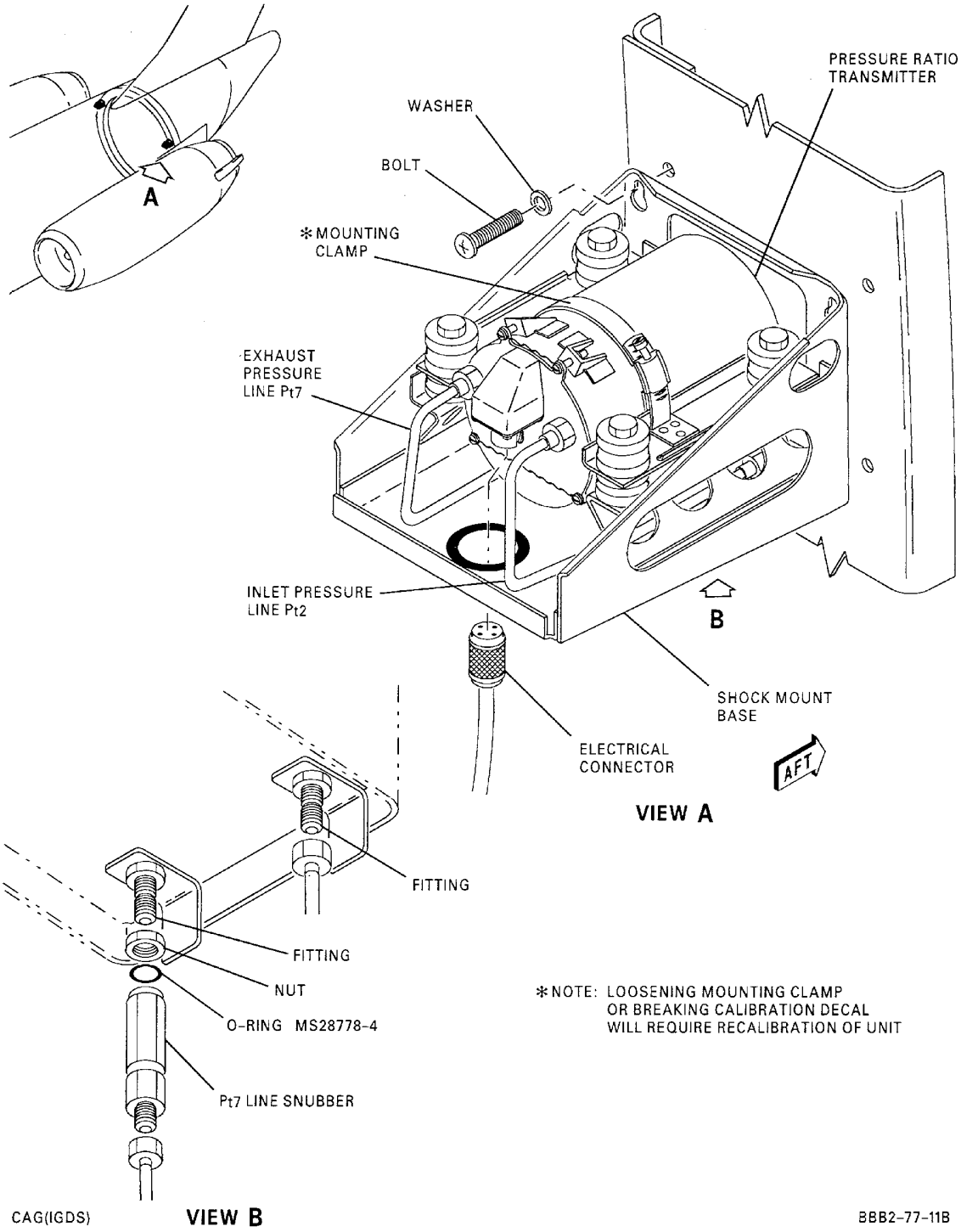
Row	Col	Number	Name
K	18	B1-306	INTEGRAL LIGHTS CENTER INST PANEL

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(4) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(5) Close access door (5901C) for left engine or (5902C) for right engine.

(6) Perform pressure ratio system test. (PAGEBLOCK 77-11-01/201 Config 1)



EPR Transmitter and Snubber - Installation
Figure 201/77-11-02-990-802

ENGINE PRESSURE RATIO (EPR) TRANSMITTER - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the EPR transmitters mounted in the fuselage aft section.

B. Access to the EPR transmitters is through the aft entrance access door.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Petrolatum VV-P-236 DPM 675	
Ammonium hydroxide, Tech grade DPM 950-21	

3. Removal/Installation Engine Pressure Ratio (EPR) Transmitter

A. Remove Transmitter (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	41	B1-2	ENGINE IGNITION RIGHT

WJE 405, 406, 410, 877, 886, 887

U	41	B1-423	ENGINE START VALVE RIGHT

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	42	B1-1	ENGINE IGNITION LEFT

WJE 405, 406, 410, 877, 886, 887

U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY AC BUS

Row	Col	Number	Name

WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

C	8	B1-959	EPR LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name

WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT OR CONNECT PLUG. WHEN CONNECTING PLUG, DO NOT OVERTIGHTEN.

(4) Disconnect electrical connector.

(5) Disconnect inlet pressure (P_{t2}) line from transmitter.

(6) Disconnect engine exhaust pressure (P_{t7}) line from snubber located at transmitter mount base.

NOTE: EPR transmitter and snubber are to be replaced as a unit.

(7) Loosen transmitter mount retaining bolts.

(8) Remove transmitter and mount.

CAUTION: TO PREVENT RECALIBRATION OF UNIT, DO NOT LOOSEN MOUNTING CLAMP OR BREAK CALIBRATION DECAL.

(9) Do not loosen mounting clamp.

(10) Remove transmitter.

NOTE: In some cases, to eliminate erratic EPR indication, dry out moisture in disconnected engine inlet pressure (Pt2) line and exhaust pressure (Pt7) line with clean dry compressed air.

(11) Check the vibration isolators spring action.

WARNING: AMMONIUM HYDROXIDE IS AN AGENT THAT IS POISONOUS, AN IRRITANT, AN ASPHYXIANT, AND CORROSIVE. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN AMMONIUM HYDROXIDE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET AMMONIUM HYDROXIDE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(12) If necessary, clean the shock mount base including the vibration isolators with a solution of household ammonia and water.

NOTE: If the vibration isolators remain in a flat non-functioning condition after cleaning, they should be replaced.

B. Install Transmitter (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverse lever is tagged, and the following circuit breakers are opened and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY AC BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
C	8	B1-959	EPR LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Place transmitter and mount on retaining bolts.

(4) Connect exhaust and inlet pressure lines to fittings on mount base. Do not tighten.

(5) Tighten mount retaining bolts.

(6) Tighten exhaust and inlet pressure line connections.

CAUTION: TO PREVENT RECALIBRATION OF UNIT, DO NOT TIGHTEN MOUNTING CLAMP OR BREAK CALIBRATION DECAL.

(7) Do not tighten mounting clamp.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT OR CONNECT PLUG. WHEN CONNECTING PLUG, DO NOT OVERTIGHTEN.

(8) Connect electrical connector.

(9) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY AC BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
C	8	B1-959	EPR LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(10) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(11) Close access door (5901C) for left engine or (5902C) for right engine.

(12) Perform pressure ratio system test. (ENGINE PRESSURE RATIO (EPR) INDICATION SYSTEM, SUBJECT 77-11-01, Page 201)

NOTE: If test equipment is not available, perform a power assurance check (SUBJECT 71-00-00, Part Power Trim Procedure) on the applicable engine. Verify that the EPR indication is normal using the part power trim charts. If indication is zero or erratic, additional troubleshooting is required.

(13) Perform status test panel RTS for Digital Flight Guidance Computer (DFGC). (DFGS STATUS/TEST, SUBJECT 22-01-05, Page 201)

C. Remove Snubber (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

CAUTION: MAKE CERTAIN WRENCHING IS ACCOMPLISHED ON HEX SURFACE OF SNUBBER ADJACENT TO TRANSMITTER TO PREVENT POSSIBLE DAMAGE TO SNUBBER BODY.

(2) Disconnect engine exhaust pressure (P_{t7}) line from snubber.

(3) Remove snubber from EPR transmitter. Remove and discard O-ring.

D. Install Snubber (Figure 201)

(1) Make certain throttle/thrust reverse lever is tagged, and the following circuit breakers are opened and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201).

WARNING: WHITE PETROLATUM IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN WHITE PETROLATUM IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT BREATHE THE MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(3) Lightly lubricate new O-ring with petrolatum (VV-P-236) and install on snubber.

(4) Install snubber on EPR transmitter.

(5) Connect engine exhaust pressure (P_{t7}) line to snubber.

(6) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

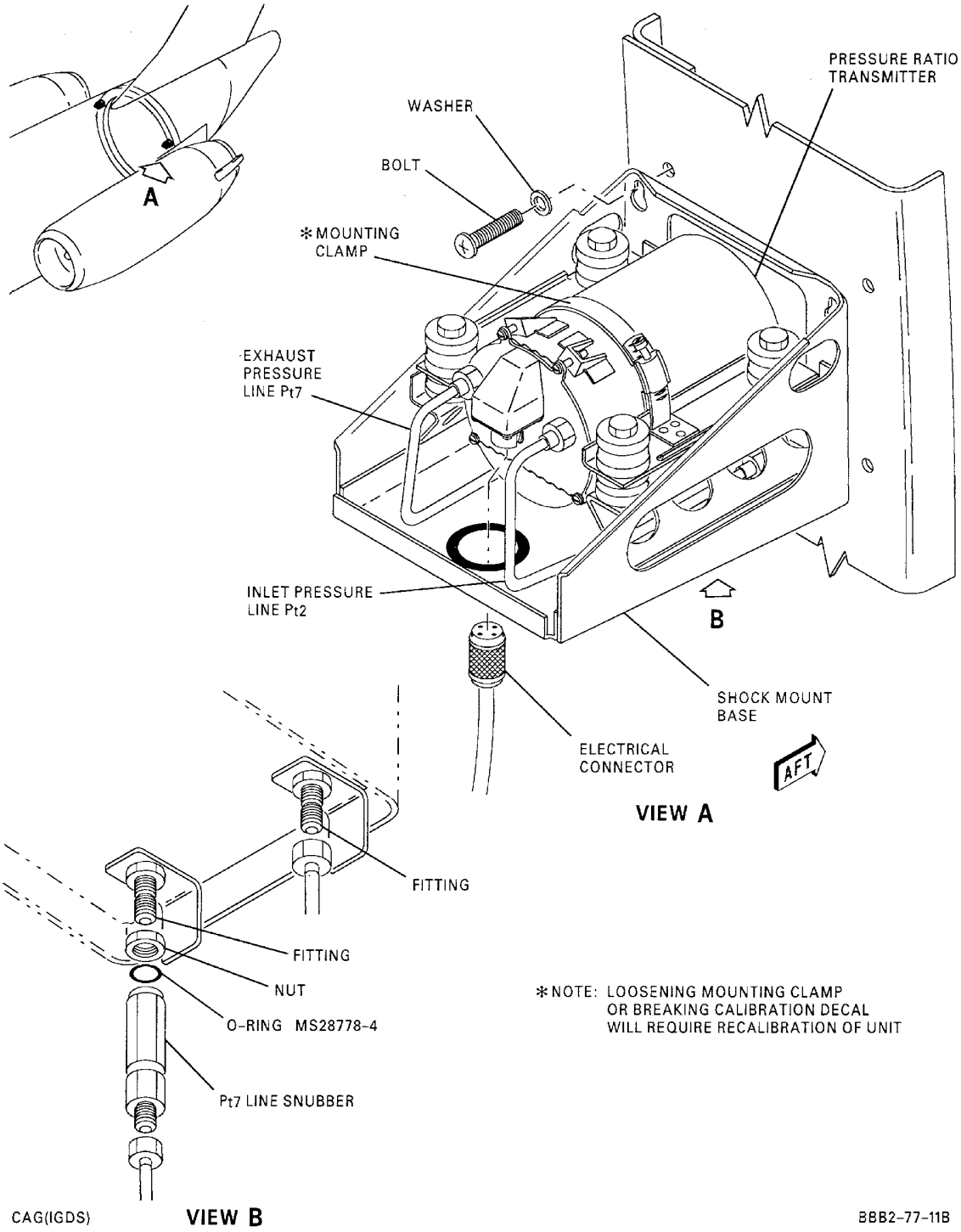
Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(7) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(8) Close access door (5901C) for left engine or (5902C) for right engine.

(9) Perform pressure ratio system test. (ENGINE PRESSURE RATIO (EPR) INDICATION SYSTEM, SUBJECT 77-11-01, Page 201)



EPR Transmitter and Snubber - Installation
Figure 201/77-11-02-990-801

EPR P_{t2} INLET PRESSURE SENSING PROBE - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the EPR P_{t2} inlet pressure sensing probe. The inlet pressure sensing probe is located in the engine inlet bullet.

B. Maintenance of the sensing probe is limited to removal/installation. Access to the sensing probe is through removal of the inlet bullet. Removal and installation procedures for each probe are identical.

2. Equipment and Materials

CAUTION: BEFORE WORKING IN NOSE COWL A PROTECTIVE BLANKET SHOULD BE SPREAD INSIDE NOSE COWL. VACUUM INSIDE NOSE COWL TO REMOVE PARTICLES WHICH MAY CAUSE DAMAGE TO PERFORATED SKIN. ANY DAMAGE TO PERFORATED SKIN MAY CAUSE DISSIMILAR METAL REACTION WHICH COULD SPREAD TO SURROUNDING AREA.

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Torque wrench (0-300 inch pounds range)	
Petrolatum VV-P-236 DPM 675	

3. Removal/Installation EPR P_{t2} Inlet Pressure Sensing Probe

A. Remove Probe. (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

WJE 407, 408, 411, 880, 884, 892, 893 (Continued)

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Loosen captive self-locking nuts that attach inlet bullet to engine inlet case.

(3) Carefully pull inlet bullet forward to disengage P_{t2} receptacle from engine P_{t2} coupler.

(4) Place inlet bullet on suitable pad to prevent damage to P_{t2} receptacle.

(5) Remove O-ring from front accessory drive case.

(6) Remove O-rings from engine P_{t2} coupler.

(7) Disconnect flexible hose from fitting on P_{t2} probe.

(8) Remove bolts attaching receptacle to bracket and remove receptacle and hose from inlet bullet.

B. Install Probe. (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Carefully position receptacle and hose in inlet bullet making certain they are properly located.

(3) Install bolts attaching receptacle to bracket.

(4) Connect flexible hose to fitting on P_{t2} probe.

(5) Check P_{t2} probe drain hole to make sure it is clear and no blockage is present.

(6) Lightly lubricate new O-rings with petrolatum (VV-P-236) and install on engine P_{t2} coupler.

(7) Lightly lubricate new O-ring with petrolatum (VV-P-236) and install on front accessory drive case.

(8) Check inlet probe tubes and bullet to ensure no foreign matter is present.

(9) Carefully align P_{t2} receptacle and coupler and install bullet.

(10) Tighten captive nuts to torque of 100 to 140 inch-pounds (11.3 to 15.8 N·m).

(11) Check that gap between inlet bullet and engine front accessory drive case is 0.050 to 0.130 inch (1.270 to 3.302 mm). (PAGEBLOCK 71-10-02/201)

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(12) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

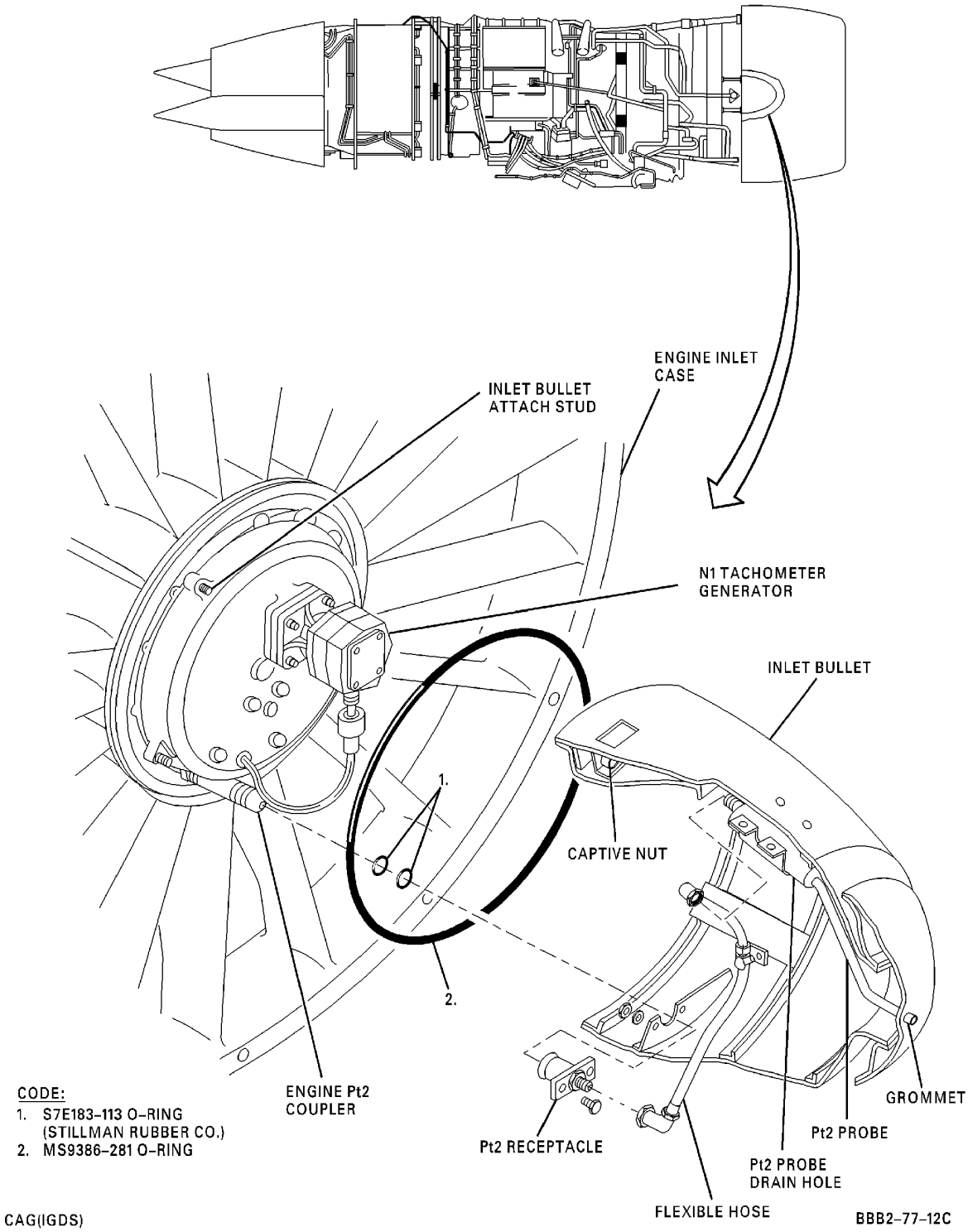
Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	25	B1-805	LEFT PRESSURE RATIO
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION



EPR P_{t2} Inlet Pressure Sensing Probe - Installation
Figure 201/77-11-03-990-804

EFFECTIVITY
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

EPR $P_{t\,2}$ INLET PRESSURE SENSING PROBE - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the EPR P_{t2} inlet pressure sensing probe. The inlet pressure sensing probe is located in the engine inlet bullet.

B. Maintenance of the sensing probe is limited to removal/installation. Access to the sensing probe is through removal of the inlet bullet. Removal and installation procedures for each probe are identical.

2. Equipment and Materials

CAUTION: BEFORE WORKING IN NOSE COWL A PROTECTIVE BLANKET SHOULD BE SPREAD INSIDE NOSE COWL. VACUUM INSIDE NOSE COWL TO REMOVE PARTICLES WHICH MAY CAUSE DAMAGE TO PERFORATED SKIN. ANY DAMAGE TO PERFORATED SKIN MAY CAUSE DISSIMILAR METAL REACTION WHICH COULD SPREAD TO SURROUNDING AREA.

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Torque wrench (0-300 inch pounds range)	
Petrolatum VV-P-236 DPM 675	

3. Removal/Installation EPR P_{t2} Inlet Pressure Sensing Probe

A. Remove Probe. (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

WJE 405, 406, 410, 877, 886, 887 (Continued)

OVERHEAD EMERGENCY AC BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
C	8	B1-959	EPR LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Loosen captive self-locking nuts that attach inlet bullet to engine inlet case.

(3) Carefully pull inlet bullet forward to disengage P_{t2} receptacle from engine P_{t2} coupler.

(4) Place inlet bullet on suitable pad to prevent damage to P_{t2} receptacle.

(5) Remove O-ring from front accessory drive case.

(6) Remove O-rings from engine P_{t2} coupler.

(7) Disconnect flexible hose from fitting on P_{t2} probe.

(8) Remove bolts attaching receptacle to bracket and remove receptacle and hose from inlet bullet.

B. Install Probe. (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

WJE 405, 406, 410, 877, 886, 887 (Continued)

OVERHEAD EMERGENCY AC BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
C	8	B1-959	EPR LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Carefully position receptacle and hose in inlet bullet making certain they are properly located.

(3) Install bolts attaching receptacle to bracket.

(4) Connect flexible hose to fitting on P_{t2} probe.

(5) Check P_{t2} probe drain hole to make sure it is clear and no blockage is present.

(6) Lightly lubricate new O-rings with petrolatum (VV-P-236) and install on engine P_{t2} coupler.

(7) Lightly lubricate new O-ring with petrolatum (VV-P-236) and install on front accessory drive case.

(8) Check inlet probe tubes and bullet to ensure no foreign matter is present.

(9) Carefully align P_{t2} receptacle and coupler and install bullet.

(10) Tighten captive nuts to torque of 100 to 140 inch-pounds (11.3 to 15.8 N·m).

(11) Check that gap between inlet bullet and engine front accessory drive case is 0.050 to 0.130 inch (1.270 to 3.302 mm). (PAGEBLOCK 71-10-02/201).

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(12) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY AC BUS

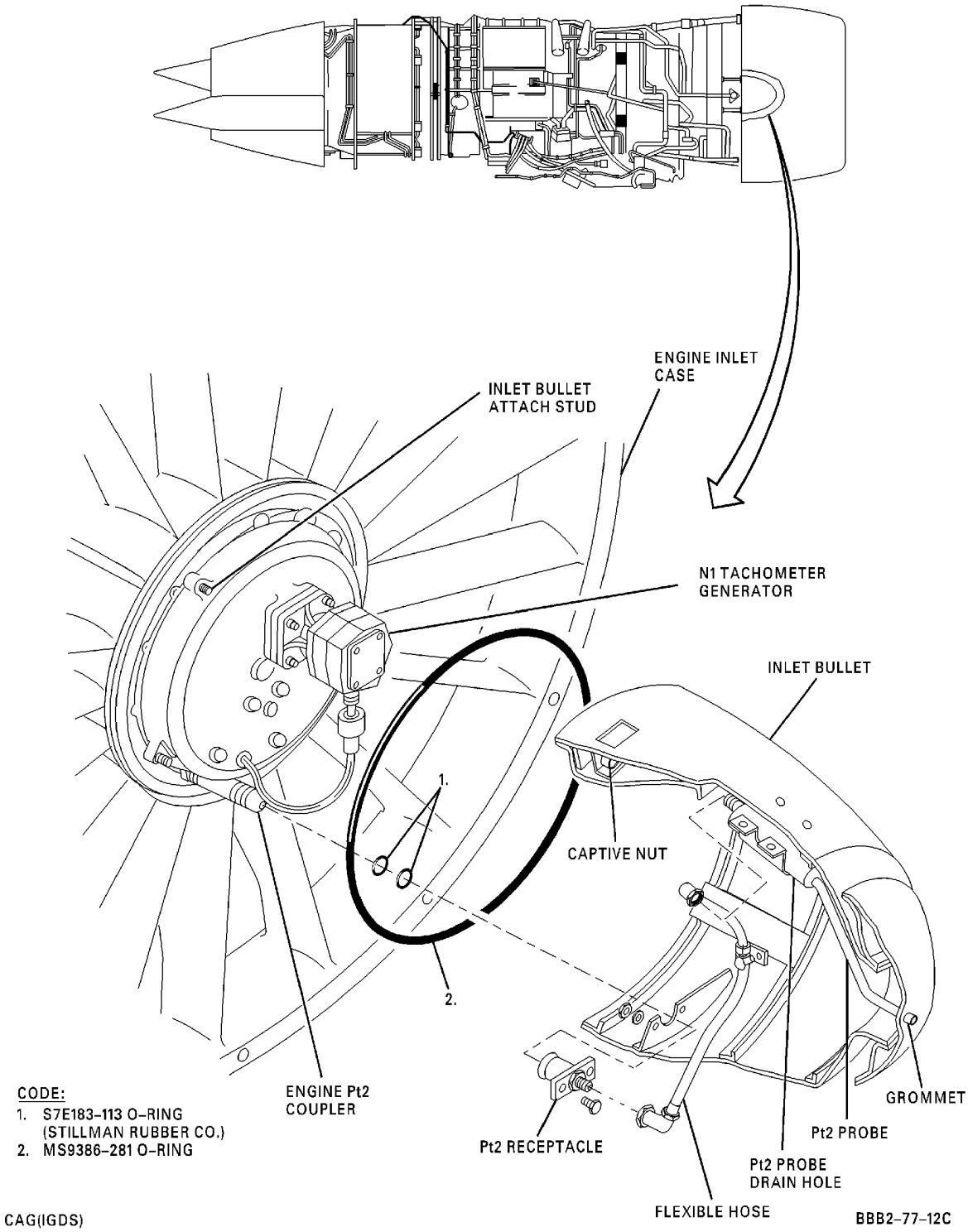
Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
C	8	B1-959	EPR LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	25	B1-806	RIGHT PRESSURE RATIO
L	26	B1-425	RIGHT ENGINE IGNITION



EPR P_{t2} Inlet Pressure Sensing Probe - Installation
Figure 201/77-11-03-990-801

EFFECTIVITY
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

EPR PT7 TURBINE EXHAUST PRESSURE PROBES - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation, check and cleaning instructions for the EPR PT7 turbine exhaust pressure probes. Eight probes manifolded together are mounted in the turbine exhaust case at approximately the 12:30, 2:00, 3:30, 5:00, 6:30, 8:00, 9:30 and 11:00 o'clock positions looking forward.

B. Maintenance of the probes is limited to removal/installation and check. The removal/installation and check procedures for probes on all engines are identical. Access to the probes is through the upper and aft lower cowl doors.

NOTE: Forward lower cowl door overlaps aft lower cowl door and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: OPEN UPPER COWL DOOR ONLY AS MUCH AS NECESSARY TO ALLOW HOLD-OPEN RODS TO BE CONNECTED TO ENGINE. OPENING DOOR TOO FAR MAY CAUSE DAMAGE TO PYLON HINGE POINTS.

CAUTION: MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

C. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Adapter PWA 45513 (Replaced by PWA 46415)	Pratt & Whitney
Adapter PWA 46415 (Replaces PWA 45513)	
WJE 401-412, 414, 873-881, 883, 884, 886, 887, 892, 893	
Compound, anti-galling, Fel-Pro C-200	
WJE 415-427, 429, 861-866, 868, 869, 871, 872, 891	
Paste, Antiseize, Molykote, P-37	
WJE ALL	
Lockwire, .032 corrosion resistant steel, P05-289	
PWA 21875 Regulator (Replaced by PWA 45363)	Pratt & Whitney
PWA 45363 Regulator (Replaces PWA 21875)	Pratt & Whitney

Table 201 (Continued)

Name and Number	Manufacturer
Solution, soap and water	
Torque wrench (0 to 200 inch pounds (22.6 N·m) range)	

3. **Removal/Installation EPR PT7 Turbine Exhaust Pressure Probes**

A. Remove Probe (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6555 TO 7245 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(4) Remove EGT thermocouple probe (T_{t7}), (PAGEBLOCK 77-21-03/201).

CAUTION: USE CARE IN REMOVING AND HANDLING PROBE. DO NOT DENT INLETS OR ORIFICES OR BEND PROBE.

(5) Disconnect and remove (PT7) manifold tubes from probe.

(6) Remove bolts securing probe to exhaust case and remove probe.

B. Install Probe (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Check probe. (Paragraph 4.A.)

WJE 401-412, 414, 873-881, 883, 884, 886, 887, 892, 893

CAUTION: EXTREME CARE MUST BE EXERCISED TO ENSURE ANTI-GALLING AND ANTI-SEIZE COMPOUNDS ARE APPLIED IN THIN EVEN COAT AND ALL EXCESS MATERIAL IS COMPLETELY REMOVED TO PREVENT COMPOUND GETTING INTO OR ONTO PARTS, PASSAGES, OR SURFACES WHERE IT MAY CAUSE MALFUNCTIONING OR EVEN FAILURE OF ENGINE.

(4) Apply thin coat of anti-galling compound (Fel-Pro C-200) to threads of adapters, bolts, and probe threaded tube connectors to facilitate removal.

NOTE: Wet Fel-Pro C-200 anti-galling compound is approved for threaded parts and mating faces of threaded and other parts in hot section and free turbine areas. Optimum results are obtained with Fel-Pro baked on, but use of wet Fel-Pro brushed on without prior surface preparation or baking is permissible. In this latter use, less long-term durability is obtained.

WJE 415-427, 429, 861-866, 868, 869, 871, 872, 891

CAUTION: EXTREME CARE MUST BE EXERCISED TO ENSURE ANTI-GALLING AND ANTI-SEIZE COMPOUNDS ARE APPLIED IN THIN EVEN COAT AND ALL EXCESS MATERIAL IS COMPLETELY REMOVED TO PREVENT COMPOUND GETTING INTO OR ONTO PARTS, PASSAGES, OR SURFACES WHERE IT MAY CAUSE MALFUNCTIONING OR EVEN FAILURE OF ENGINE.

(5) Apply thin coat of antiseize compound (Molykote P-37) to threads of adapters, bolts, and probe threaded tube connectors to facilitate removal.

WJE ALL

(6) Install probe in port in fan exhaust outer duct, move probe inward through seal in wall of exhaust case and align bolt holes.

(7) Install bolts and secure probe when probe is fully seated against mounting boss on fan exhaust outer duct.

(8) Torque probe attach bolts 125 to 140 inch-pounds (14.13 to 15.82 N·m).

(9) Install EGT thermocouple probe (T_{t7}). (PAGEBLOCK 77-21-03/201)

(10) Connect manifold tubes to probe, torque nuts 90 to 100 inch pounds (10.17 to 11.30 N·m.).

(11) Safety tube nuts and bolts together with P05-289 lockwire.

NOTE: Early average pressure probes incorporate unused PT7F (fan pressure) connection; install cap and plug on this fitting and tighten. Safety cap with .032 corrosion-resistant lockwire.

(12) Remove tools, equipment, loose hardware, and debris from maintenance area.

(13) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

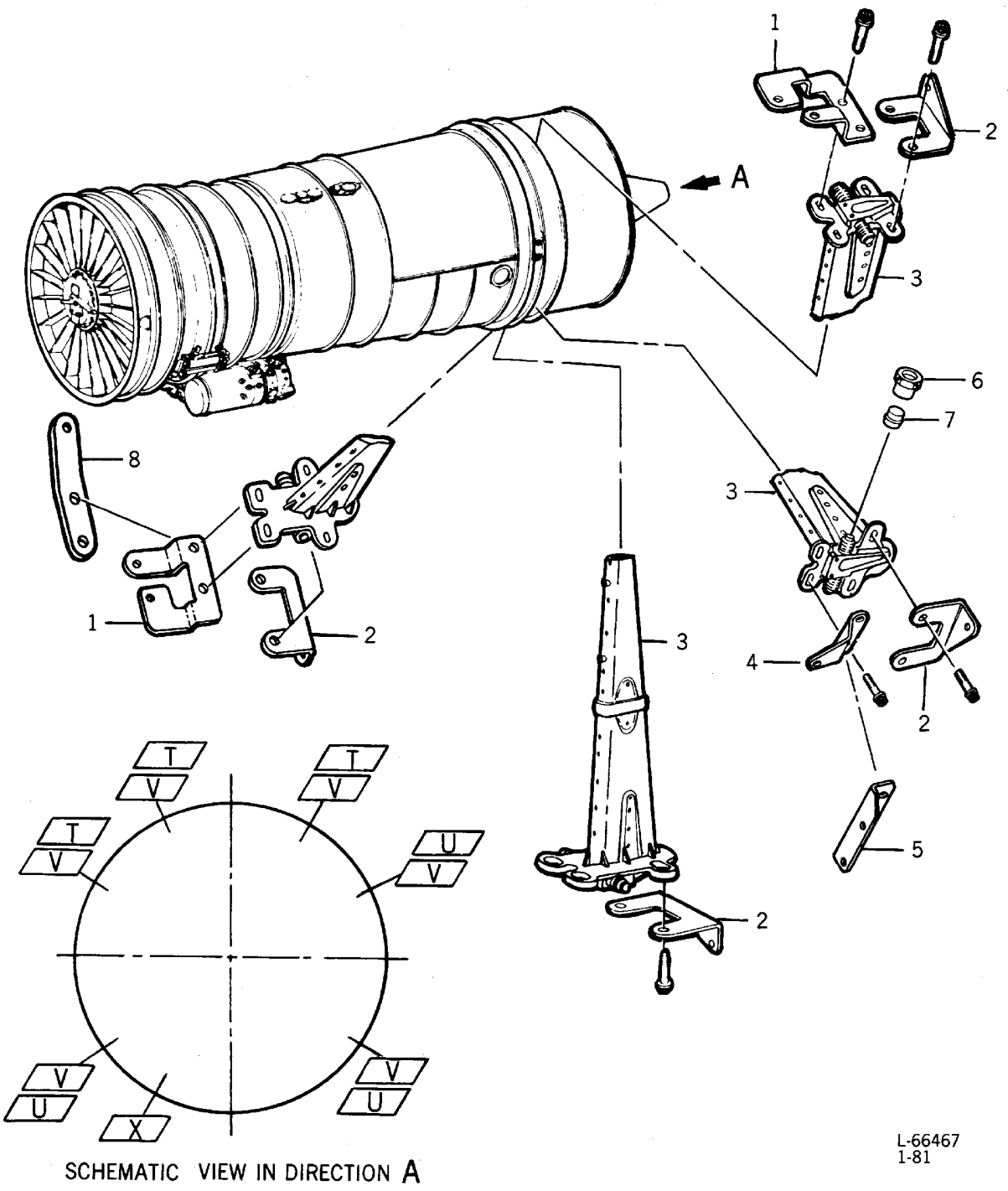
(14) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(15) Close access door (5901C) for left engine or (5902C) for right engine.

(16) The table that follows is the key to Figure 201:

Table 202 EPR PT7 Turbine Exhaust Pressure Probes - Installation

1. Angle Bracket (Six Required At Locations Marked V Prior to P&W SB 5224) (Three Required At Locations Marked T Incorporating P&W SB 5224)
2. Bracket (All Eight Locations)
3. Pressure Probe (Eight Required)
4. Angle Bracket (Location Marked X) (Prior to P&W SB 5224)
5. Bracket (Location Marked X Incorporating P&W SB 5224)
6. Cap (Prior to P&W SB 5204)
7. Plug (Prior to P&W SB 5204)
8. Bracket (Three Required At Locations Marked U Incorporating P&W SB 5224)



EPR PT7 Turbine Exhaust Pressure Probes - Installation
Figure 201/77-11-04-990-801

4. Check EPR PT7 Turbine Exhaust Pressure Probes

A. Check Probe (Figure 202)

NOTE: Probes should be checked for blockage approximately 100 hours after a new rear compressor rotor and stator (high compressor) is installed, whenever rubbing is suspected, or approximately 1,000 hour intervals conditional upon operators experience.

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6555 TO 7245 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(4) Check probe tube connectors for thread damage.

(5) Check probe, tubes, bottom disk, and adapter for cracks.

B. Clean Probe (Probe Removed From Engine)

(1) Clear obstructed sensing holes using hand-held 0.029 inch (0.736 mm) drill. Do not mar or enlarge sensing holes.

(2) Use suction or pressure air to remove loose foreign matter from inside of probe.

(3) Dry the condensation trap and make sure that the pressure inlet orifice and drain plug hole are fully open.

(4) Install the Pt $_7$ condensation trap. (EXTERNAL PARTS - REMOVAL/INSTALLATION-04, PAGEBLOCK 72-09-74/401,

(5) Put 35 - 40 psig (241.3 - 275.8 kPa) air in the pressure manifold (at the turbine exhaust outer duct). Use PMC 2277 or PMC 9659 leak check fluid to look for air leaks in manifold connections that were loosened. No leaks are permitted.

NOTE: Air will flow out through the probe holes during this pressure test. Keep air pressure up during the leak checks.

(6) Remove air pressure equipment and connect the airframe Pt_7 sense line to the engine exhaust pressure manifold.

C. Clean Probe (Probe Installed In Engine)

(1) Disconnect the line to the exhaust pressure manifold on the turbine exhaust outer duct.

(2) Attach a line to the pressure manifold and pressure flush the manifold and probes with hot water at 122 - 160°F (50 - 71°C). Monitor the spray pattern for blocked probes (there are five holes in each probe).

(3) If a probe has holes that are fully blocked (either no water comes out of one or more holes or there is only small leakage), remove the blockage with a hand-held 0.029 inch (0.737 mm) drill. Do not cause damage to a hole or make it larger.

(4) After all holes flow freely in all eight probes, stop the pressure flush procedure and drain all remaining water.

(5) Flow air through the cleaned probes to dry the manifold and probes for approximately ten minutes. Monitor all probe holes for air flow.

(6) Remove the Pt_7 condensation trap (post-SB 5452). (EXTERNAL PARTS - REMOVAL/INSTALLATION-04, PAGEBLOCK 72-09-74/401)

(7) Dry the condensation trap and make sure that the pressure inlet orifice and drain plug hole are fully open.

(8) Install the Pt $_7$ condensation trap. (EXTERNAL PARTS - REMOVAL/INSTALLATION-04, PAGEBLOCK 72-09-74/401,

(9) Put 35 - 40 psig (241.3 - 275.8 kPa) air in the pressure manifold (at the turbine exhaust outer duct). Use PMC 2277 or PMC 9659 leak check fluid to look for air leaks in manifold connections that were loosened. No leaks are permitted.

NOTE: Air will flow out through the probe holes during this pressure test. Keep air pressure up during the leak checks.

(10) Remove air pressure equipment and connect the airframe Pt_7 sense line to the engine exhaust pressure manifold.

(11) Start the engine and do a ground idle run for five minutes. (ENGINE GENERAL - DESCRIPTION, PAGEBLOCK 72-00-00/001, Page 501)

D. Check PT7 Manifold Condensation Trap

(1) Drain condensation trap housing as follows:

(a) Remove drain plug from bottom of condensation trap (mounted at 6 o'clock position on turbine exhaust outer duct) and discard O-ring. (Figure 203)

(b) Drain all accumulated moisture from trap.

NOTE: Condensation trap should be checked and drained periodically as a precautionary measure.

(c) Lightly lubricate new O-ring with petrolatum (VV-P-236) and install O-ring on plug.

CAUTION: ENSURE THAT 0.050 INCH (1.270 MM) HOLE IN PLUG IS OPEN AND NOT OBSTRUCTED.

(d) Install drain plug in bottom of condensation trap and tighten. Safety plug with P05-289 lockwire.

E. Pressure Check Probes (Air Pressure Check)

(1) Pressure check PT7 manifold and pressure probe connections as follows:

(a) Disconnect tube to PT7 pressure manifold on turbine exhaust outer rear duct.

(b) Connect adapter PWA 46415 (formerly 45513) to PT7 manifold outlet and attach source of dry filtered compressed air, with regulator PWA 45363 (formerly 21875), to adapter.

(c) Pressurize PT7 system 35 to 45 psig (241.3 to 310.3 kPa).

NOTE: Air will escape through probe sensing holes during pressure test. Maintain air pressure while checking for leaks.

(d) Using soap and water solution, check each connection in manifold and at probes for leakage. No leakage permitted.

NOTE: If leaks exist, check nut torque. PT7 manifold nuts should be 65 to 70 inch pounds (7.35 to 7.9 N·m). Manifold to probe connections should be 90 to 100 inch pounds (10.17 to 11.30 N·m).

NOTE: Vent in plug at bottom of condensation trap should remain open and unobstructed.

(e) Relieve air pressure and remove regulator and adapter.

(f) Connect tube to PT7 pressure manifold.

(g) Remove tools, equipment, loose hardware, and debris from maintenance area.

(2) Remove tag from throttle/thrust reverse lever, and remove tags and close following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(3) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(4) Close access door (5901C) for left engine or (5902C) for right engine.

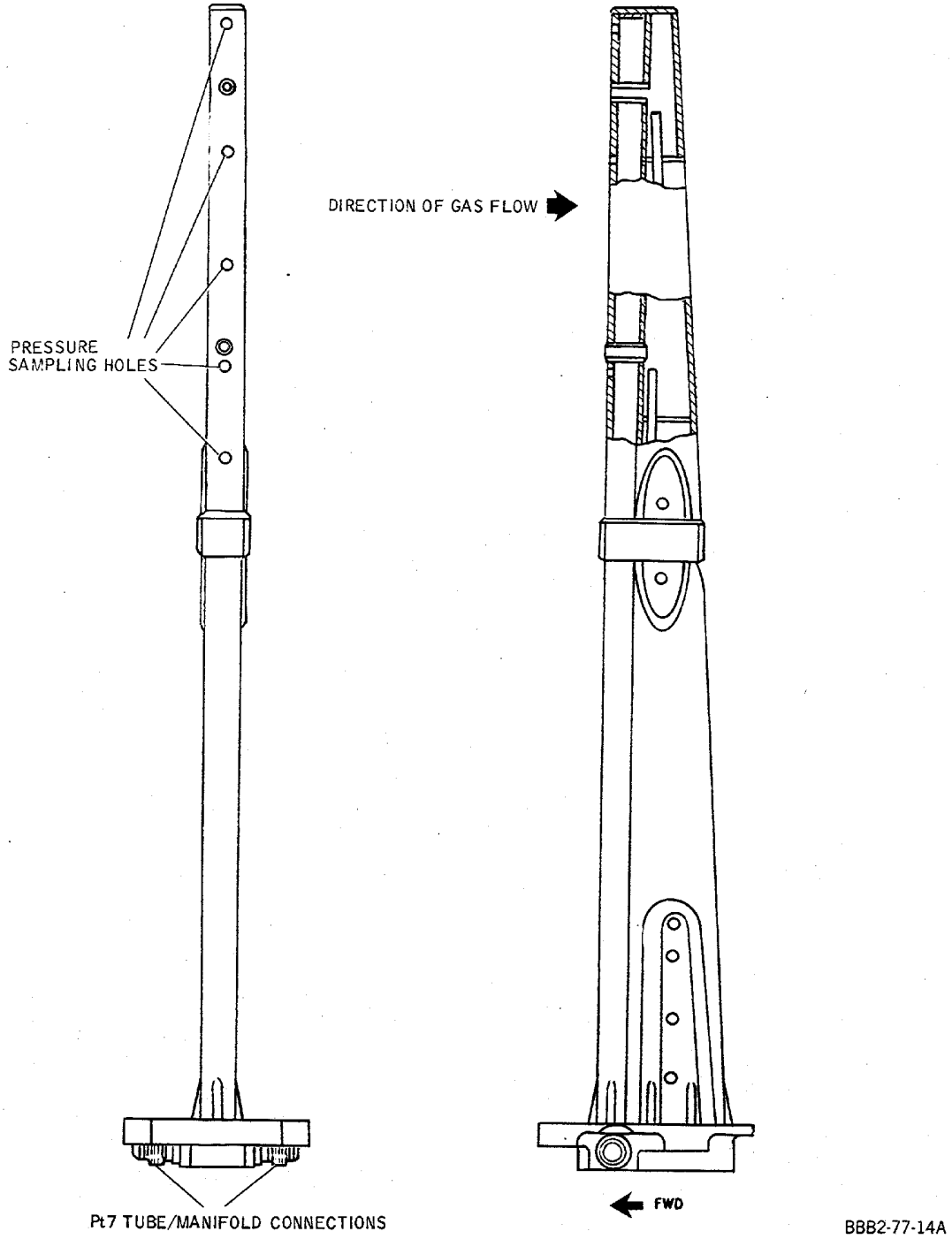
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

(5) Perform pressure ratio system test. (PAGEBLOCK 77-11-01/201 Config 1).

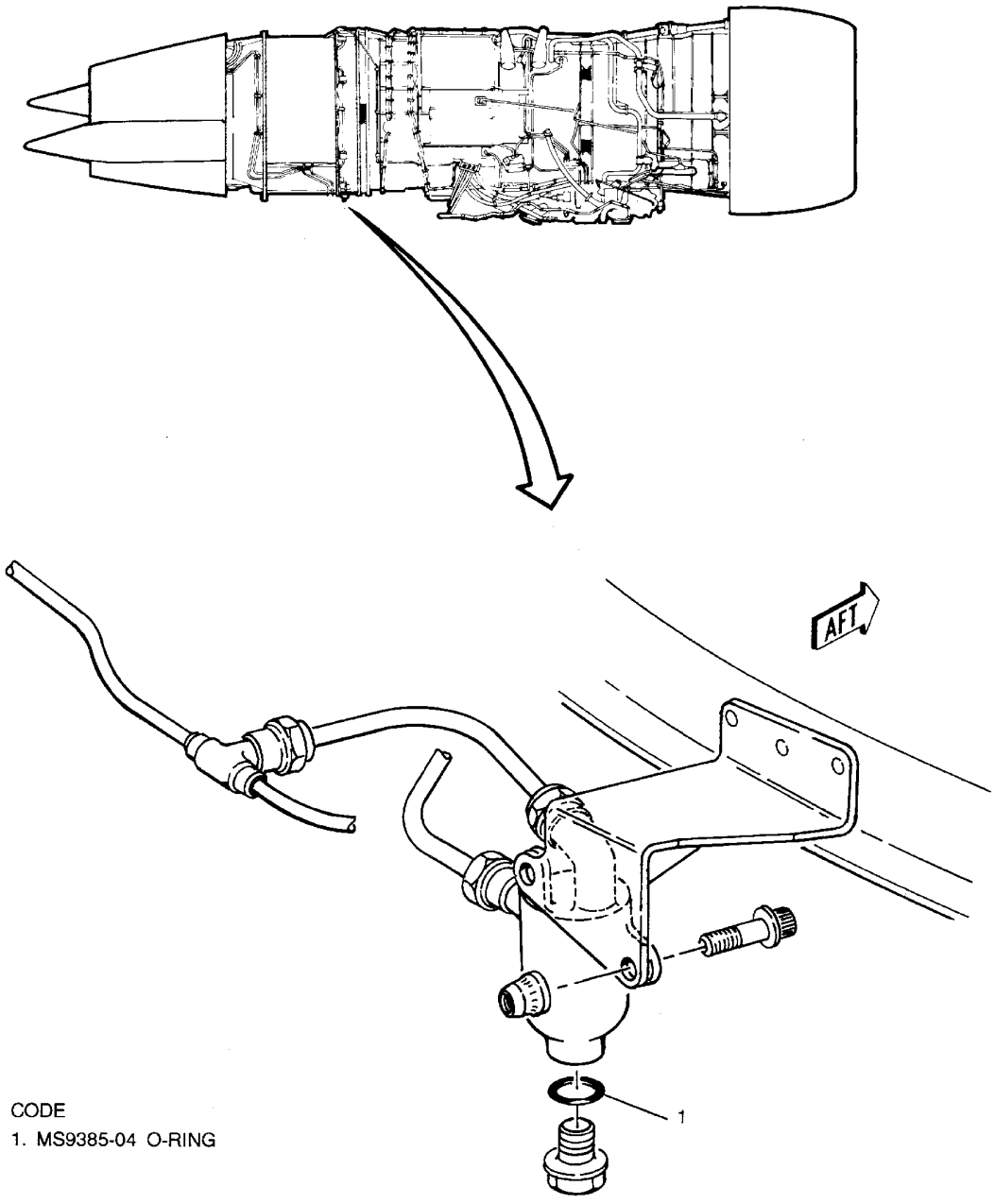
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

(6) Perform pressure ratio system test. (PAGEBLOCK 77-11-01/201 Config 2).

WJE ALL



EPR PT7 Turbine Exhaust Pressure Probes - Check
Figure 202/77-11-04-990-802



PT7 Manifold Condensation Trap
Figure 203/77-11-04-990-803

N1 RPM AND N2 RPM TACHOMETER SYSTEMS - TROUBLE SHOOTING

1. General

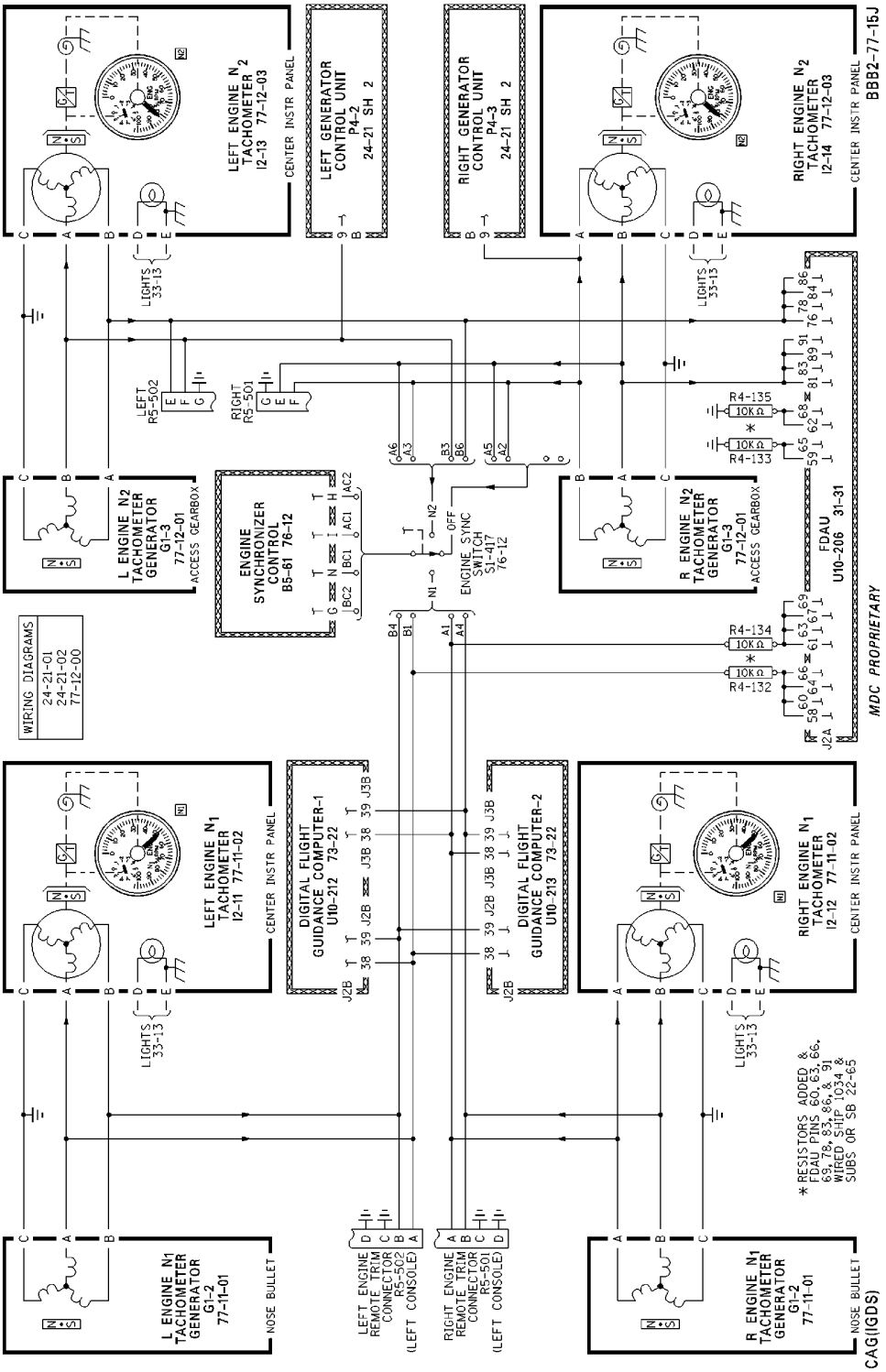
A. This maintenance practice provides trouble shooting procedures for the N_1 and N_2 Revolutions Per Minute (RPM) tachometer systems.

2. Trouble Shooting N_1 RPM and N_2 RPM Tachometer Systems

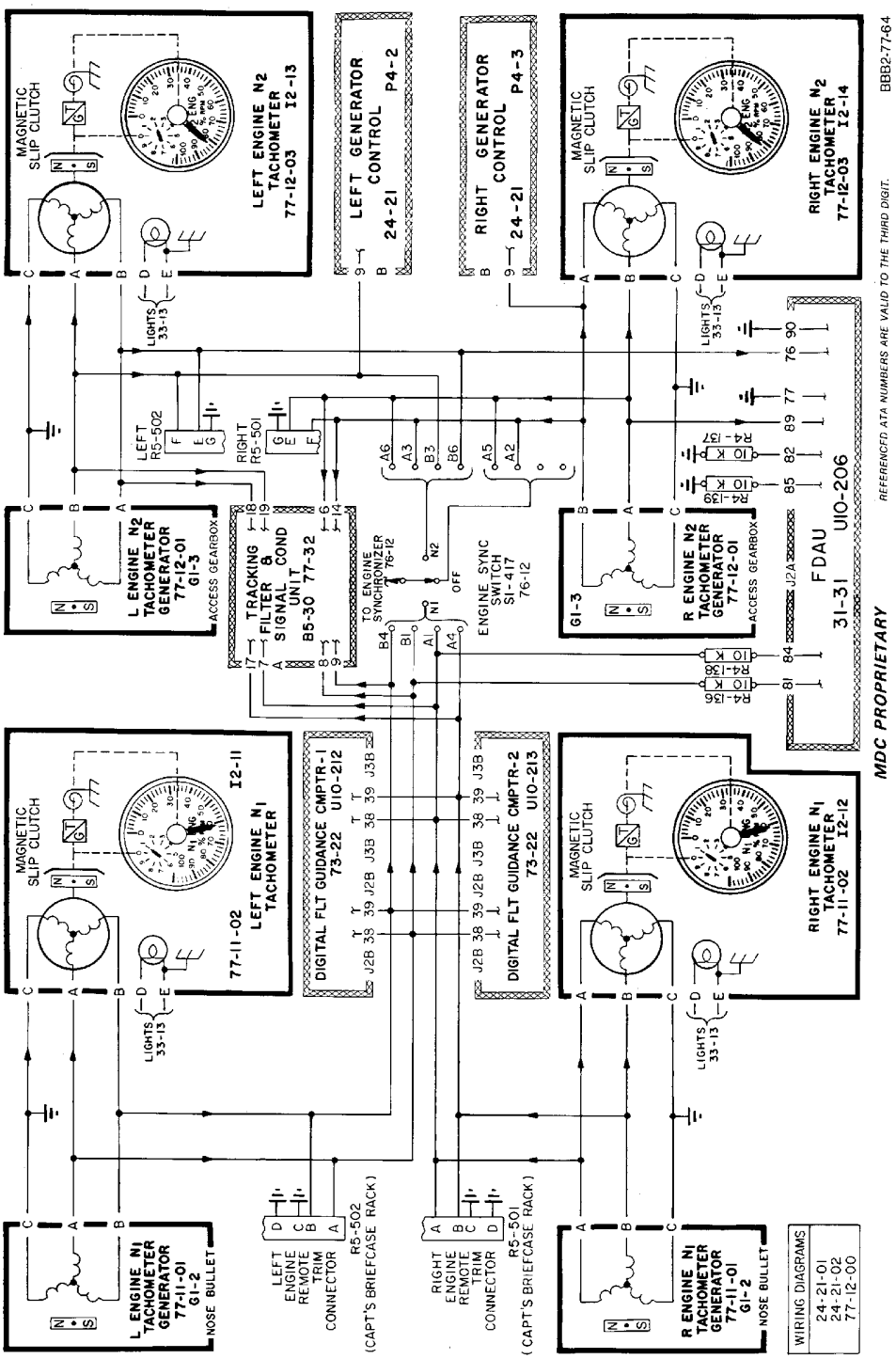
NOTE: Tachometer system wiring and indicator integrity should be checked prior to tachometer generator test.

	Possible Causes	Isolation Procedure	Correction
A. ENGINE TACHOMETER SYSTEM NOT FUNCTIONING			
(1)	Defective tachometer indicator	Interchange left and right tachometer indicator electrical connectors and operate engine.	If opposite indicator operates replace defective indicator. If opposite indicator does not operate refer to steps (2) and (3).
(2)	Defective tachometer generator		Replace generator.
(3)	Tachometer system wiring open	Remove indicator from instrument panel. Disconnect connector from indicator and check resistance between pins A or B and ground pin C. Check continuity between ground pin C and structure. Continuity should be read.	Repair wiring as necessary.
B. ENGINE TACHOMETER INDICATOR POINTER FLUCTUATES EXCESSIVELY			
(1)	Tachometer indicator defective	Disconnect electrical connector from indicator and perform test out lined in paragraph 2.A. step (1).	Replace indicator.
(2)	Loose electrical connection	Check all electrical connections for tightness.	Tighten loose connections.
(3)	Tachometer generator defective		Replace generator.
C. ENGINE TACHOMETER INDICATOR READS LOW			
(1)	Tachometer indicator defective	Disconnect electrical connector from indicator and perform test out lined in paragraph 2.A. step (1).	Replace indicator.
(2)	Tachometer generator defective		Replace generator.

CAUTION: ENSURE ELECTRICAL CONNECTORS ARE CONNECTED TO PROPER INDICATORS UPON COMPLETION OF TROUBLE SHOOTING PROCEDURES.



N_1 and N_2 Indication - Schematic
Figure 101/77-12-01-990-803 (Sheet 1 of 2)



N_1 and N_2 Indication - Schematic
Figure 101/77-12-01-990-803 (Sheet 2 of 2)

N1 RPM AND N2 RPM TACHOMETER SYSTEMS - TROUBLE SHOOTING

1. General

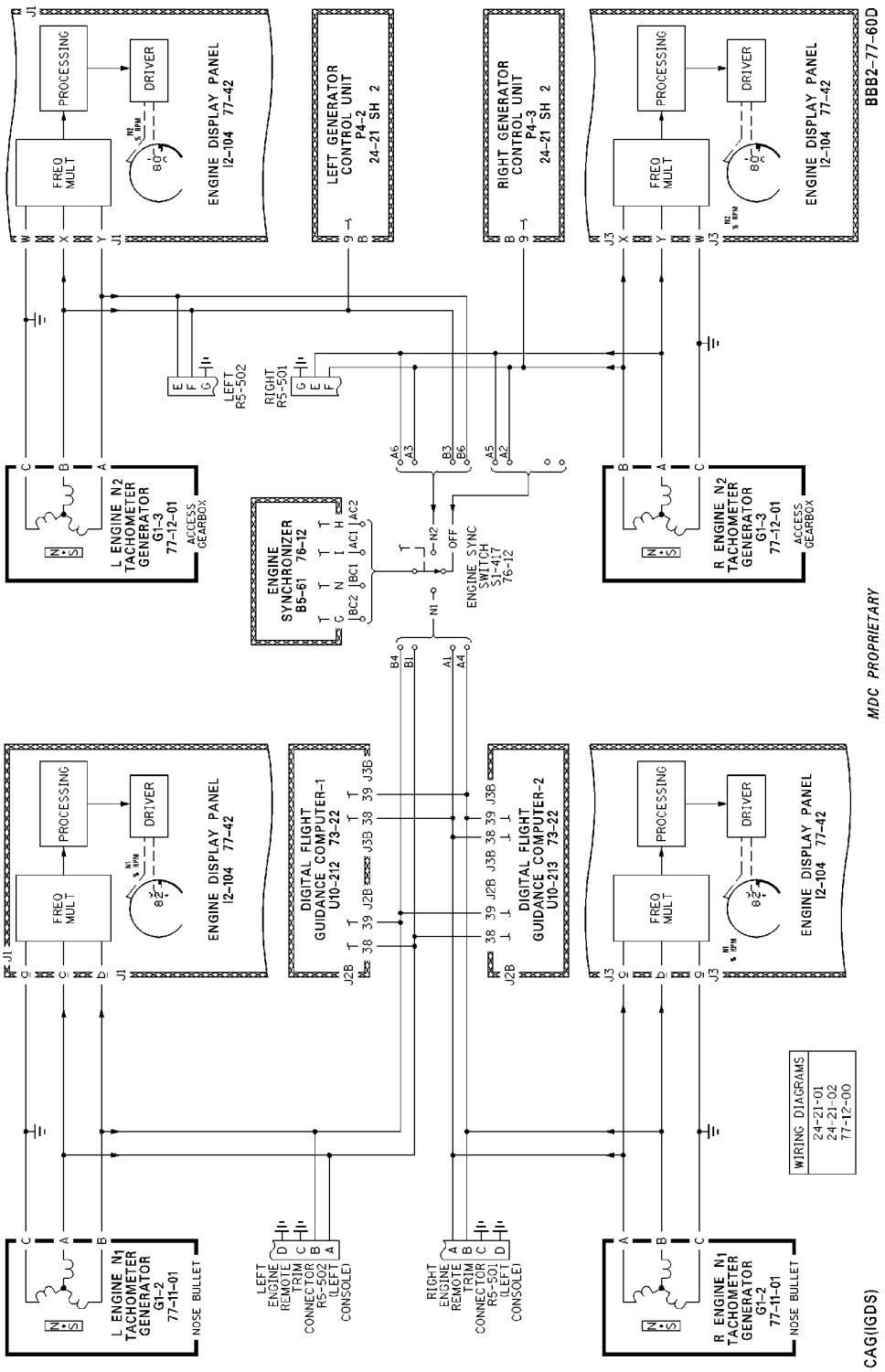
A. This maintenance practice provides trouble shooting procedures for the N_1 and N_2 RPM tachometer systems.

2. Trouble Shooting N_1 RPM and N_2 RPM Tachometer Systems

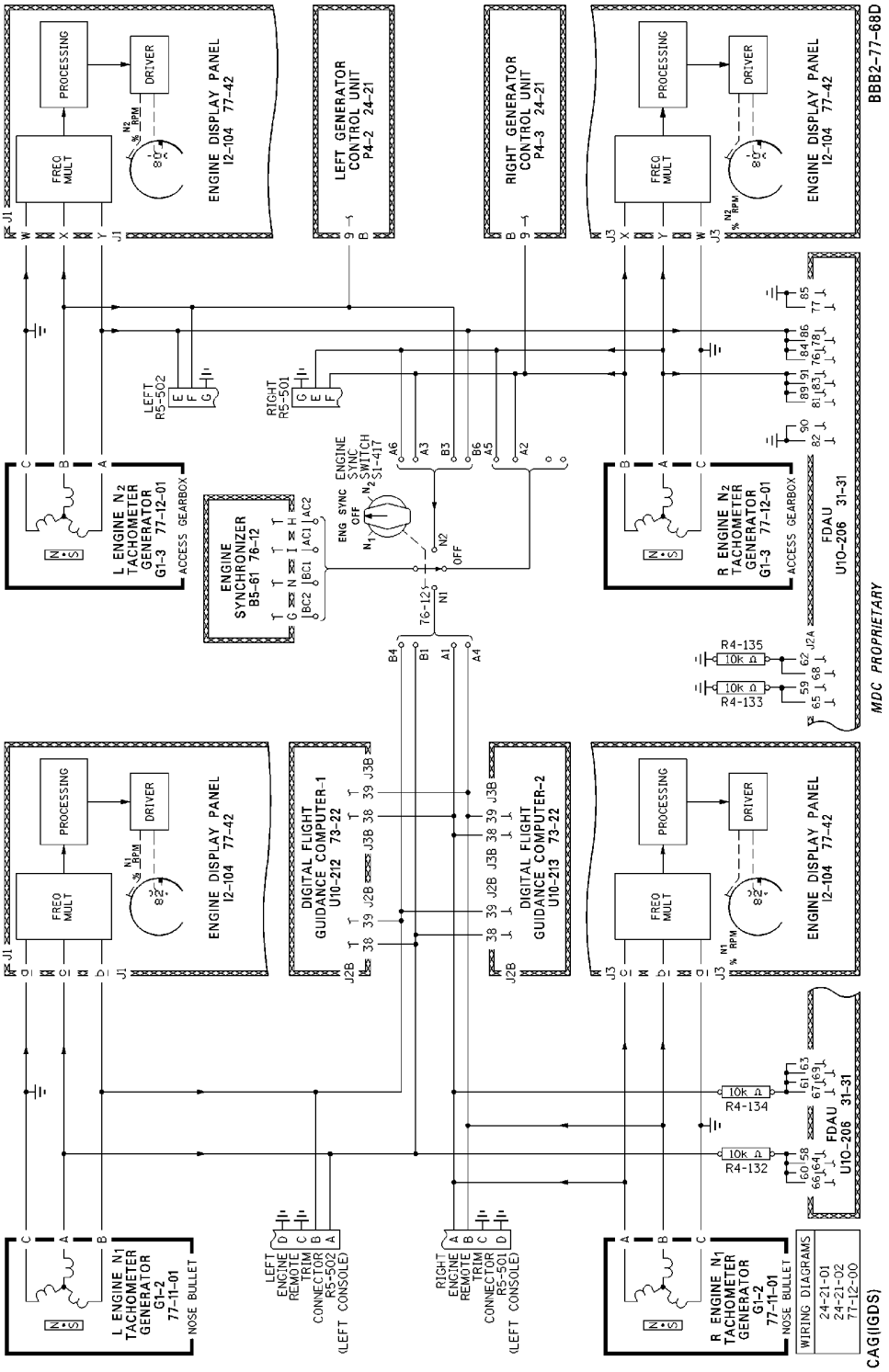
NOTE: Tachometer system wiring and indication system integrity should be checked prior to tachometer generator test.

	Possible Causes	Isolation Procedure	Correction
A. ENGINE TACHOMETER SYSTEM NOT FUNCTIONING			
(1)	Defective pressure ratio display on Engine Display Panel (EDP)	Perform BIT. (SUBJECT 77-10-00, Page 5) If no failure displayed, replace (EDP) with known good (EDP).	If failure is displayed, replace Engine Display Panel (EDP). If failure corrected, replace (EDP).
(2)	Defective tachometer generator		Replace generator.
(3)	Tachometer system wiring open	Remove (EDP) from instrument panel. Disconnect connector from (EDP) and check resistance between pins *C or *B and ground pin *A. Check continuity between ground pin *A and structure. Continuity should be read.	Repair wiring as necessary.
B. ENGINE N_1 or N_2 RPM DISPLAY POINTER FLUCTUATES EXCESSIVELY			
(1)	N_1 or N_2 RPM display on (EDP) defective	Disconnect (EDP) electrical connector and perform test outlined in paragraph 2.A. step (1).	Replace (EDP).
(2)	Loose electrical connection	Check all electrical connections for tightness.	Tighten loose connections.
(3)	Tachometer generator defective		Replace generator.
C. ENGINE N_1 or N_2 RPM DISPLAY READS LOW			
(1)	N_1 or N_2 RPM display on (EDP) defective	Disconnect (EDP) electrical connector and perform test out lined in paragraph 2.A. step (1).	Replace (EDP).
(2)	Tachometer generator defective		Replace generator.

CAUTION: ENSURE ELECTRICAL CONNECTORS ARE CONNECTED TO PROPER INDICATORS UPON COMPLETION OF TROUBLE SHOOTING PROCEDURES.



N_1 and N_2 Indication - Schematic
Figure 101/77-12-01-990-801 (Sheet 1 of 2)



N_1 and N_2 Indication - Schematic
Figure 101/77-12-01-990-801 (Sheet 2 of 2)

N1 RPM AND N2 RPM TACHOMETER SYSTEMS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides engine N_1 RPM and N_2 RPM tachometer systems testing procedures with engines shutdown. Testing is accomplished with a portable tachometer tester or standard test generator at predetermined speeds while simultaneously obtaining similar readings on N_1 and N_2 tachometer indicators.

B. The N_1 tachometer generator is mounted on the engine front accessory drive case under the inlet bullet. The N_2 tachometer generator is mounted on the right side of the engine accessory gearbox.

C. Access to electrical connectors is gained through access door (8105C) for left engine or (8206C) for right engine located on bottom of left and right engine pylons.

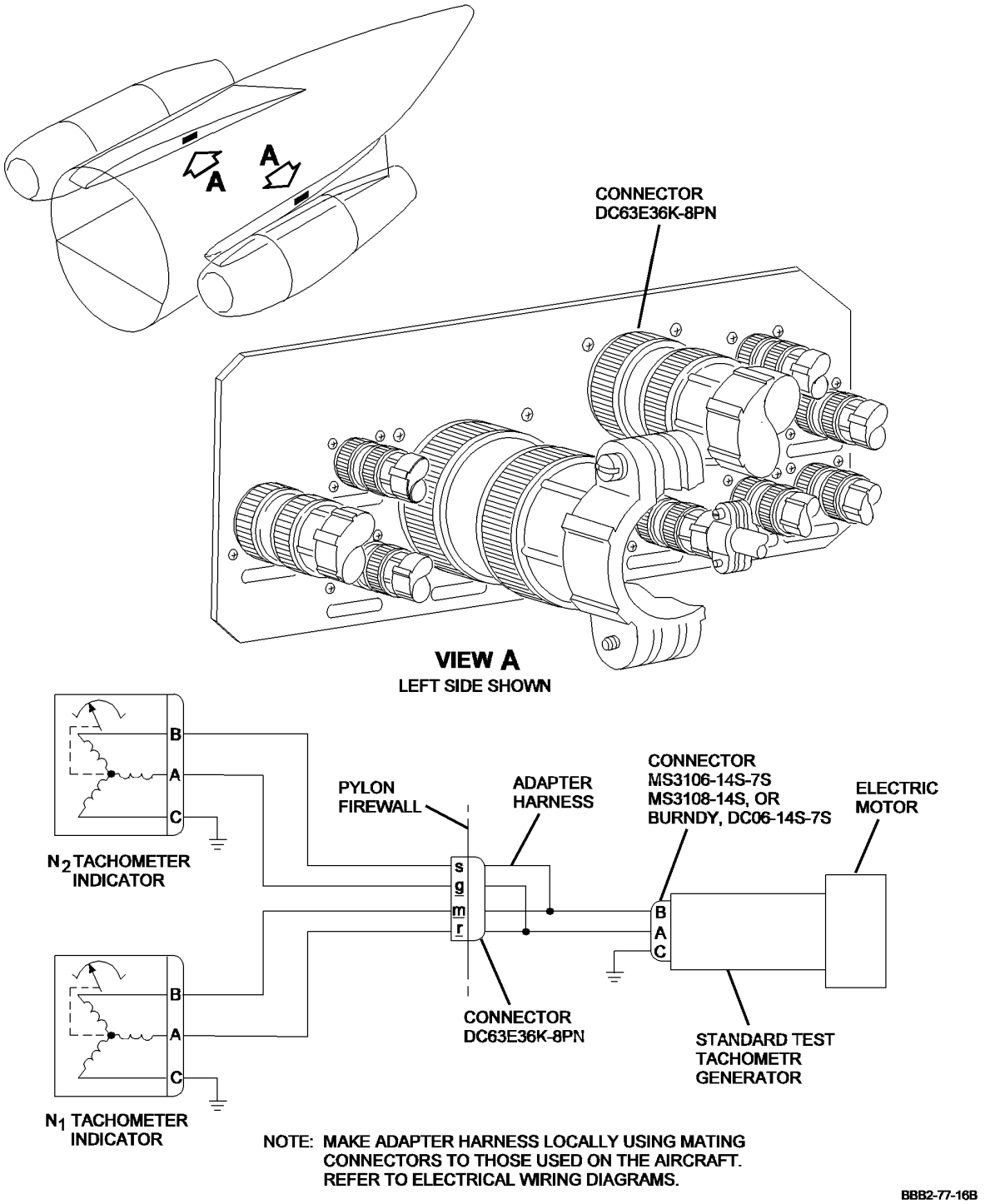
NOTE: Forward lower cowl door overlaps aft lower cowl door and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: IF APU IS USED, MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

D. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.



N_1 RPM and N_2 RPM Tachometer Systems - Test Connections
Figure 201/77-12-01-990-805

EFFECTIVITY
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Generator, standard test (locally fabricated or use tester)	
Harness, adapter (locally fabricated. (Figure 201)	
Motor, electric (locally fabricated or use tester)	
Tester, portable tachometer (P/N CA-11-FCS)	Quantum Dynamics Incorp. (SCC 16951)

3. Adjustment/Test N_1 RPM and N_2 RPM Tachometer Systems

A. Test Tachometer System Using Standard Test Generator (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

NOTE: If desired, tachometer system can be tested using a portable tachometer tester, P/N CA-11-FCS or a standard test generator fabricated locally.

(4) Disconnect electrical connector from R5-5 or R5-6 respectable and connect adapter harness.

(5) With standard test generator set to values listed in Table 202, both N_1 and N_2 indicators on center instrument panel must read the percentages simultaneously and within tolerances noted.

NOTE: Tap the indicators lightly before reading. The cover glass on each indicator must be tight and free of cracks. The indicator pointers must operate smoothly over the scale.

(6) Disconnect test generator adapter harness, connect electrical connector to R5-5 or R5-6 receptacle.

(7) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(8) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(9) Close access door (5901C) for left engine or (5902C) for right engine.

B. Test Tachometer Generator Using Portable Tachometer Tester P/N CA-11-FCS

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

NOTE: The following procedure is applicable to left and right engine tachometer generators.

(4) Remove the applicable tachometer generator from engine. (PAGEBLOCK 77-12-02/201) or (PAGEBLOCK 77-12-03/201)

(5) Mount tachometer generator on tester two-to-one speed booster.

(6) Carefully insert booster drive shaft into tester gear box.

(7) Position swing clamps and secure booster to tester with clamp nuts.

(8) Connect tester power cable to 115 VAC, 60-cycle power source.

(9) Connect tester tachometer test generator cable to tester.

(10) Connect other end of test cable to tachometer generator mounted on tester.

(11) Place tester selector switch in generator test position.

(12) Place tester power switch in on position.

(13) Turn RPM control switch to desired speed.

(14) With engine tachometer generator running at selected speed read master indicator on tester.

(15) Place tester selector switch in indicator test position and read master indicator on tester.

NOTE: This action drives the master tachometer generator located on tester.

(16) Refer to comparison table inside tester cover and check reading obtained in Paragraph 3.B.(13) with reading obtained in Paragraph 3.B.(14).

(17) When malfunction is indicated replace defective tachometer indicator.

(18) Remove and stow test equipment.

(19) Install the applicable tachometer generator on engine. (PAGEBLOCK 77-12-02/201) or (PAGEBLOCK 77-12-03/201)

(20) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(21) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(22) Close access door (5901C) for left engine or (5902C) for right engine.

Table 202 Standard Test Generator Values

Generator RPM	Indicator % RPM	Tolerances % RPM
0	0	±0.50
840	20	±0.50
2520	60	±0.80
4200	100	±0.50

N1 RPM AND N2 RPM TACHOMETER SYSTEMS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides engine N_1 RPM and N_2 RPM tachometer systems testing procedures with engines shutdown. Testing is accomplished with a portable tachometer tester or standard test generator at predetermined speeds while simultaneously obtaining similar readings on N_1 and N_2 tachometer display.

B. The N_1 tachometer generator is mounted on the engine front accessory drive case under the inlet bullet. The N_2 tachometer generator is mounted on the right side of the engine accessory gearbox.

C. Access to electrical connectors is gained through access door (8105C) for left engine or (8206C) for right engine located on bottom of left and right engine pylons.

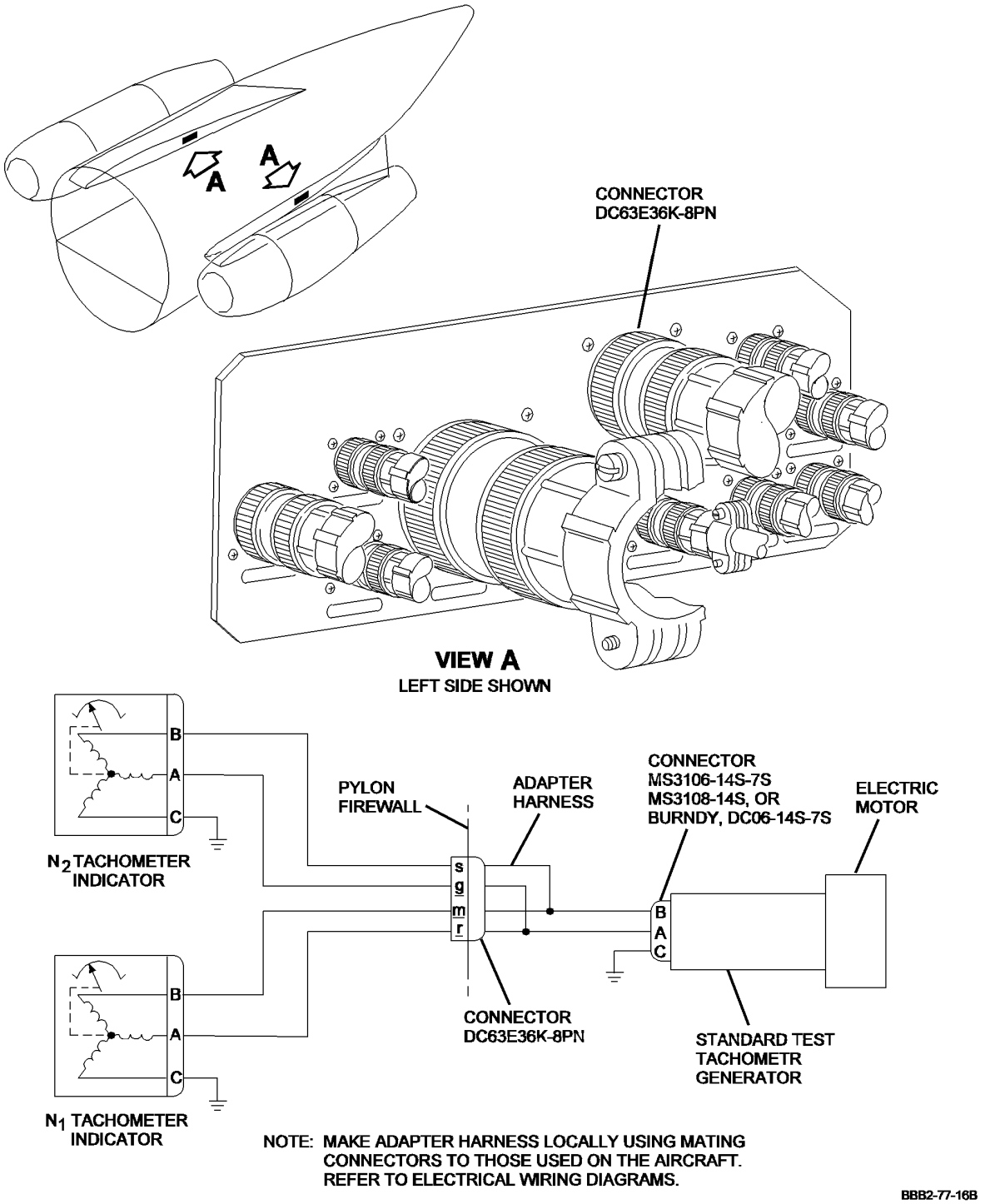
NOTE: Forward lower cowl door overlaps aft lower cowl door and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: IF APU IS USED, MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

D. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.



N_1 RPM and N_2 RPM Tachometer Systems - Test Connections
Figure 201/77-12-01-990-804

EFFECTIVITY
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Generator, standard test (locally fabricated or use tester)	
Harness, adapter (locally fabricated. (Figure 201)	
Motor, electric (locally fabricated or use tester)	
Tester, portable tachometer (P/N CA-11-FCS)	Quantum Dynamics Incorp. (SCC 16951)

3. Adjustment/Test N_1 RPM and N_2 RPM Tachometer Systems

A. Test Tachometer System Using Standard Test Generator (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

NOTE: If desired, tachometer system can be tested using a portable tachometer tester, P/N CA-11-FCS or a standard test generator fabricated locally.

(4) Disconnect electrical connector from R5-5 or R5-6 respectable and connect adapter harness.

(5) With standard test generator set to values listed in Table 202, both N_1 and N_2 displays on Engine Display Panel must read the percentages simultaneously and within tolerances noted.

(6) Disconnect test generator adapter harness, connect electrical connector to R5-5 or R5-6 receptacle.

(7) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(8) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(9) Close access door (5901C) for left engine or (5902C) for right engine.

B. Test Tachometer Generator Using Portable Tachometer Tester P/N CA-11-FCS

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

NOTE: The following procedure is applicable to left and right engine tachometer generators.

(4) Remove the applicable tachometer generator from engine. (PAGEBLOCK 77-12-02/201) or (PAGEBLOCK 77-12-03/201)

(5) Mount tachometer generator on tester two-to-one speed booster.

(6) Carefully insert booster drive shaft into tester gear box.

(7) Position swing clamps and secure booster to tester with clamp nuts.

(8) Connect tester power cable to 115 VAC, 60-cycle power source.

(9) Connect tester tachometer test generator cable to tester.

(10) Connect other end of test cable to tachometer generator mounted on tester.

(11) Place tester selector switch in generator test position.

(12) Place tester power switch in on position.

(13) Turn RPM control switch to desired speed.

(14) With engine tachometer generator running at selected speed read master indicator on tester.

(15) Place tester selector switch in indicator test position and read master indicator on tester.

NOTE: This action drives the master tachometer generator located on tester.

(16) Refer to comparison table inside tester cover and check reading obtained in Paragraph 3.B.(13) with reading obtained in Paragraph 3.B.(14).

(17) When malfunction is indicated replace defective tachometer indicator.

(18) Remove and stow test equipment.

(19) Install the applicable tachometer generator on engine. (PAGEBLOCK 77-12-02/201) or (PAGEBLOCK 77-12-03/201)

(20) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(21) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(22) Close access door (5901C) for left engine or (5902C) for right engine.

Table 202 Standard Test Generator Values

Generator RPM	Indicator % RPM	Tolerances % RPM
0	0	±0.50
840	20	±0.50
2520	60	±0.80
4200	100	±0.50

N1 TACHOMETER GENERATOR - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the N_1 tachometer generator. The generator is mounted on the engine front accessory drive case under the inlet bullet.

B. Maintenance of the generator is limited to removal/installation. Removal/installation procedures for the generator on all engines are identical. Access to the generator is through removal of the inlet bullet.

CAUTION: BEFORE WORKING IN NOSE COWL A PROTECTIVE BLANKET SHOULD BE SPREAD INSIDE NOSE COWL. VACUUM INSIDE NOSE COWL TO REMOVE PARTICLES WHICH MAY CAUSE DAMAGE TO PERFORATED SKIN. ANY DAMAGE TO PERFORATED SKIN MAY CAUSE DISSIMILAR METAL REACTION WHICH COULD SPREAD TO SURROUNDING AREA.

C. The N_1 tachometer indicator is located on the center instrument panel in the flight compartment.

Removal/installation procedures are outlined in PAGEBLOCK 77-10-00/201.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Plug pliers	
Torque wrench (0 to 200 inch pounds (22.6 N·m) range)	
Lockwire .020 corrosion resistant steel, P05-288	
Grease MIL-G-23827 DPM 326	
Petrolatum VV-P-236 DPM 675	

3. Removal/Installation N_1 Tachometer Generator

A. Remove Generator (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6555 TO 7245 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(4) Loosen captive self-locking nuts attaching inlet bullet to engine inlet case.

(5) Carefully pull inlet bullet forward to disengage P_{t2} receptacle from engine P_{t2} coupler.

(6) Place inlet bullet on suitable pad to prevent damage to P_{t2} receptacle.

(7) Remove O-ring from front accessory drive case.

(8) Remove O-rings from engine P_{t2} coupler.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT PLUG.

(9) Disconnect N_1 tachometer generator electrical connector.

(10) Remove N_1 tachometer generator and generator mount pad gasket.

B. Install Generator (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Install new gasket on mounting pad.

(4) Lightly lubricate generator drive shaft with light coating of grease (MIL-G-23827).

(5) Position generator on mounting pad studs, and install washers and nuts. Torque nuts to 50 to 70 inch-pounds (5.6 to 7.9 N·m).

WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 891-893

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT OR CONNECT PLUG. WHEN CONNECTING PLUG, DO NOT OVERTIGHTEN.

(6) Connect electrical connector to tachometer generator. Safety connector with P05-288 lockwire.

NOTE: Connector is properly installed when no relative motion exists between backshell and coupling ring.

(7) Lightly lubricate new O-rings with petrolatum (VV-P-236) and install on engine $P_{t\,2}$ coupler.

WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 891-893 (Continued)

(8) Lightly lubricate new O-ring with petrolatum (VV-P-236) and install on front accessory drive case.

(9) Check inlet probe tubes and inlet bullet to ensure no foreign matter is present.

(10) Carefully align Pt_2 probe receptacle and coupler and install inlet bullet.

(11) Tighten captive nuts to torque of 100 to 140 inch-pounds (11.3 to 15.8 N·m).

(12) Check that gap between inlet bullet and engine front accessory drive case is 0.050 to 0.130 inch (1.270 to 3.302 mm). (PAGEBLOCK 71-10-02/201)

(13) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 891-893			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

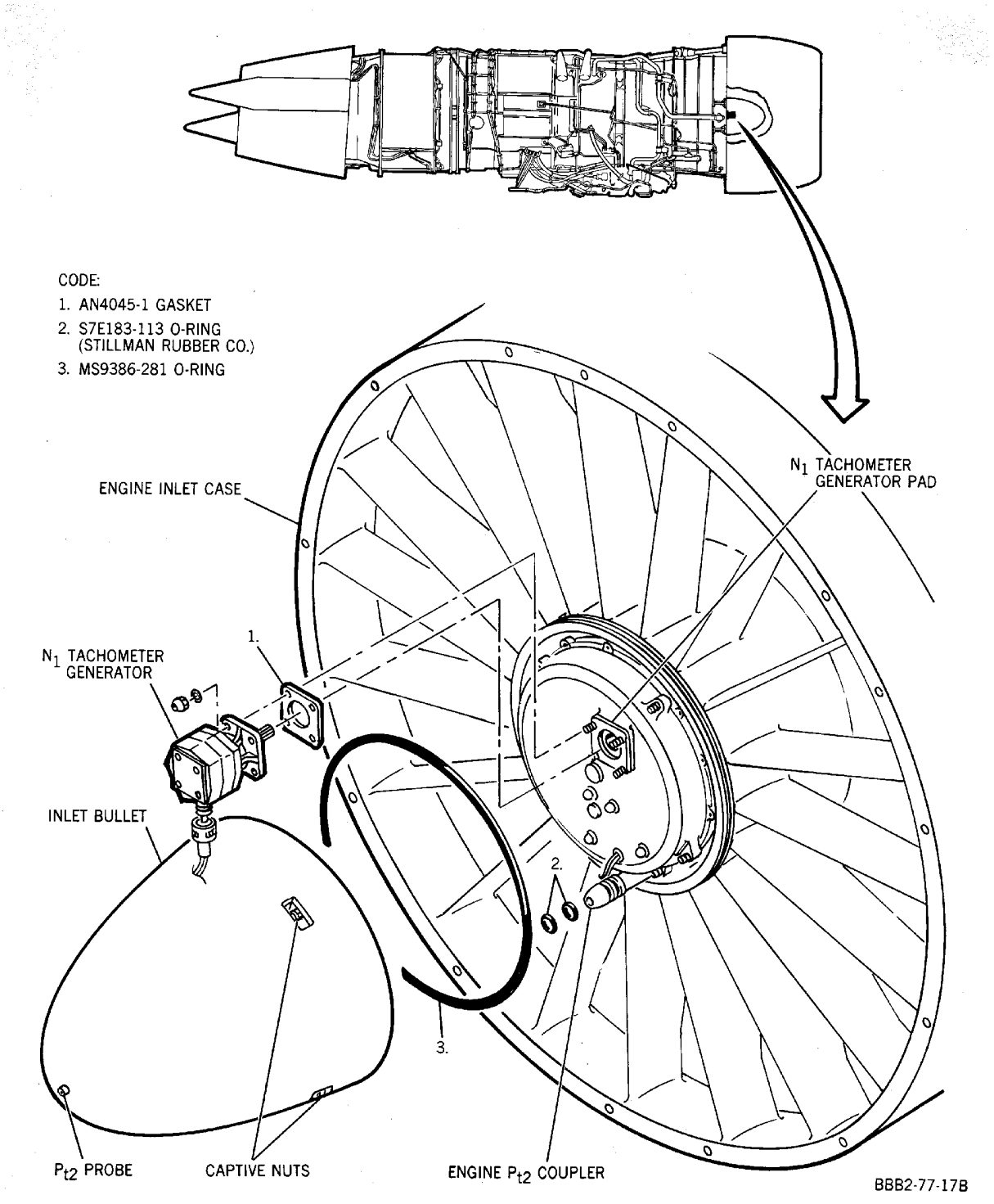
WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(14) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(15) Close access door (5901C) for left engine or (5902C) for right engine.

(16) Check N_1 tachometer generator for proper operation during next engine run.

WJE ALL



N_1 Tachometer Generator - Installation
Figure 201/77-12-02-990-801

N2 TACHOMETER GENERATOR - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the N_2 tachometer generator. The generator is mounted on the right side of the engine accessory gearbox.

B. Maintenance of the generator is limited to removal/installation. Removal/installation procedures for the generator on all engines are identical. Access to the generator is through the aft lower cowl door.

NOTE: Forward lower cowl door overlaps aft lower cowl door and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

C. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.

D. The N_2 tachometer indicator is located on the center instrument panel in the flight compartment. Removal/installation procedures are provided in POWER, SUBJECT 77-10-00, Page 201.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Plug pliers	
Torque wrench (0 to 100 inch pounds (0 to 11.3 N·m) range)	
Lockwire .020 corrosion resistant steel P05-288	
Grease MIL-G-23827 DPM 326	

3. Removal/Installation N_2 Tachometer Generator

A. Remove Generator. (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6555 TO 7245 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTORS, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT PLUG.

(4) Disconnect connector from tachometer.

(5) Remove N_2 tachometer generator and gasket from accessory gearbox studs.

B. Install Generator (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT

WJE 415-427, 429, 861-866, 868, 869, 871-874, 891 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Install generator gasket on accessory drive gearbox studs.

(4) Lightly lubricate generator drive shaft with light coating of grease (MIL-G-23827).

(5) Position generator on studs with electrical connector positioned outboard, and install washers and nuts. Torque nuts to 50 to 70 inch-pounds (5.7 to 7.9 N·m).

WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 891-893

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT OR CONNECT PLUG. WHEN CONNECTING PLUG, DO NOT OVERTIGHTEN.

(6) Connect electrical connector to tachometer generator. Safety connector with P05-288 lockwire.

NOTE: Connector is properly installed when no relative motion exists between backshell and coupling ring.

WJE ALL

(7) Remove tools, equipment, loose hardware, and debris from maintenance area.

(8) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

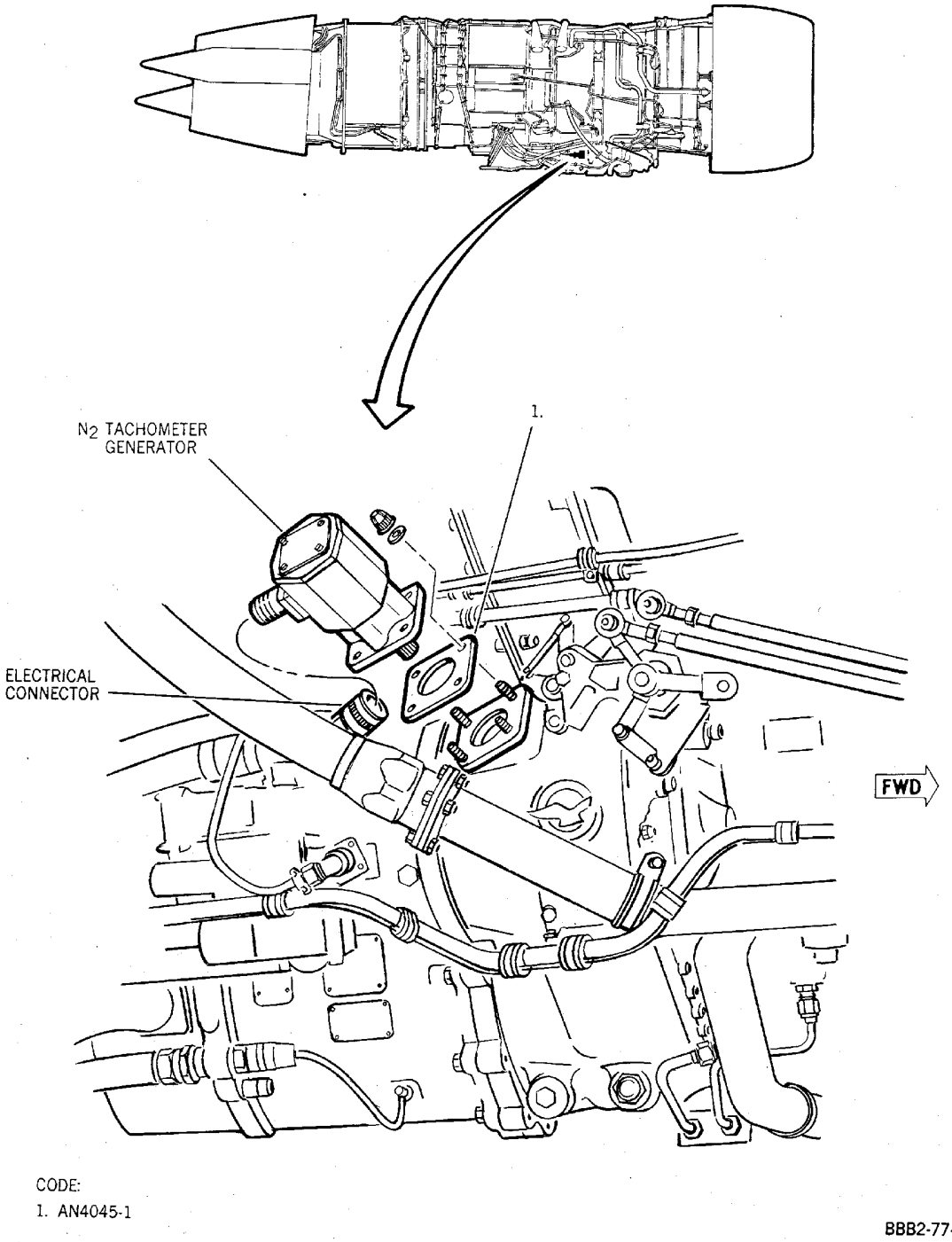
Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(9) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(10) Close access door (5901C) for left engine or (5902C) for right engine.

(11) Check N_2 tachometer generator for proper operation during next engine run.



N_2 Tachometer Generator - Installation
Figure 201/77-12-03-990-801

TEMPERATURE - DESCRIPTION AND OPERATION

1. General

A. Engine indicating temperature subsystem furnishes a display of EGT. EGT measures the temperature of the exhaust gas stream at the high pressure turbine exhaust, and transmits this measurement in the form of an electrical signal to an indicator in the flight compartment. The system utilizes thermocouple-type heat-sensing probes, an electrical cable for transmitting the signal, and an analog pointer type indicator.

2. Exhaust Gas Temperature (EGT) Indication

A. Description

(1) The engine EGT system consists of an EGT indicator, eight dual junction thermocouple probes, a thermocouple cable terminal box, and an averaging cable. The system is supplied 28 Volts Direct Current (VDC) power through a circuit breaker located on the overhead panel.

(2) The EGT system monitors the engine exhaust gas temperature by means of dual junction thermocouple probes that generate electrical signals which are transmitted to the EGT indicator by an EGT thermocouple cable and aircraft wiring harness.

(3) EGT Thermocouple Probe - Each thermocouple contains two thermocouple junctions which are parallel and are electrically averaged in the head of the thermocouple. A short alumel circuit and a long chromel circuit extend into the gaspath. High temperature in the engine exhaust induces voltage in the alumel and chromel circuits, and the voltage obtainable across the terminal studs at the head of the thermocouple is an average of the voltage induced at each of the internal junctions. Thermocouple function is primarily a result of different materials (alumel and chromel) at the thermocouple junctions and the temperature differential between the "hot" junction and the "cold" junction. The hot junction (thermocouple) is located in the area to be measured (exhaust stream), and the cold junction is generally located in the flight compartment instrument. With different materials and a temperature differential between the hot and cold junctions, a voltage is induced in the thermocouple circuit which is proportional to the temperature differential and which can be measured via a calibrated instrument in the flight compartment. The thermocouple probes are located at eight positions around the turbine exhaust case.

(4) Two types of wire are used in the system: chromel and alumel. The chromel wire is non-magnetic, positive, and color-coded white. The alumel wire is magnetic, negative, and color-coded green.

(5) EGT Thermocouple Harness Cable - The thermocouple cable assembly consists of an electrical harness connecting each of the thermocouple circuits to a common junction box. The cable runs around the outer circumference of the fan exhaust outer duct, with a branch of the harness attached to each thermocouple stud. The eight thermocouple circuits are averaged at a junction box at the bottom of the engine using a central bus bar, where wiring is connected to transmit the signals to the EGT indicator located on the center instrument panel in the flight compartment.

(6) EGT Thermocouple Terminal Box - The EGT thermocouple terminal box consists of two terminal blocks and a cover. Studs on the terminal blocks are chromel and alumel. The terminal box is mounted on the turbine exhaust case at approximately the 5 o'clock position. The terminal box connects one set of junctions of each thermocouple probe in parallel to provide an averaging circuit. Connection to the circuit is made at the terminal box stud terminals. In addition, the second set of thermocouple probe junctions are connected to the terminal box stud terminals so the readings of each probe can be obtained individually. This permits maintenance personnel to check for engine exhaust gas temperature spread.

(7) EGT Indicator - The EGT indicator converts the heat-generated temperature signal from the thermocouple probes to a visual display of exhaust gas temperature. The indicator contains the necessary electronics for processing the signals from the thermocouple probes, and provides the following: pointer display for exhaust gas temperature in degrees centigrade. The indicator displays the exhaust gas temperature for a range of zero to 800 degrees centigrade.

B. Operation

(1) Heating of the thermocouple probes during engine operation generates a small current at each of the 16 thermocouple junctions (two per probe). Individual temperature samplings by one junction of each probe are averaged by the parallel-wired, EGT cable circuit. The resultant averaged signal is conveyed to the EGT indicator in the flight compartment.

TEMPERATURE - DESCRIPTION AND OPERATION

1. General

A. Engine indicating temperature subsystem furnishes a display of EGT. EGT measures the temperature of the exhaust gas stream at the high pressure turbine exhaust, and transmits this measurement in the form of an electrical signal to an Engine Display Panel in the flight compartment. The system utilizes thermocouple-type heat-sensing probes, an electrical cable for transmitting the signal, and displays the information in digital as well as analog format.

2. Exhaust Gas Temperature (EGT) Indication

A. Description

(1) The engine EGT system consists of an Engine Display Panel eight dual junction thermocouple probes, a thermocouple cable terminal box, and an averaging cable. The system is supplied 28 VDC power through a circuit breaker located on the overhead panel.

(2) The EGT system monitors the engine exhaust gas temperature by means of dual junction thermocouple probes that generate electrical signals which are transmitted to the Engine Display Panel by an EGT thermocouple cable and aircraft wiring harness.

(3) EGT Thermocouple Probe - Each thermocouple contains two thermocouple junctions which are parallel and are electrically averaged in the head of the thermocouple. A short alumel circuit and a long chromel circuit extend into the gaspath. High temperature in the engine exhaust induces voltage in the alumel and chromel circuits, and the voltage obtainable across the terminal studs at the head of the thermocouple is an average of the voltage induced at each of the internal junctions. Thermocouple function is primarily a result of different materials (alumel and chromel) at the thermocouple junctions and the temperature differential between the "hot" junction and the "cold" junction. The hot junction (thermocouple) is located in the area to be measured (exhaust stream), and the cold junction is generally located in the flight compartment instrument. With different materials and a temperature differential between the hot and cold junctions, a voltage is induced in the thermocouple circuit which is proportional to the temperature differential and which can be measured via a calibrated instrument in the flight compartment. The thermocouple probes are located at eight positions around the turbine exhaust case.

(4) Two types of wire are used in the system: chromel and alumel. The chromel wire is non-magnetic, positive, and color-coded white. The alumel wire is magnetic, negative, and color-coded green.

(5) EGT Thermocouple Harness Cable - The thermocouple cable assembly consists of an electrical harness connecting each of the thermocouple circuits to a common junction box. The cable runs around the outer circumference of the fan exhaust outer duct, with a branch of the harness attached to each thermocouple stud. The eight thermocouple circuits are averaged at a junction box at the bottom of the engine using a central bus bar, where wiring is connected to transmit the signals to the Engine Display Panel located on the center instrument panel in the flight compartment.

(6) EGT Thermocouple Terminal Box - The EGT thermocouple terminal box consists of two terminal blocks and a cover. Studs on the terminal blocks are chromel and alumel. The terminal box is mounted on the turbine exhaust case at approximately the 5 o'clock position. The terminal box connects one set of junctions of each thermocouple probe in parallel to provide an averaging circuit. Connection to the circuit is made at the terminal box stud terminals. In addition, the second set of thermocouple probe junctions are connected to the terminal box stud terminals so the readings of each probe can be obtained individually. This permits maintenance personnel to check for engine exhaust gas temperature spread.

(7) EGT Indication - The Engine Display Panel converts heat-generated temperature signal from thermocouple probes to a visual display of exhaust gas temperature. EGT thermocouple input is conditioned by a high grade instrumentation amplifier and then digitized. Cold junction temperature is sensed by a solid state transducer and also digitized. From these digitized values, the EGT is computed, and thermocouple law compensation correction made. Computed EGT is formatted and output to the counter/pointer display. Display for EGT is in degrees centigrade. EGT limit markings are indicated on dial face.

B. Operation

(1) Heating of the thermocouple probes during engine operation generates a small current at each of the 16 thermocouple junctions (two per probe). Individual temperature samplings by one junction of each probe are averaged by the parallel-wired, EGT cable circuit. The resultant averaged signal is conveyed to the Engine Display Panel in the flight compartment.

EXHAUST GAS TEMPERATURE (EGT) INDICATION - TROUBLE SHOOTING

1. General

A. This maintenance practice provides trouble shooting procedures for the EGT indication system.

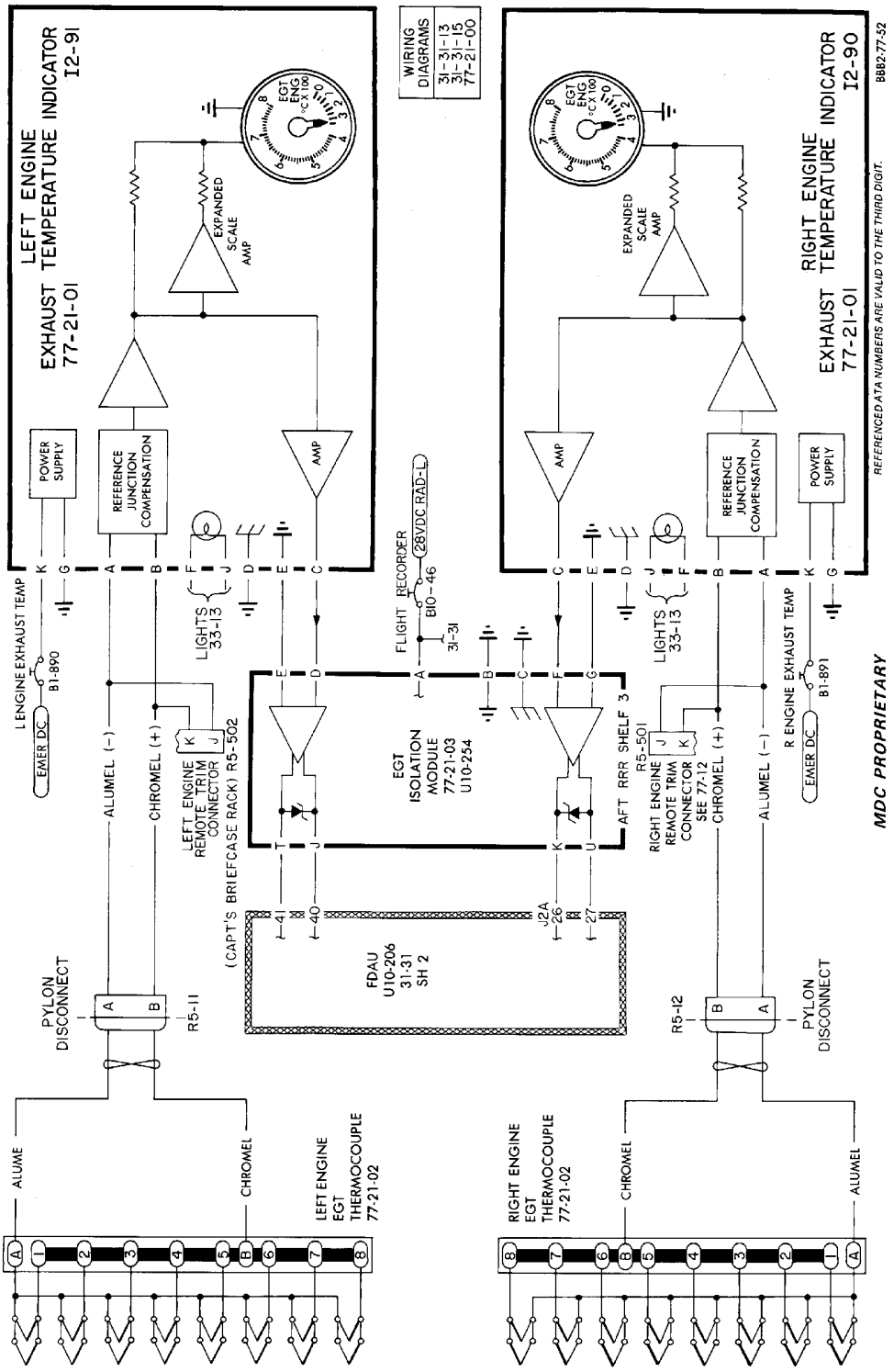
NOTE: The EGT indication system will meet required accuracy when either thermocouple lead has a resistance value up to 200 ohms.

2. Trouble Shooting Exhaust Gas Temperature (EGT) Indication

	Possible Causes	Isolation Procedure	Correction
A. ENGINE EXHAUST GAS TEMPERATURE SYSTEM NOT FUNCTIONING			
CAUTION: DO NOT PLACE AN OHMMETER ACROSS THE INDICATOR TERMINALS AS PERMANENT DAMAGE WILL RESULT.			
(1)	Thermocouple lead broken	Remove indicator from instrument panel. (PAGEBLOCK 77-21-01/201) Disconnect thermocouple leads from indicator. Check between thermocouple leads for continuity.	If continuity is present, replace indicator.
(2)	Exhaust temperature indicator defective	Ref. step (1).	Ref. step (1).
B. ENGINE EXHAUST GAS TEMPERATURE INDICATOR FLUCTUATES			
(1)	Loose thermocouple connection	Check all thermocouple connections for tightness.	Tighten connections as necessary.
(2)	Exhaust temperature indicator defective		Replace indicator.
C. ENGINE EXHAUST GAS TEMPERATURE INDICATOR READS LOW IN COMPARISON TO EPR, N_1 and N_2			
(1)	Corrosion on connections	Check connections for corrosion.	Clean connections if corroded.
(2)	Exhaust temperature indicator defective	Ref. 2.A. step (1).	Ref. 2.A. step (1).
(3)	Thermocouple leads open	Disconnect thermocouple leads from indicator and connect leads together. Disconnect thermocouple leads at thermocouple junction block on engine. Check for continuity across thermocouple terminals.	If circuit is continuous, and thermocouple circuit complete, refer to steps (1) and (2). If thermocouple circuit is open, refer to SUBJECT 77-21-04.
D. ENGINE EXHAUST GAS TEMPERATURE INDICATOR READS HIGH IN COMPARISON TO EPR, N_1 and N_2			
CAUTION: DO NOT PLACE AN OHMMETER ACROSS THE INDICATOR TERMINALS AS PERMANENT DAMAGE WILL RESULT.			

(Continued)

Possible Causes		Isolation Procedure	Correction
(1)	Exhaust temperature indicator defective	Remove indicator from instrument panel. (PAGEBLOCK 77-21-01/201) Disconnect thermocouple leads from indicator. Check between thermocouple leads for continuity.	If continuity is present, replace indicator.



EGT Indication - Schematic
Figure 101/77-21-00-990-801

EFFECTIVITY
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

EXHAUST GAS TEMPERATURE (EGT) INDICATION - TROUBLE SHOOTING

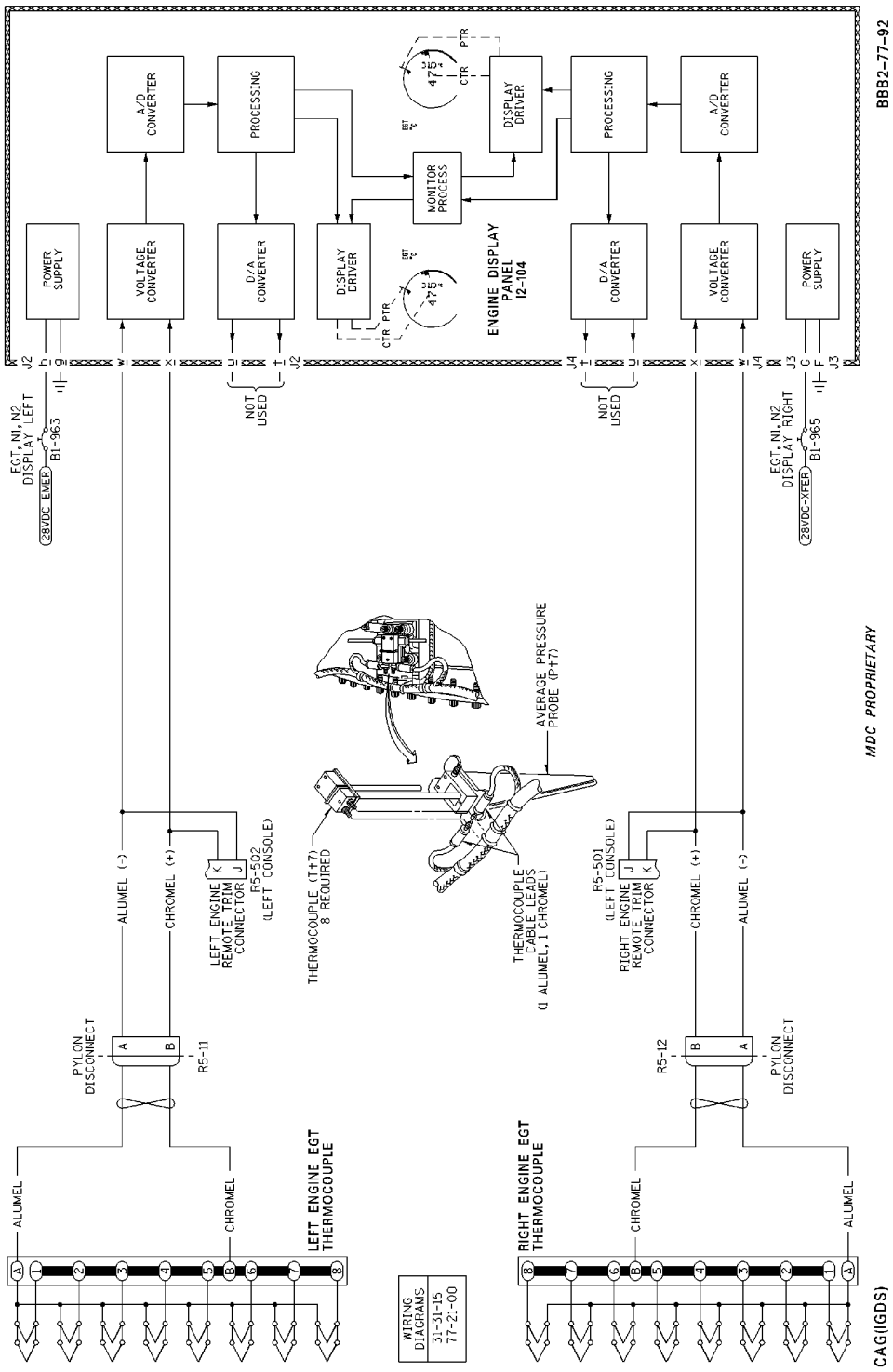
1. General

A. This maintenance practice provides trouble shooting procedures for the EGT indication system.

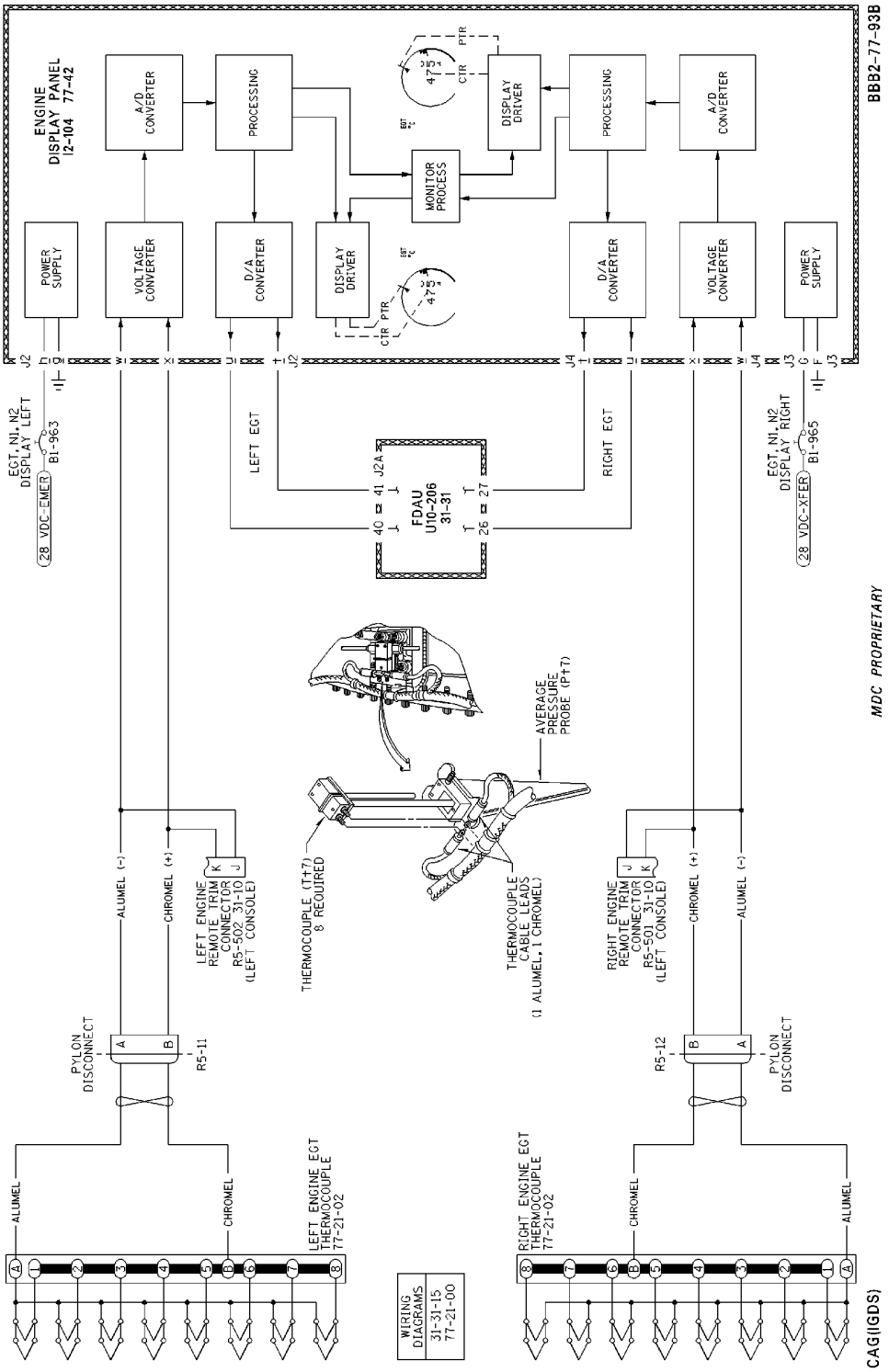
NOTE: The EGT indication system will meet required accuracy when either thermocouple lead has a resistance value up to 200 ohms.

2. Trouble Shooting Exhaust Gas Temperature (EGT) Indication

	Possible Causes	Isolation Procedure	Correction
A. ENGINE EXHAUST GAS TEMPERATURE SYSTEM NOT FUNCTIONING			
(1)	Thermocouple lead broken	Remove Engine Display Panel (EDP). (POWER, SUBJECT 77-10-00, Page 201) Disconnect (EDP) check continuity.	If continuity present replace (EDP).
(2)	Defective EGT display on (EDP)	Perform BIT. (SUBJECT 77-10-00, Page 5) If on failure is displayed, replace (EDP) with known good (EDP).	If failure is displayed, replace (EDP). If failure connected, replace (EDP).
B. ENGINE EXHAUST GAS TEMPERATURE INDICATOR FLUCTUATES			
(1)	Loose thermocouple connection	Check all thermocouple connections for tightness.	Tighten connections as necessary.
(2)	Defective EDP display on EDP.	Ref. 2.A. step (2).	Ref. 2.A. step (2).
C. ENGINE EXHAUST GAS TEMPERATURE READS LOW IN COMPARISON TO EPR, N_1 and N_2			
(1)	Corrosion on connections	Check connections for corrosion.	Clean connections if corroded.
(2)		Ref. 2.A. step (2).	Ref. 2.A. step (2).
(3)	Thermocouple leads open	Disconnect connector from EDP. Disconnect thermocouple leads at thermocouple junction block on engine. Check for continuity across thermocouple terminals.	If circuit is continuous, and thermocouple circuit complete, refer to steps (1) and (2). If thermocouple circuit is open, refer to SUBJECT 77-21-04.
D. ENGINE EXHAUST GAS TEMPERATURE READS HIGH IN COMPARISON TO EPR, N_1 and N_2			
(1)	Defective pressure ratio display on Engine Display Panel (EDP)	Perform BIT. (SUBJECT 77-10-00, Page 5) If no failure displayed, replace (EDP) with known good (EDP).	If failure is displayed, replace Engine Display Panel (EDP). If failure corrected, replace (EDP).



EGT Indication - Schematic
Figure 101/77-21-00-990-802 (Sheet 1 of 2)



EGT Indication - Schematic
Figure 101/77-21-00-990-802 (Sheet 2 of 2)

EXHAUST GAS TEMPERATURE (EGT) INDICATION - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides adjustment/test procedures to verify the accuracy of the complete EGT system during engine operation. Test is accomplished on the ground by comparison of the flight compartment EGT indicator with a calibrated test instrument.

B. The adjustment/test procedures for the EGT systems on all engines are identical. Access for installation of the test cable is through the upper and aft lower cowl doors.

NOTE: Lower forward cowl doors overlap aft lower cowl doors and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: OPEN UPPER COWL DOOR ONLY AS MUCH AS NECESSARY TO ALLOW HOLD-OPEN RODS TO BE CONNECTED TO ENGINE. OPENING DOOR TOO FAR MAY CAUSE DAMAGE TO PYLON HINGE POINTS.

CAUTION: IF APU IS USED, MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

C. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.

CAUTION: SHOULD MAINTENANCE BE REQUIRED ON CONNECTORS IN EGT SYSTEM AIRCRAFT WIRING, MAKE CERTAIN THAT NO INTER-MIXING OF CHROMEL AND ALUMEL WIRES AND CONNECTOR COMPONENTS OCCURS. WHEREVER CHROMEL AND ALUMEL PARTS MAKE CONTACT, A NEW THERMOCOUPLE JUNCTION OCCURS THAT WILL CREATE UNPREDICTABLE ERRORS IN EGT INDICATIONS.

D. Aircraft wiring used in the EGT indicating system consists of two types of wire: chromel and alumel. Chromel wire is positive, non-magnetic, color coded white, and connected to chromel pins and sockets. Alumel wire is negative, magnetic, color coded green and connected to alumel pins and sockets.

NOTE: A quick and accurate check can be accomplished with a magnet. Alumel will be attracted by the magnet, chromel will not.

2. Equipment and Materials

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

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Lockwire, .020 corrosion resistant steel, P05-288	
Torque wrench (0 to 50 inch pounds (0 to 5.70 N·m) range)	

Table 201 (Continued)

Name and Number	Manufacturer
Temperature Potentiometer (0 to 660°C range)	
Test cable (locally fabricated)	

3. Adjustment/Test Exhaust Gas Temperature (EGT) Indication

A. Test System (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

WARNING: TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

CAUTION: MAKE CERTAIN THAT CHROMEL TERMINAL OF TEST CABLE IS CONNECTED TO CHROMEL STUD AND ALUMEL TERMINAL IS CONNECTED TO ALUMEL STUD AND THAT CHROMEL AND ALUMEL NUTS ARE ON THEIR RESPECTIVE STUDS.

(4) At EGT thermocouple cable junction box, located on the lower, right, aft side of turbine case, connect test cable to system connection terminal studs.

CAUTION: ROUTE AND SECURE CABLE AS FAR AS POSSIBLE FROM HOT ENGINE PARTS TO PREVENT BURNING OF INSULATION.

(5) Connect chromel and alumel wires of test cable to potentiometer.

NOTE: The alumel (green insulation) wire connects to the (-) negative connection. The chromel (white insulation) wire connects to the (+) positive connection.

(6) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(7) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(8) Close access door (5901C) for left engine or (5902C) for right engine.

(9) Place potentiometer in ON position.

(10) With affected engine not running, compare flight compartment EGT indicator reading with temperature potentiometer reading. Readings should agree within ±10°C.

(11) Start affected engine. (GENERAL, SUBJECT 71-00-00, Page 501)

(12) With affected engine running at part power and or takeoff power, compare flight compartment EGT indicator reading with temperature potentiometer reading. Reading should agree within ±6°C.

(13) Place potentiometer in OFF position.

(14) If comparisons are not within limits of Paragraph 3.A.(10) and Paragraph 3.A.(12), check for crossed connection (chromel to alumel junctions) in aircraft wiring.

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

WARNING: TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(15) Tag throttle/thrust reverser lever, and open and tag following circuit breakers

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT

(Continued)

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(16) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(17) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(18) Disconnect test harness at potentiometer and at EGT thermocouple cable junction box.

(19) Torque alumel nuts (0.190-32 thread size) 18 to 22 inch-pounds (2.03 to 2.49 N·m).

(20) Torque chromel nuts (0.164-32 thread size) 15 to 18 inch-pounds (1.70 to 2.03 N·m).

(21) Remove test cable.

(22) Remove tools, equipment, loose hardware, and debris from maintenance area.

(23) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 407, 408, 411, 880, 884, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 407, 408, 411, 880, 884, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	26	B1-424	LEFT ENGINE IGNITION

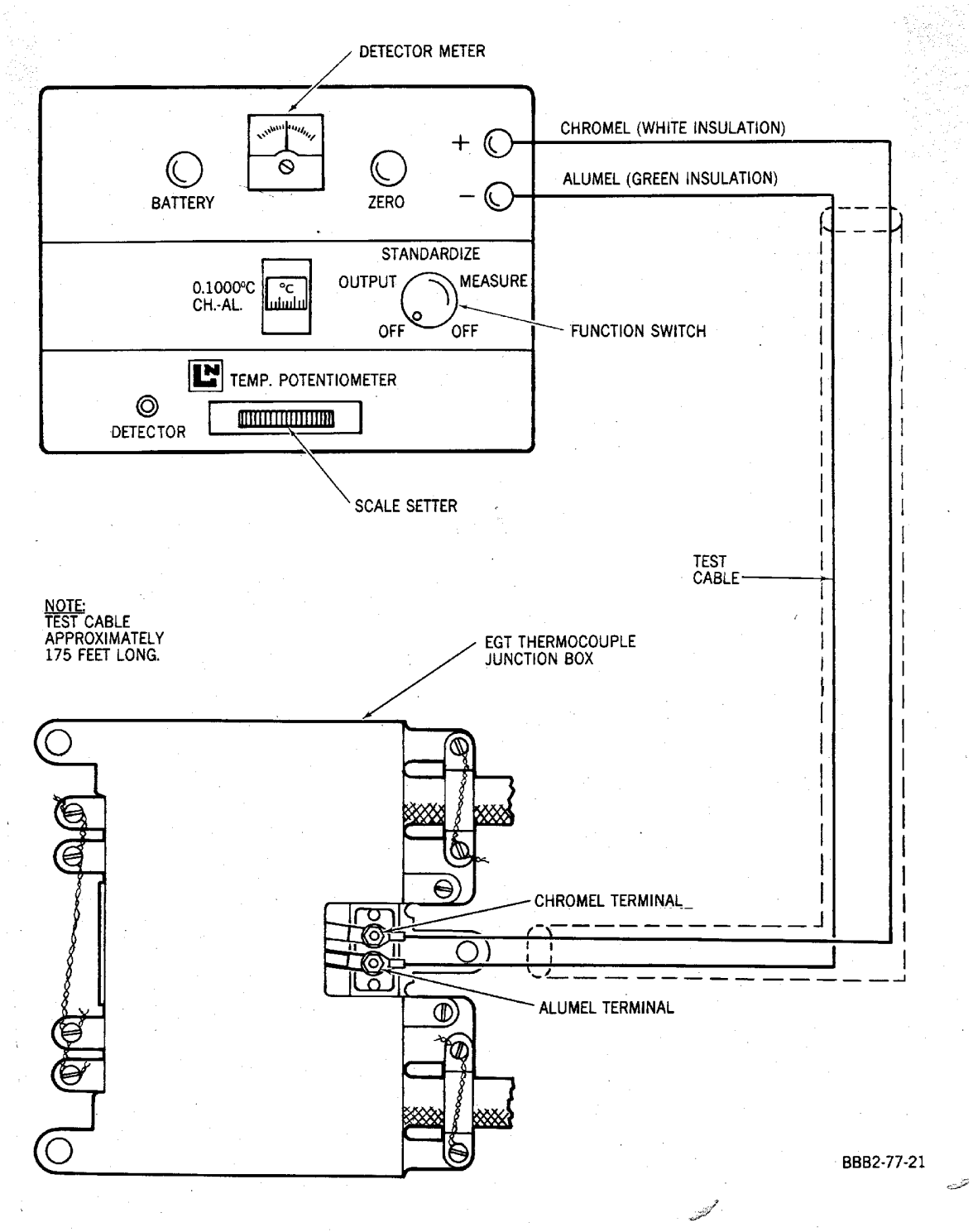
UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(24) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(25) Close access door (5901C) for left engine or (5902C) for right engine.



Temperature Potentiometer and Test Cable - Connections
Figure 201/77-21-00-990-804

EXHAUST GAS TEMPERATURE (EGT) INDICATION - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides adjustment/test procedures to verify the accuracy of the complete EGT system during engine operation. Test is accomplished on the ground by comparison of the flight compartment EGT display with a calibrated test instrument.

B. The adjustment/test procedures for the EGT systems on all engines are identical. Access for installation of the test cable is through the upper and aft lower cowl doors.

NOTE: Lower forward cowl doors overlap aft lower cowl doors and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: OPEN UPPER COWL DOOR ONLY AS MUCH AS NECESSARY TO ALLOW HOLD-OPEN RODS TO BE CONNECTED TO ENGINE. OPENING DOOR TOO FAR MAY CAUSE DAMAGE TO PYLON HINGE POINTS.

CAUTION: IF APU IS USED, MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

C. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.

CAUTION: SHOULD MAINTENANCE BE REQUIRED ON CONNECTORS IN EGT SYSTEM AIRCRAFT WIRING, MAKE CERTAIN THAT NO INTER-MIXING OF CHROMEL AND ALUMEL WIRES AND CONNECTOR COMPONENTS OCCURS. WHEREVER CHROMEL AND ALUMEL PARTS MAKE CONTACT, A NEW THERMOCOUPLE JUNCTION OCCURS THAT WILL CREATE UNPREDICTABLE ERRORS IN EGT INDICATIONS.

D. Aircraft wiring used in the EGT indicating system consists of two types of wire: chromel and alumel. Chromel wire is positive, non-magnetic, color coded white, and connected to chromel pins and sockets. Alumel wire is negative, magnetic, color coded green and connected to alumel pins and sockets.

NOTE: A quick and accurate check can be accomplished with a magnet. Alumel will be attracted by the magnet, chromel will not.

2. Equipment and Materials

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

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Lockwire, .020 corrosion resistant steel, P05-288	
Torque wrench (0 to 50 inch pounds (0 to 5.70 N·m) range)	

Table 201 (Continued)

Name and Number	Manufacturer
Temperature Potentiometer (0 to 660°C range)	
Test cable (locally fabricated)	

3. Adjustment/Test Exhaust Gas Temperature (EGT) Indication

A. Test System (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	41	B1-2	ENGINE IGNITION RIGHT

WJE 405, 406, 410, 877, 886, 887

U	41	B1-423	ENGINE START VALVE RIGHT

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872

U	42	B1-1	ENGINE IGNITION LEFT

WJE 405, 406, 410, 877, 886, 887

U	42	B1-422	ENGINE START VALVE LEFT

WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

X	35	B1-965	EGT, N1, N2 DISPLAY RIGHT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name

WJE 401-404, 406, 412, 414, 875-879, 886, 887

B	15	B1-963	EGT, N1, N2 DISPLAY LEFT

WJE 410

B	16	B1-963	EGT, N1, N2 DISPLAY LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name

WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

CAUTION: MAKE CERTAIN THAT CHROMEL TERMINAL OF TEST CABLE IS CONNECTED TO CHROMEL STUD AND ALUMEL TERMINAL IS CONNECTED TO ALUMEL STUD AND THAT CHROMEL AND ALUMEL NUTS ARE ON THEIR RESPECTIVE STUDS.

(4) At EGT thermocouple cable junction box, located on the lower, right, aft side of turbine case, connect test cable to system connection terminal studs.

CAUTION: ROUTE AND SECURE CABLE AS FAR AS POSSIBLE FROM HOT ENGINE PARTS TO PREVENT BURNING OF INSULATION.

(5) Connect chromel and alumel wires of test cable to potentiometer.

NOTE: The alumel (green insulation) wire connects to the potentiometer (-) negative connection. The chromel (white insulation) wire connects to the potentiometer (+) positive connection.

(6) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
X	35	B1-965	EGT, N1, N2 DISPLAY RIGHT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 401-404, 406, 412, 414, 875-879, 886, 887			
B	15	B1-963	EGT, N1, N2 DISPLAY LEFT
WJE 410			
B	16	B1-963	EGT, N1, N2 DISPLAY LEFT

WJE 410 (Continued)

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(7) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(8) Close access door (5901C) for left engine or (5902C) for right engine.

(9) Place potentiometer in ON position.

(10) With affected engine not running, compare flight compartment EGT display reading with temperature potentiometer reading. Readings should agree within ±10°C.

(11) Start affected engine. (GENERAL, SUBJECT 71-00-00, Page 501)

(12) With affected engine running at part power and or takeoff power, compare flight compartment EGT display reading with temperature potentiometer reading. Reading should agree within ±6°C.

(13) Place potentiometer in OFF position.

(14) If comparisons are not within limits of Paragraph 3.A.(10) and Paragraph 3.A.(12), check for crossed connection (chromel to alumel junctions) in aircraft wiring.

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURE. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(15) Tag throttle/thrust reverser lever, and open and tag following circuit breakers

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT

WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
X	35	B1-965	EGT, N1, N2 DISPLAY RIGHT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 401-404, 406, 412, 414, 875-879, 886, 887			
B	15	B1-963	EGT, N1, N2 DISPLAY LEFT
WJE 410			
B	16	B1-963	EGT, N1, N2 DISPLAY LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(16) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(17) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(18) Disconnect test harness at potentiometer and at EGT thermocouple cable junction box.

(19) Torque alumel nuts (0.190-32 thread size) 18 to 22 inch-pounds (2.03 to 2.49 N·m).

(20) Torque chromel nuts (0.164-32 thread size) 15 to 18 inch-pounds (1.70 to 2.03 N·m).

(21) Remove test cable.

(22) Remove tools, equipment, loose hardware, and debris from maintenance area.

(23) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405, 406, 410, 877, 886, 887			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415, 417-419, 421, 423, 863-866, 869, 871, 872			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405, 406, 410, 877, 886, 887			
U	42	B1-422	ENGINE START VALVE LEFT
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
X	35	B1-965	EGT, N1, N2 DISPLAY RIGHT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 401-404, 406, 412, 414, 875-879, 886, 887			
B	15	B1-963	EGT, N1, N2 DISPLAY LEFT
WJE 410			
B	16	B1-963	EGT, N1, N2 DISPLAY LEFT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
K	26	B1-424	LEFT ENGINE IGNITION

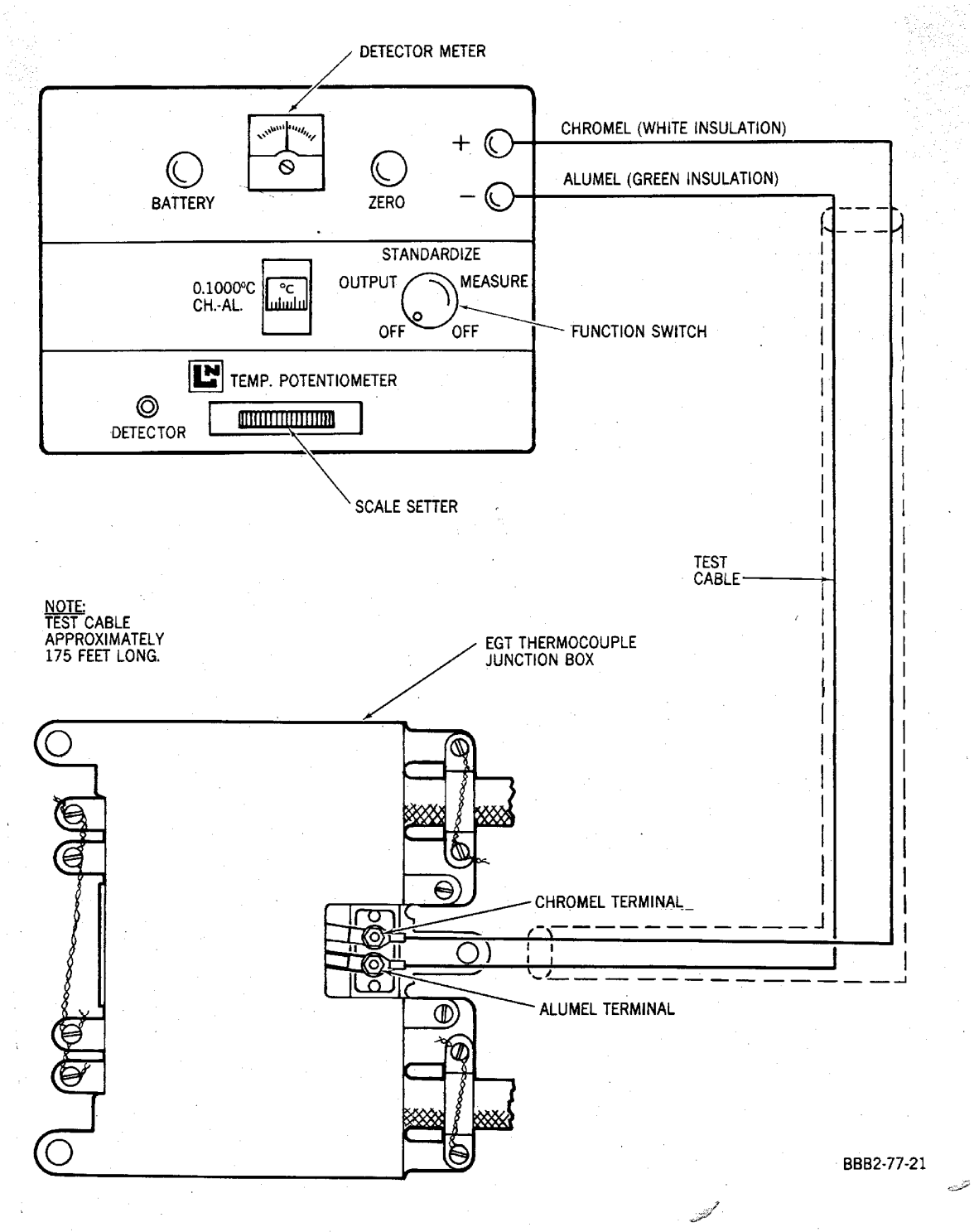
UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(24) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(25) Close access door (5901C) for left engine or (5902C) for right engine.



Temperature Potentiometer and Test Cable - Connections
Figure 201/77-21-00-990-803

EGT INDICATORS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the EGT indicators.

B. Maintenance of the EGT indicators is limited to removal/installation.

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 891

C. On aircraft 109-134, 159, 161-165, 201-999, with Primary Engine Display Panel. (Ref. 77-42-00, Page 201)

WJE 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893

D. Except for circuit breaker callout, Removal/installation procedures for the EGT indicators are identical. Instructions for a typical indicator removal/installation are given.

E. Access to the indicator clamps and connectors is at the center instrument panel in the flight compartment.

2. Removal/Installation EGT Indicators

A. Remove Indicator (Figure 201)

(1) Open and tag following circuit breakers as applicable.

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

(2) Loosen adjustment screws on front of panel until indicator can be removed without binding, and remove indicator from panel.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT PLUG.

(3) Disconnect electrical connector.

B. Install Indicator (Figure 201)

(1) Make certain that following applicable circuit breakers are open and tagged.

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

(2) Check indicator for dents, cracked glass, or damaged electrical connector pins.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTOR, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO CONNECT PLUG. WHEN CONNECTING PLUG, DO NOT OVERTIGHTEN.

(3) Connect electrical connector.

NOTE: Connector plug is properly installed when no relative motion exists between plug backshell and coupling ring.

CAUTION: EXERCISE CARE WHEN HANDLING INDICATORS. DO NOT DROP INDICATOR. INTERNAL DAMAGE COULD RESULT.

CAUTION: TO PREVENT INSTRUMENT INTERNAL AND OUTER CASE DAMAGE, DO NOT OVER-TORQUE ADJUSTMENT SCREWS WHEN TIGHTENING CLAMP AROUND INSTRUMENT HOUSING.

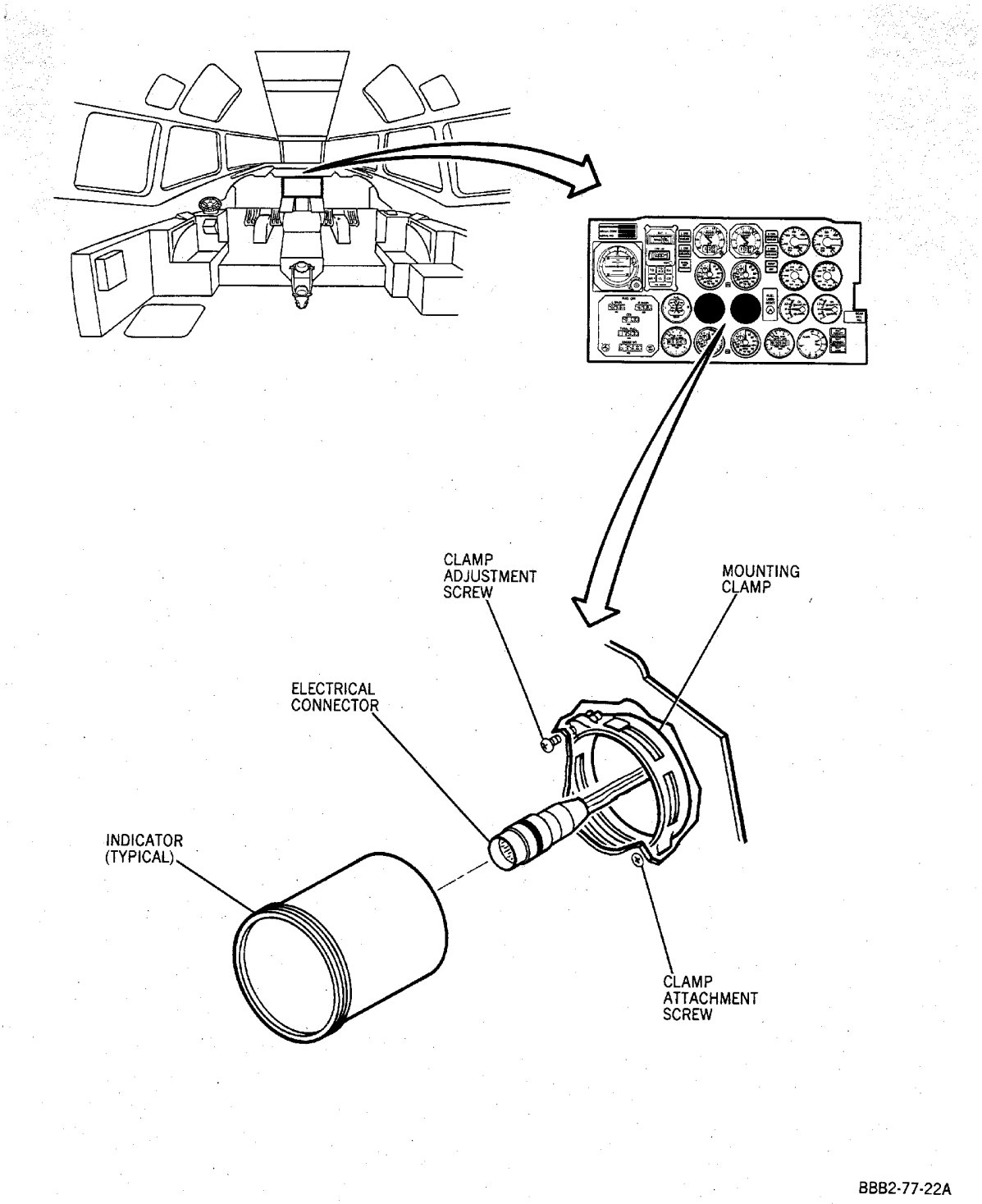
(4) Install indicator in panel. Tighten adjustment screws.

(5) Remove tools, equipment, loose hardware, and debris from maintenance area.

(6) Remove tags and close following applicable circuit breaker.

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT



EGT Indicator - Installation
Figure 201/77-21-01-990-801

EGT THERMOCOUPLE PROBES - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation, adjustment/test, check, and cleaning/painting instructions for the EGT thermocouple probes (T_{t7}). The probes are housed in the EPR turbine exhaust pressure probes P_{t7} which are mounted in the turbine exhaust case at approximately the 12:30, 2:00, 3:30, 5:00, 6:30, 8:00, 9:30 and 11:00 o'clock positions looking forward.

B. Maintenance of the probes is limited to removal/installation, adjustment/test, check, and cleaning/painting. The removal/installation, adjustment/test, check, and cleaning/painting procedures for probes on all engines are identical.

C. Access to the probes is through the upper and aft lower cowl doors.

NOTE: Forward lower cowl door overlaps aft lower cowl door, and must be opened prior to opening aft lower cowl door.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: OPEN UPPER COWL DOOR ONLY AS MUCH AS NECESSARY TO ALLOW HOLD-OPEN RODS TO BE CONNECTED TO ENGINE. OPENING DOOR TOO FAR MAY CAUSE DAMAGE TO PYLON HINGE POINTS.

CAUTION: MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

D. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.

CAUTION: SHOULD MAINTENANCE BE REQUIRED ON CONNECTORS IN EGT SYSTEM AIRCRAFT WIRING, MAKE CERTAIN THAT NO INTER-MIXING OF CHROMEL AND ALUMEL WIRES AND CONNECTOR COMPONENTS OCCURS. WHEREVER CHROMEL AND ALUMEL PARTS MAKE CONTACT, A NEW THERMOCOUPLE JUNCTION OCCURS THAT WILL CREATE UNPREDICTABLE ERRORS IN EGT INDICATIONS.

E. Aircraft wiring for the EGT indicating system consists of alumel and chromel connector pins, sockets, and wire. Alumel wire is connected to alumel pins and sockets, and chromel wire is connected to chromel pins and sockets.

NOTE: A quick and accurate check can be accomplished with a magnet. Alumel will be attracted by the magnet, chromel will not.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
AC Cleaning Compound Type 2	

Table 201 (Continued)

Name and Number	Manufacturer
Compound, anti-galling, Fel-Pro C-200	
Heat gun	
Lockwire, .032 corrosion-resistant steel, P05-289	
Nozzle, thermocouple cleaning (locally fabricated)	
Ohmmeter	
Piston engine grit blast cleaning equipment	
Torque wrench0 in-lb (0 N·m) to 50 in-lb (6 N·m) range	

3. **Removal/Installation EGT Thermocouple Probes**

A. Remove Probe (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6555 TO 7245 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(4) Tag thermocouple cable leads and terminal studs.

(5) Disconnect thermocouple leads.

NOTE: Nut and stud diameters of alumel terminals are larger than those of chromel nuts and studs.

CAUTION: THERMOCOUPLE WIRES, SHEATH, AND INSULATION CAN BE EASILY DAMAGED OR SHORTED BY IMPROPER HANDLING.

(6) Remove screws and remove thermocouple probe.

(7) Install protective cap over opening in pressure probe (P_{t7})

B. Install Probe (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Remove protective cap from pressure probe (P_{t7}).

(4) Visually check thermocouple probe (T_{t7}) for condition. (Ref. Paragraph 5.)

(5) Install thermocouple probe into pressure probe and align attach holes.

CAUTION: EXTREME CARE MUST BE EXERCISED TO ENSURE ANTI-GALLING AND ANTI-SEIZE COMPOUNDS ARE APPLIED IN THIN EVEN COAT AND ALL EXCESS MATERIAL IS COMPLETELY REMOVED TO PREVENT COMPOUND GETTING INTO OR ONTO PARTS, PASSAGES, OR SURFACES WHERE IT MAY CAUSE MALFUNCTIONING OR EVEN FAILURE OF ENGINE.

(6) Apply thin coat of anti-galling compound (Fel-Pro C-200) to threads of screws to facilitate removal and install screws in probe flange. Torque screws 18 in-lb (2 N·m) to 20 in-lb (2 N·m). Safety screws with P05-289 lockwire.

NOTE: Wet Fel-Pro C-200 anti-galling compound is approved for threaded parts and mating faces of threaded and other parts in hot section and free turbine areas. Optimum results are obtained with Fel-Pro baked on, but use of wet Fel-Pro brushed on without prior surface preparation or baking is permissible. In this latter use, less long-term durability is obtained.

(7) Remove tags and connect thermocouple cable leads to probe studs.

CAUTION: TORQUE REQUIREMENTS FOR LOCKNUTS ON THERMOCOUPLE LEAD STUDS MUST BE OBSERVED. OVERTORQUING OF LOCKNUTS CAN RESULT IN STUD LOOSENING OR BREAKAGE.

(8) Torque alumel nuts (0.190-32 thread size)10 in-lb (1.13 N·m) to 15 in-lb (1.69 N·m).

(9) Torque chromel nuts (0.164-32 thread size)8 in-lb (0.90 N·m) to 12 in-lb (1.36 N·m).

NOTE: Proper installation of clincher type locknuts on thermocouple lead studs requires that no washer be used, and that cylindrical grooved portion of nut lead the way onto stud.

(10) Perform continuity and resistance check. (Ref. Paragraph 4.)

(11) Remove tools, equipment, loose hardware, and debris from maintenance area.

(12) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

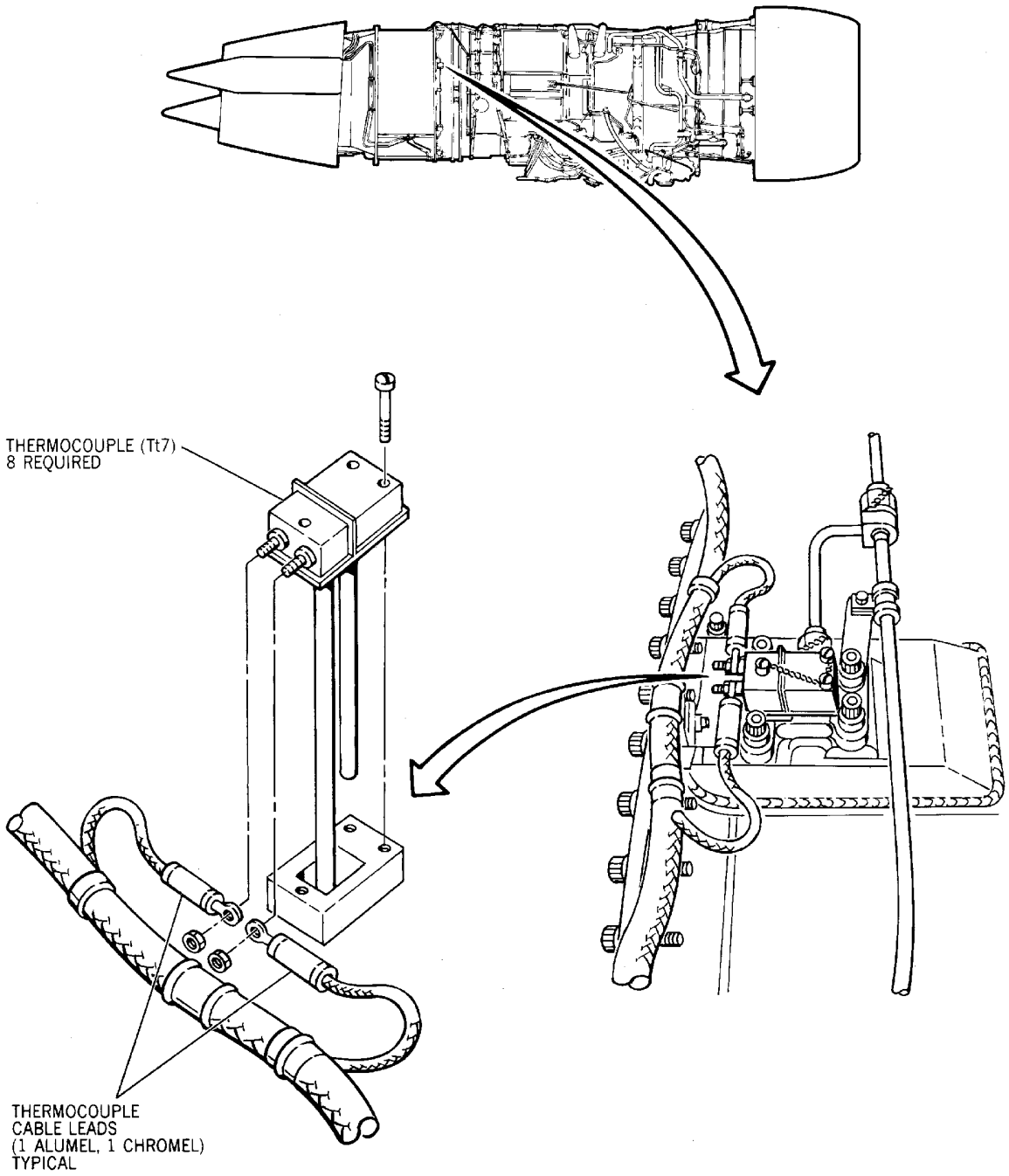
Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,684 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(13) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(14) Close access door (5901C) for left engine or (5902C) for right engine.

(15) Check EGT system for proper operation at next engine run.



EGT Thermocouple Probes - Installation
Figure 201/77-21-03-990-801

4. Adjustment/Test EGT Thermocouple Probes

A. Continuity and Insulation Resistance Test (Figure 202)

NOTE: Before performing any of the following tests, be sure that thermocouple has been satisfactorily cleaned. (Ref. Paragraph 6.)

(1) Apply heat at junctions of thermocouples with heat source.

NOTE: Application of heat during functional test, in many instances, causes wire to thermally change dimensions. If thermocouple circuit is cracked, circuit may become discontinuous and millivolt output will drop to zero. This condition cannot be readily detected by loop resistance and insulation checks at ambient temperature.

(2) Check for continuity by using low voltage ohmmeter at terminal posts. Deflection of needle on low voltage ohmmeter shows continuity in thermocouple circuits.

(3) Using sensitive ohmmeter or wheatstone bridge, check continuity of thermocouple across studs. Maximum internal loop resistance of probe shall be 1.5 ohms.

NOTE: Test leads must be securely attached to thermocouple studs. For most accurate reading, secure test leads with thermocouple nuts.

(4) Using low voltage ohmmeter, check insulation resistance between both chromel and alumel terminals and body of thermocouple for minimum of 25 seconds for each measurement. Resistance must be at least 10,000 ohms. If resistance is within limits, thermocouples shall be returned to service.

NOTE: Low voltage ohmmeter utilizing less than 40 volts (DC) and maintained at an accuracy of five percent shall be used for determining insulation resistance. A megger or other high voltage test shall not be used under any circumstances.

(5) Check continuity and resistance as follows:

(a) Remove cover from thermocouple junction box and remove buss bar.

(b) Using sensitive ohmmeter or wheatstone bridge, check continuity of thermocouple and harness.

(c) Maximum resistance of probe with harness shall be 4.580 ohms.

NOTE: Test leads must be securely attached to thermocouple studs or studs in junction box. For most accurate reading, secure test leads with thermocouple nuts.

(d) Install buss bar and cover on thermocouple junction box.

B. Defective or rejected thermocouples fall into following basic categories:

(1) No continuity in circuit.

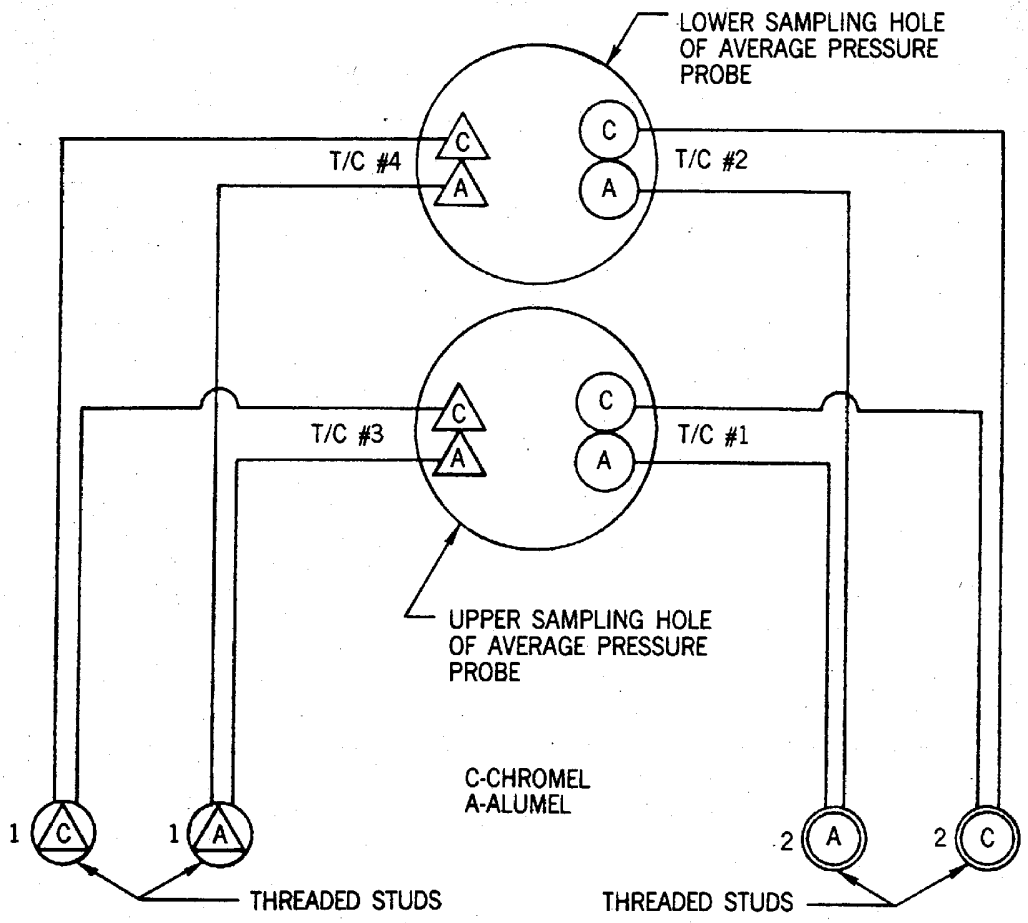
(2) Shorted circuit

(3) Low insulating resistance.

C. Check for Secondary Junctions

(1) Apply heat gun to head of thermocouple to 600°F (316°C) to 700°F (371°C).

(2) Check for deflection of milli-voltmeter at each set of studs. Milli-voltmeter should not deflect.



EGT Thermocouple Probes - Test Schematic
Figure 202/77-21-03-990-802

5. Check EGT Thermocouple Probes

A. Visually Check Probe

(1) Check exposed surfaces of probe for nicks, cracks or evidence of heat erosion. Reject cracked probes.

NOTE: Minor nicks are not cause for rejection.

(2) Check probe sheath for evidence of looseness at braze joint.

(3) Check terminal studs for looseness or thread damage.

(4) On probe which has been cleaned by abrasive blasting, check terminals for loss of insulation.

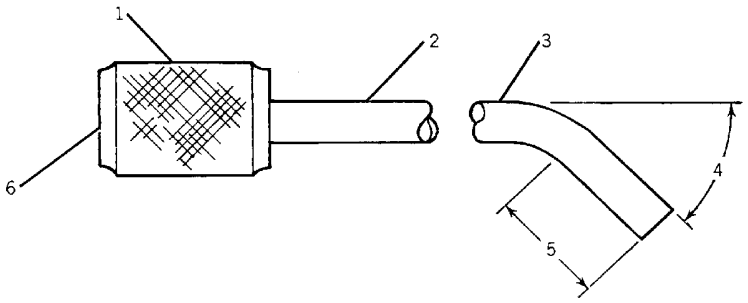
6. Cleaning/Painting EGT Thermocouple Probes

A. Clean Probes (Figure 203)

(1) Perform minor cleaning operations which may be necessary, exercising caution to prevent damage.

(2) Remove carbon coating on thermocouple head which reduces thermocouple insulation resistance. Remove coating before checking insulation resistance value, using piston engine spark plug cleaning equipment containing AC Cleaning Compound, Type 2.

NOTE: Care shall be taken not to subject parts to excessive grit blasting. Blast head only enough to remove carbon between studs.



1. Standard Connector
2. 0.040 Inch (1.016 mm) ID to 0.058 Inch (1.473 mm) OD Tube
3. 0.250 Inch (6.350 mm)
4. 45 Degrees
5. 0.200 Inch (5.080 mm)
6. Apply 100 psig (689.5 kPa) Air Pressure Here

L-16864
6-75

BBB2-77-47

Thermocouple Cleaning Nozzle
Figure 203/77-21-03-990-803

EGT THERMOCOUPLE HARNESS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation, adjustment/test, check, and cleaning/painting instructions for the EGT thermocouple harness. The harness is mounted around the periphery of the engine at the turbine case.

B. Maintenance of the harness is limited to removal/installation, adjustment/test, check, and cleaning/painting. The removal/installation, adjustment/test, check, and cleaning/painting procedures on all engines are identical. Access to the harness is through the upper and aft lower cowl doors.

CAUTION: DO NOT BEND HARNESS IN RADIUS SMALLER THAN 5-INCHES MINIMUM OR DAMAGE WILL RESULT.

C. The thermocouple harness consists of an electrical harness connecting each of the thermocouple circuits to a common junction box. The harness runs around the outer circumference of the fan exhaust outer duct, with a branch of the harness attached to each thermocouple stud. The eight thermocouple circuits are averaged at a junction box at the bottom of the engine, using a central bus bar.

NOTE: Forward lower cowl doors overlap the aft lower cowl door and must be opened prior to opening aft lower cowl door.

D. For procedures to open cowl doors on all engines, refer to GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 71-00-00/201.

WARNING: TO PREVENT INJURY TO PERSONNEL, EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: OPEN UPPER COWL DOOR ONLY AS MUCH AS NECESSARY TO ALLOW HOLD-OPEN RODS TO BE CONNECTED TO ENGINE. OPENING DOOR TOO FAR MAY CAUSE DAMAGE TO PYLON HINGE POINTS.

CAUTION: MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

CAUTION: SHOULD MAINTENANCE BE REQUIRED ON CONNECTORS IN EGT SYSTEM AIRCRAFT WIRING, MAKE CERTAIN THAT NO INTER-MIXING OF CHROMEL AND ALUMEL WIRES AND CONNECTOR COMPONENTS OCCURS. WHEREVER CHROMEL AND ALUMEL PARTS MAKE CONTACT, A NEW THERMOCOUPLE JUNCTION OCCURS THAT WILL CREATE UNPREDICTABLE ERRORS IN EGT INDICATIONS.

E. Aircraft wiring for the EGT indicating system consists of alumel and chromel connector pins, sockets, and wire. Alumel wire is connected to alumel pins and sockets, and chromel wire is connected to chromel pins and sockets.

NOTE: A quick and accurate check can be accomplished with a magnet. Alumel will be attracted by the magnet, chromel will not.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Lockwire, 0.025 corrosion-resistant steel	
Ohmmeter	
Wheatstone Bridge	
Torque wrench 0 in-lb (0 N·m) to 50 in-lb (6 N·m) range	
Torque wrench 0 in-lb (0 N·m) to 200 in-lb (23 N·m) range	
Denatured Ethyl Alcohol DPM 514	W.P. Fuller Co. Los Angeles, CA
Wiss No. J7 jeweler's snips	
3M Co. No. 69 glass cloth tape	
MS 9226-04 nickel alloy lockwire	

3. **Removal/Installation EGT Thermocouple Harness**

A. Remove Harness (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 PSI (6550 KPA) TO 1050 PSI (7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(4) Tag all thermocouple harness leads at applicable probes.

(5) Disconnect leads from probes.

NOTE: Nut and stud diameters of alumel terminals are larger than those of chromel nuts and studs.

(6) Remove junction box cover.

(7) Tag applicable harness leads at junction box.

(8) Disconnect leads from junction box studs.

NOTE: Nut and stud diameters of alumel terminals are larger than those of chromel nuts and studs.

(9) Remove clamp attaching harness to junction box.

(10) Remove harness from junction box and engine.

B. Install Harness (Figure 201)

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR THRUST REVERSER OPERATION COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893 (Continued)

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

(3) Position harness around turbine exhaust case.

(4) Connect harness leads to probe located at 12:30 o'clock for right side, and to probe located at 11:00 o'clock for left side.

(5) Install clamp attaching cable to junction box. Safety screws with 0.025 corrosion-resistant steel lockwire.

(6) Connect harness leads to remaining two probes.

CAUTION: TORQUE REQUIREMENTS FOR LOCKNUTS ON THERMOCOUPLE LEAD STUDS MUST BE OBSERVED. OVERTORQUING OF LOCKNUTS CAN RESULT IN STUD LOOSENING OR BREAKAGE.

(7) Torque alumel terminal stud nuts (0.190-32 thread size) 10 in-lb (1 N·m) to 15 in-lb (2 N·m).

(8) Torque chromel terminal stud nuts (0.164-32 thread size) 8 in-lb (1 N·m) to 12 in-lb (1 N·m).

NOTE: Proper installation of clincher type locknuts on thermocouple lead studs requires that no washer be used, and that cylindrical grooved portion of nut lead the way onto stud.

(9) Connect harness leads to corresponding studs in junction box.

(10) Torque alumel terminal stud nuts (0.190-32 thread size) 18 in-lb (2 N·m) to 22 in-lb (2 N·m).

(11) Torque chromel terminal stud nuts (0.164-32 thread size) 15 in-lb (2 N·m) to 18 in-lb (2 N·m).

(12) Install junction box cover. Safety screws with 0.025 corrosion-resistant steel lockwire.

(13) Remove tools, equipment, loose hardware, and debris from maintenance area.

(14) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	41	B1-2	ENGINE IGNITION RIGHT

WJE 415-427, 429, 861-866, 868, 869, 871-874, 891 (Continued)

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	41	B1-423	ENGINE START VALVE RIGHT
WJE 415-427, 429, 861-866, 868, 869, 871-874, 891			
U	42	B1-1	ENGINE IGNITION LEFT
WJE 405-408, 410, 411, 877, 880, 884, 886, 887, 892, 893			
U	42	B1-422	ENGINE START VALVE LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 405, 407-409, 411, 416, 420, 422, 424-427, 429, 861, 862, 868, 873, 874, 880, 881, 883, 884, 891-893			
B	15	B1-890	ENGINE EXHAUST TEMP LEFT
C	15	B1-891	ENGINE EXHAUST TEMP RIGHT

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE ALL			
K	26	B1-424	LEFT ENGINE IGNITION

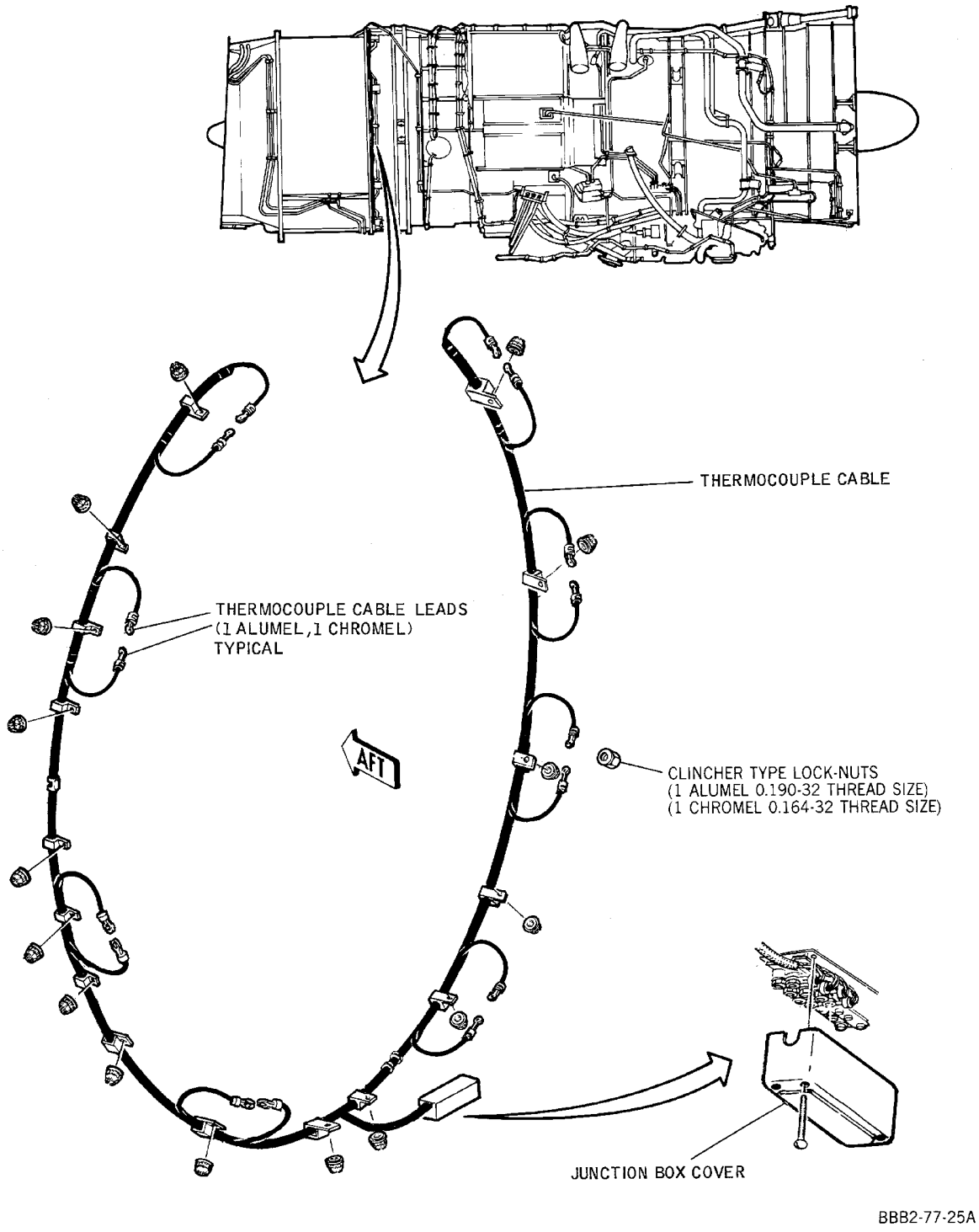
UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(15) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(16) Close access door (5901C) for left engine or (5902C) for right engine.

(17) Check EGT system for proper operation at next engine run.



EGT Thermocouples Harness - Installation
Figure 201/77-21-04-990-801

4. Adjustment/Test EGT Thermocouple Harness

A. Test Harness (Figure 202), (Figure 203) and (Figure 204)

NOTE: Validity of electrical tests made in the field may depend upon limitations inherent in the common ohmmeter. This instrument is not dependable for determining exact wire resistances of thermocouple harness. It may, however, be used to detect gross failures such as open or intermittent circuits, and metal-to-metal short circuits. Also, approximate insulation resistance may be tested if certain precautions are observed. Ohmmeter used in following tests must be of good quality and in good condition; i.e. free from "stickiness" of meter needle, with pinjacks firm, test leads sound, and dry cells in condition to permit full scale deflection for all positions of range switch.

(1) Continuity Test

(a) Set ohmmeter range switch to range which has center scale value of approximately 10 ohms.

NOTE: Broken wires which come into contact intermittently due to flexing will cause needle to fluctuate. False intermittent indications will result if ohmmeter prods are not in firm contact with clean terminals; also, if ohmmeter prods, leads, or jacks are defective.

(b) Perform continuity test in accordance with referenced schematic and junction box terminal layout.

(c) Reject any harness for discontinuity.

(2) Insulation Resistance Test

(a) Ensure that thermocouple junction box and harness are properly installed and connected.

CAUTION: LOW VOLTAGE OHMMETER UTILIZING 50 VOLTS (DC) OR LESS AND MAINTAINED AT AN ACCURACY OF FIVE PERCENT SHALL BE USED FOR DETERMINING INSULATION RESISTANCE. MEGGER OR OTHER HIGH VOLTAGE TEST SHALL NOT BE USED UNDER ANY CIRCUMSTANCES.

(b) Using low voltage ohmmeter, check insulation for short circuits, excessive leakage, and internal insulation chafing discrepancies. Check proper operation of instrument by touching test prods together and noting needle deflection to read zero ohms.

(c) Place one prod in contact with harness steel wire braid covering and other prod in contact with alumel conductor.

(d) Read ohmmeter. If resistance noted is below 50,000 ohms, proceed as follows:

1) If full-scale deflection (zero ohms) is noted and no terminals are in accidental contact, reject part.

2) If large (but not full-scale) deflection is noted, presence of carbon or excessive moisture may be indicated.

NOTE: Carbon yields fairly steady reading. Moisture tends to produce readings which waver or drift after 5 to 30 seconds.

3) If presence of moisture is indicated, remove harness as described in Paragraph 3., and bake at 200°F (93°C) to 250°F (121°C) for 1 hour and retest.

NOTE: False drift may be due to variations in applied voltage. To check for false drift, place prods in contact with each other for 10 seconds. Reading must not wander from full-scale deflection.

(e) Repeat Paragraph 4.A.(2)(b) through Paragraph 4.A.(2)(d) with one prod in contact with harness steel wire braid covering and other in contact with chromel conductor.

(f) Perform resistance test of insulation between conductors using low voltage ohmmeter. Place one prod on chromel terminal and other on alumel terminal. If resistance noted is below 50,000 ohms, reject harness.

NOTE: Both ends of conductors being tested in preceding step must be open (disconnected) to read insulation resistance.

(3) Short Circuit Test

(a) Set ohmmeter range switch to range which has center scale value of approximately 10 ohms.

(b) Place one prod in good contact with well-cleaned alumel terminal and other in good contact with well-cleaned chromel terminal. Flex harness gently and observe instrument needle. If any deflection results (unless caused by accidental contact between other terminals of harness), reject harness.

NOTE: Both ends of conductors being tested in preceding step must be open (disconnected) to indicate an internal short.

(4) Check continuity and resistance as follows:

(a) Remove cover from thermocouple junction box and remove bus bar.

(b) Using sensitive ohmmeter or wheatstone bridge, check continuity of thermocouple and harness.

(c) Maximum resistance of probe with harness shall be 4.580 ohms.

NOTE: Test leads must be securely attached to thermocouple studs or studs in junction box. For most accurate reading, secure test leads with thermocouple nuts.

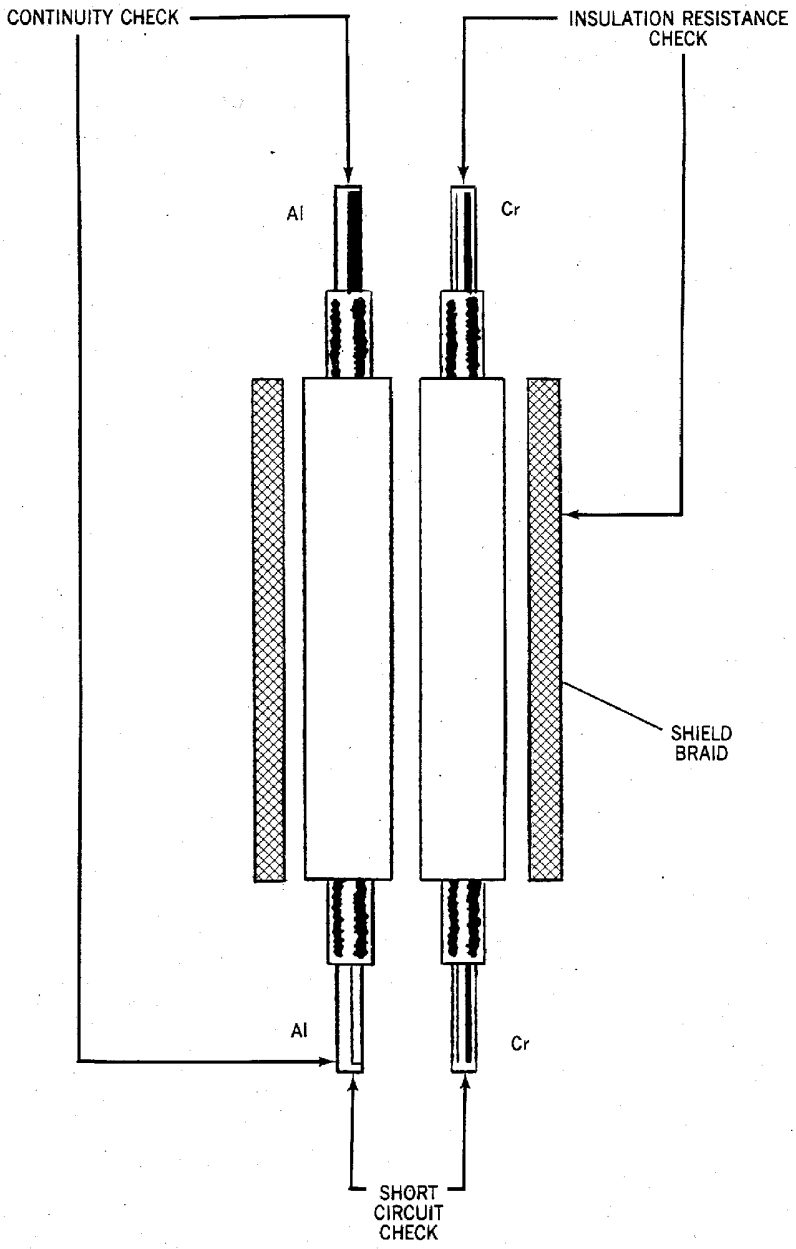
(d) Install bus bar and cover on thermocouple junction box.

(5) Defective or rejected thermocouple harness fall into following basic categories:

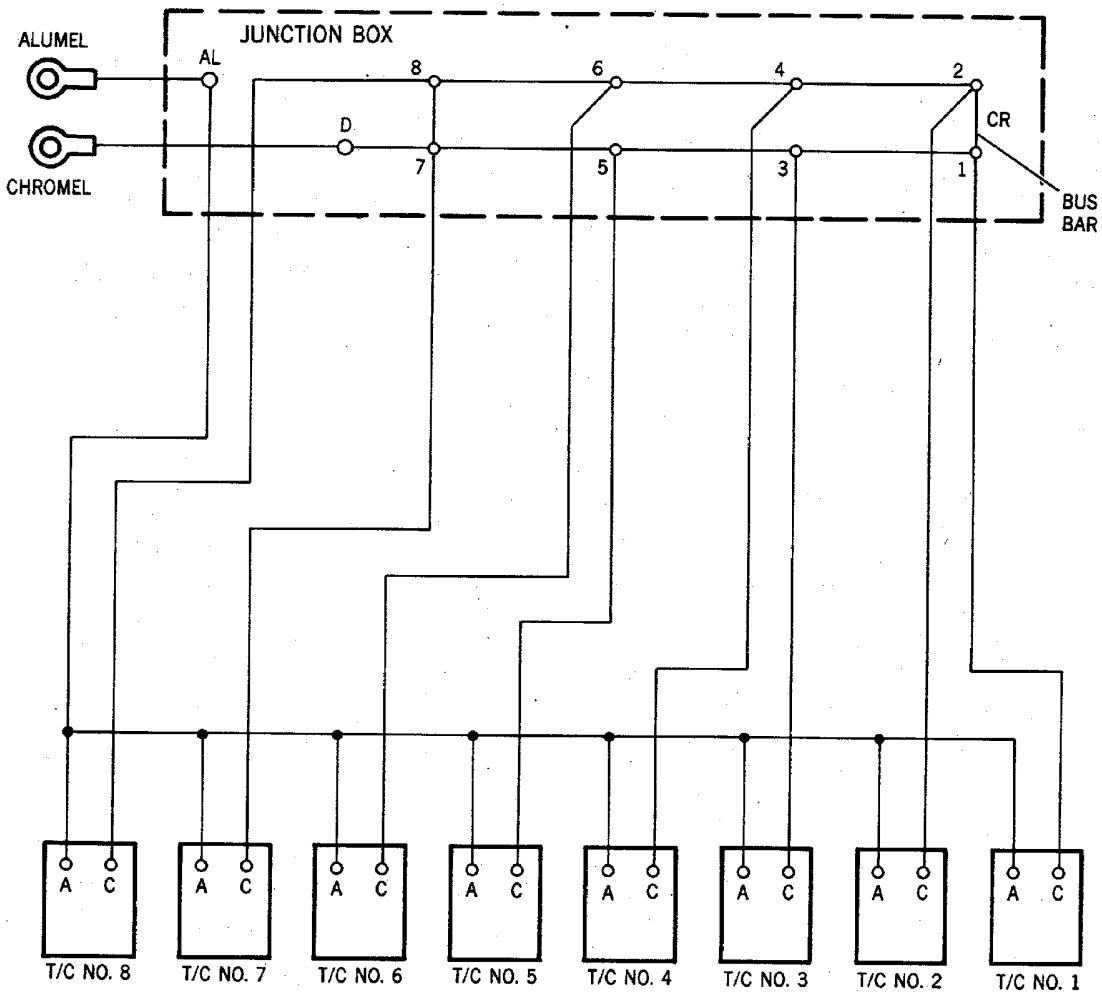
(a) No continuity in circuit.

(b) Shorted circuit.

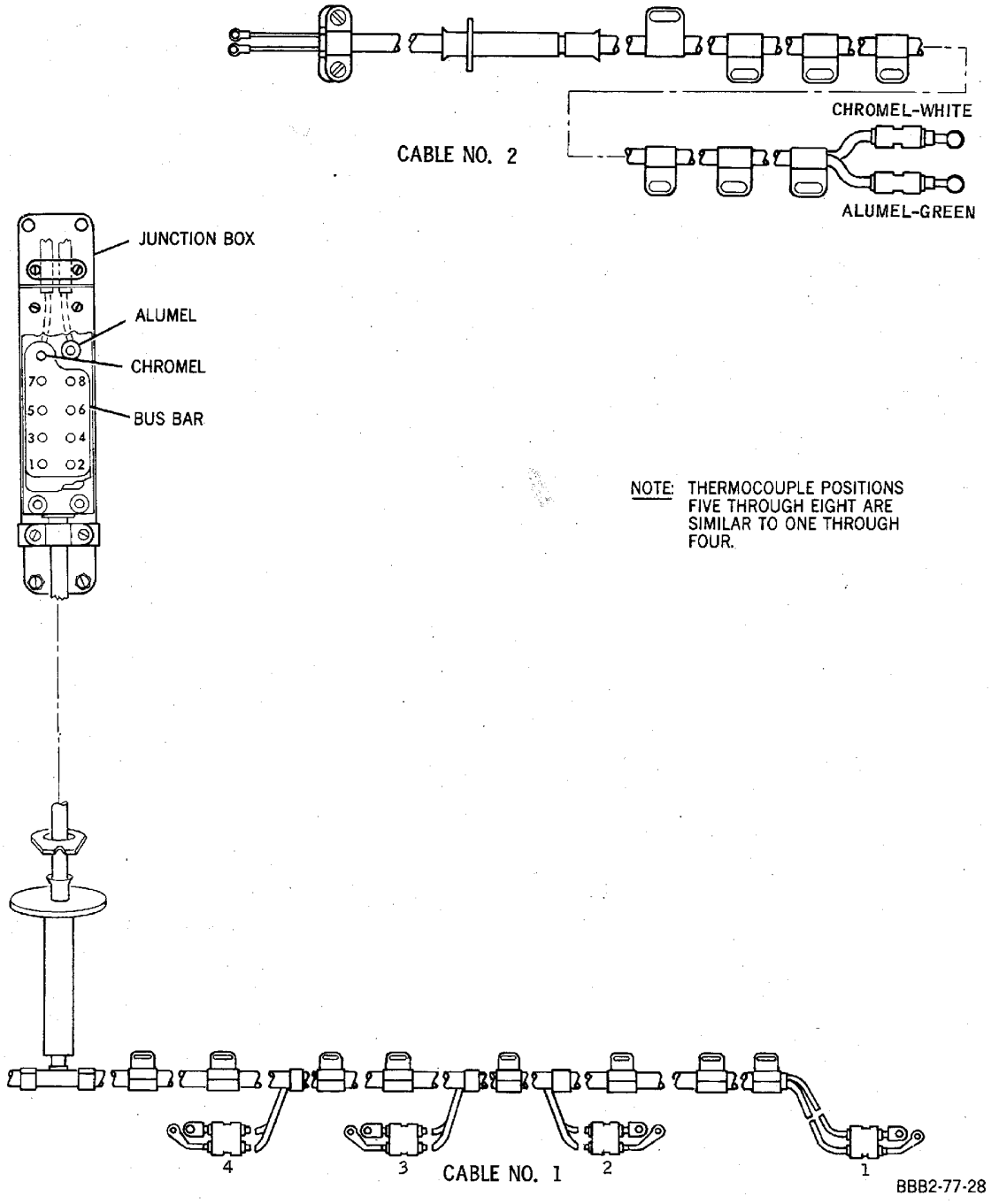
(c) Low insulation resistance.



Thermocouple Harness - Test Schematic
Figure 202/77-21-04-990-802



Thermocouple Harness - Schematic
Figure 203/77-21-04-990-803



Thermocouple Harness - Schematic
Figure 204/77-21-04-990-804

5. Check EGT Thermocouple Harness

A. Visually Check Harness

(1) Check thermocouple box and cable for evidence of damage to steel braid and to terminals.

(2) Defective or rejected thermocouple box and cable falls into following basic categories:

(a) Damaged or frayed braid.

(b) Damaged or broken terminals.

(c) Damaged or broken brackets.

NOTE: Replace left or right thermocouple harness, as required.

(3) Repair damage or frayed braid. (PAGEBLOCK 77-21-04/201)

6. Cleaning/Painting EGT Thermocouple Harness

A. Clean Harness

WARNING: ETHYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ETHYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ETHYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Clean external surfaces by wiping with cloth slightly dampened with denatured ethyl alcohol.

CAUTION: IMBEDDED STAINLESS STEEL PARTICLES MAY ADVERSELY AFFECT ACCURACY OF LOW LEVEL MILLIVOLT EGT SIGNALS, THEREFORE, ENSURE THAT ALL FOREIGN MATERIAL IS REMOVED FROM TERMINALS.

(2) If necessary, clean thermocouple harness and lead alumel and chromel terminal lugs using a stainless steel brush or stainless steel pad (without soap).

(3) Remove residue using clean compressed air at 30 psig (207 kPa) Pounds per Square Inch Gauge (PSIG) minimum discharge pressure.

7. EGT Thermocouple Cable Braided Shield Repair

A. Repair Electrical Cable Wire Braid

NOTE: Electrical cable wire braid covering which are worn, broken, cut or otherwise damaged can be repaired as follows:

(1) Cut braid around entire circumference at damaged spot using Wiss No. J7, or equivalent jeweler's snips. Slide two sections of braid apart. (Figure 205, Step 1)

(2) Place two layers of 3M Co. No. 69 glass cloth tape (or equivalent) around wire bundle in damaged area. Place piece of tinned copper grounding strap longitudinally across taped area. Push ends of braid over grounding strap and as close together as possible. (Figure 205, Step 2)

(3) Place two layers of 3M Co. No. 69 glass cloth tape circumferentially over braid, one-quarter inch from end of braid ends on each side of cut. (Figure 205, Step 3)

(4) Fan out loose ends of braid and carefully fold back over tape.

CAUTION: ENSURE ALL LOOSE WIRE BRAID ENDS ARE CAREFULLY FOLDED BACK SINCE ANY SHREDDING OR PENETRATION OF INSULATION BY SUCH LOOSE ENDS MIGHT RESULT IN MALFUNCTION.

(5) Cover all ends of folded braid with two layers of No. 69 glass cloth. (Figure 205, Step 4)

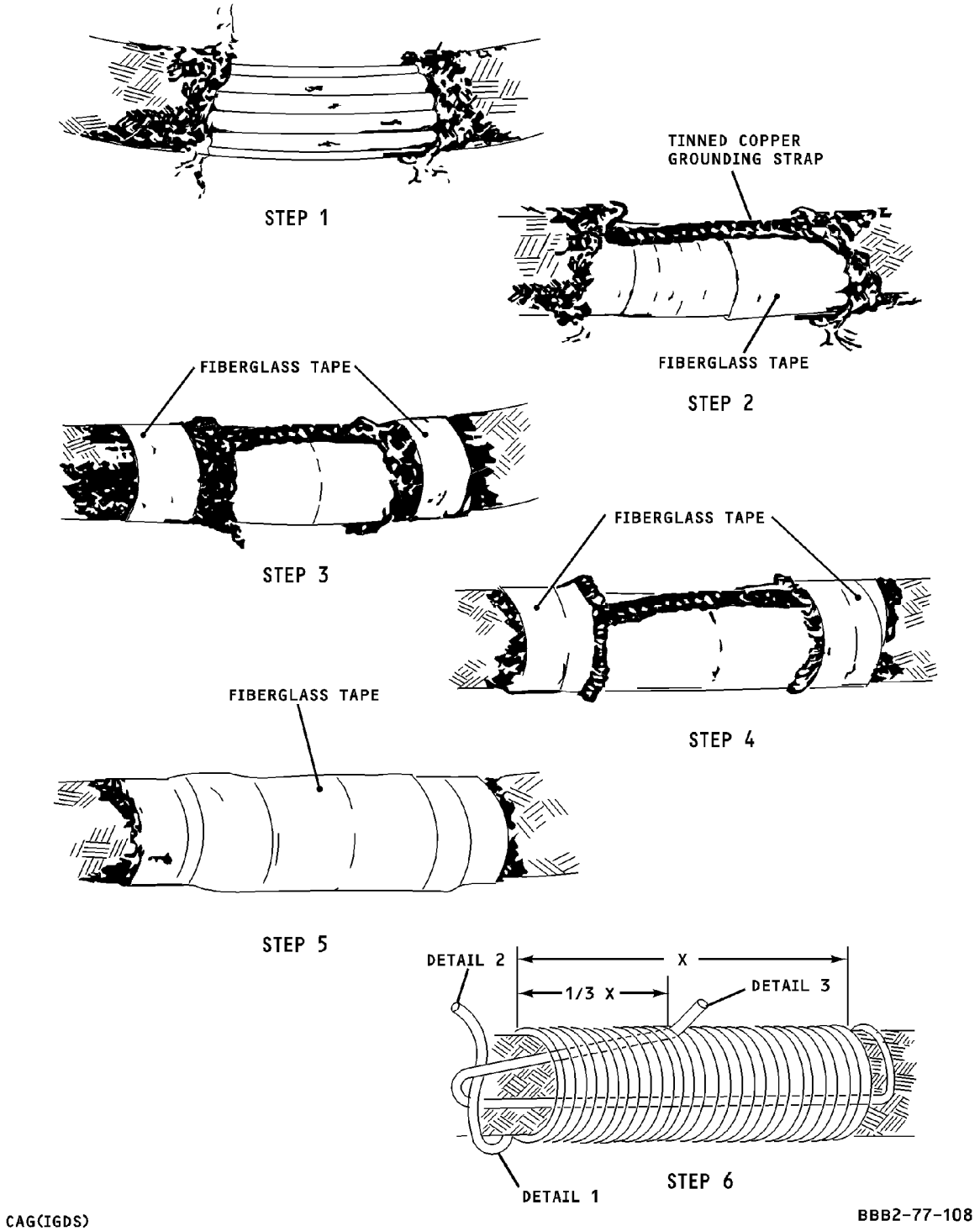
(6) Build up space between braid ends with No. 69 glass cloth tape so that repair area has constant diameter. Wrap entire area with two layers of No. 69 glass cloth tape. (Figure 205, Step 5)

(7) Wrap repaired area using MS9226-04 nickel alloy lockwire as shown in Figure 205, Step 6. Cut suitable length of wire and loop one end. Hold wrapping wire snugly against cable braid to left as shown in Step 6. Starting at opposite end, tightly and uniformly wrap wire over cable braid and repaired area using technique as shown.

NOTE: Make certain that wire overlaps glass cloth tape and contacts wire braid at each end of repair.

(8) When approximately two-thirds of wrapping length is completed, allow short end of loop to remain exposed. Continue wrapping wire to complete remaining distance shown as one-third "X" in Figure 205. Maximum repair length, represented by "X" is four inches.

(9) After final turn of wrapping, insert wire (Figure 205, Detail 1) through loop. Cut off surplus end of wire (Figure 205, Detail 2) so that remaining length is approximately one third of repair length. Pull loop end (Figure 205, Detail 3) snug to make certain that end loop is tight, then cut wire end flush.



Electrical Cable Wire Braid Repair
Figure 205/77-21-04-990-805

EGT ISOLATION MODULE - MAINTENANCE PRACTICES

1. General

A. This procedures provide instructions for removing and installing EGT isolation module.

B. EGT isolation module is install on aft right radio rack shelf 3.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items.

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Dust caps, electrical connector MS90376	

3. Removal/Installation EGT Isolation Module

A. Remove EGT Isolation Module

WARNING: TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Open this circuit breaker and install safety tag:

UPPER EPC, LEFT RADIO DC BUS

Row	Col	Number	Name
G	21	B10-46	FLIGHT RECORDER

(2) Disconnect and cap electrical connector from EGT isolation module.

(3) Remove the four screws and washers securing module to tray and remove module.

B. Install EGT Isolation Module

WARNING: TAG AND USE SAFETY CLIPS TO SAFETY THE CIRCUIT BREAKERS. IF THE CIRCUIT BREAKERS ARE NOT OPENED, TAGGED, AND SAFETIED, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Make sure that this circuit breaker is open and has safety tag:

UPPER EPC, LEFT RADIO DC BUS

Row	Col	Number	Name
G	21	B10-46	FLIGHT RECORDER

(2) Install module in tray with four screws and washers.

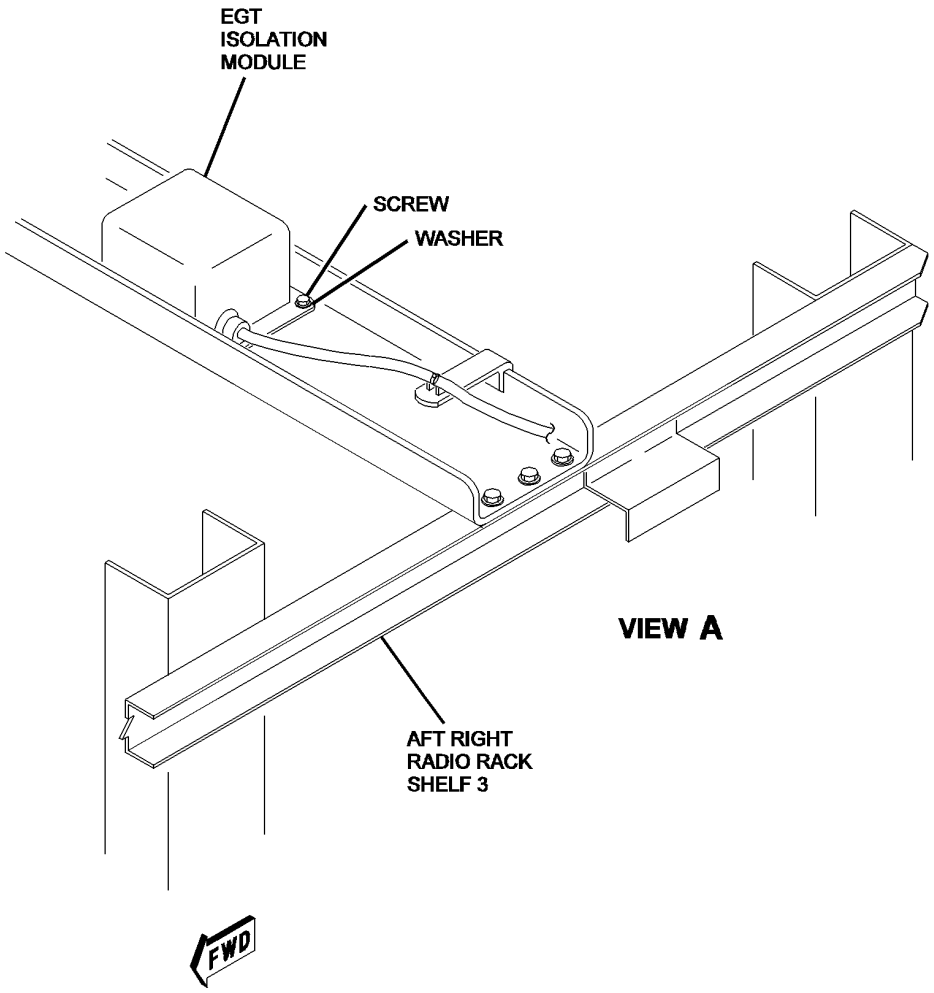
(3) Remove dust caps and check for unwanted material. Connect electrical connector to module.

(4) Remove the safety tag and close this circuit breaker:

UPPER EPC, LEFT RADIO DC BUS

Row	Col	Number	Name
G	21	B10-46	FLIGHT RECORDER

C. Perform test of EGT system. (EXHAUST GAS TEMPERATURE (EGT) INDICATION - MAINTENANCE PRACTICES, PAGEBLOCK 77-21-00/201 Config 1 or EXHAUST GAS TEMPERATURE (EGT) INDICATION - MAINTENANCE PRACTICES, PAGEBLOCK 77-21-00/201 Config 2)



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EGT Isolation Module - Removal/Installation
Figure 201/77-21-05-990-801

ANALYZERS - DESCRIPTION AND OPERATION

1. General

A. The analyzer portion of the engine indicating system consists of the Engine Vibration Monitor (EVM) system which, used in addition to other engine indicating systems, provides a means of detecting possible internal engine malfunction.

2. Engine Vibration System

A. Description

(1) EVM System - The EVMsystem consists of four vibration pickups, two vibration indicators, a vibration pickup selector switch, and a vibration system test switch. Electrical power is supplied from the 28-volt Direct Current (DC) bus through a circuit breaker to the vibration indicators.

(2) Engine Vibration Pickups - Two vibration pickups are mounted on each engine; one on the compressor case, and the other on the turbine case. The pickup is a linear velocity transducer which converts the mechanical energy of vibration into an electrical signal. The pickup consists of a bobbin coil, a stabilized permanent magnet, and coil springs which are contained within a non-magnetic stainless steel case provided with an external electrical connector. The pickup has a frequency range of 45 to 1500 cps.

(3) Engine Vibration Indicators - The two engine vibration indicators are mounted in the flight compartment and present dial presentations of engine vibration amplitude. The indicator is an integral vibration amplifier and indicator consisting of a power supply, amplifier, filter, and an integrally lighted meter. The electronic components and meter are contained in a panel mount-type meter case which is provided with an external electrical connector. The indicator is calibrated to display a vibration amplitude of 0 to 5 mils. For aircraft with the Wavelabs or CEC EVM system, the indication in the cockpit is displayed as a single vibration amplitude value of 0 to 5 mils.

(4) Engine Vibration Pickup Selector Switch - The engine vibration pickup selector switch mounted in the flight compartment provides selection of either compressor (FWD) or turbine (AFT) pickups for both engines.

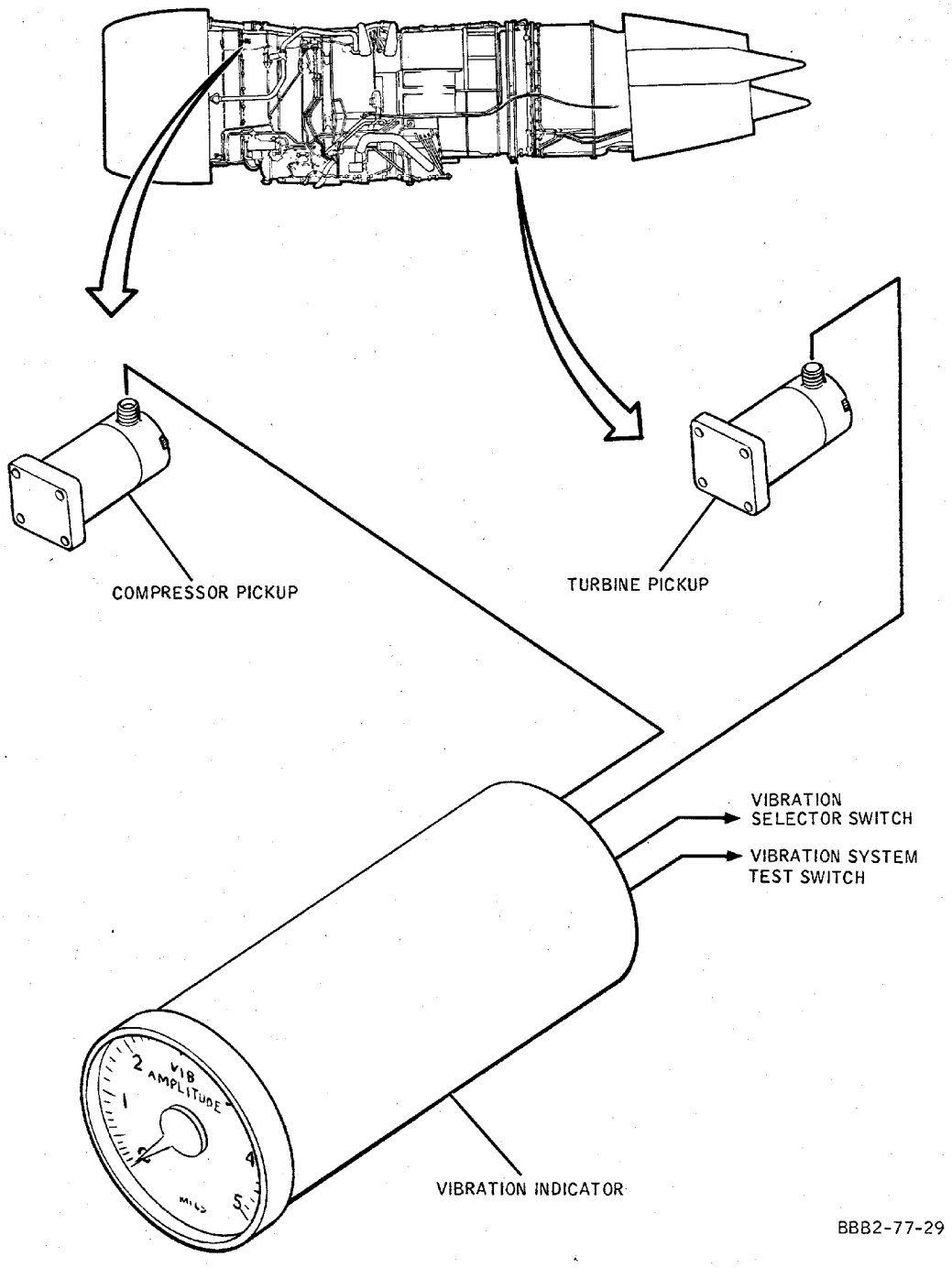
(5) Engine Vibration System Test Switch - The engine vibration system test switch mounted in the flight compartment provides the means by which vibration system integrity and operation can be checked for both engines.

B. Operation

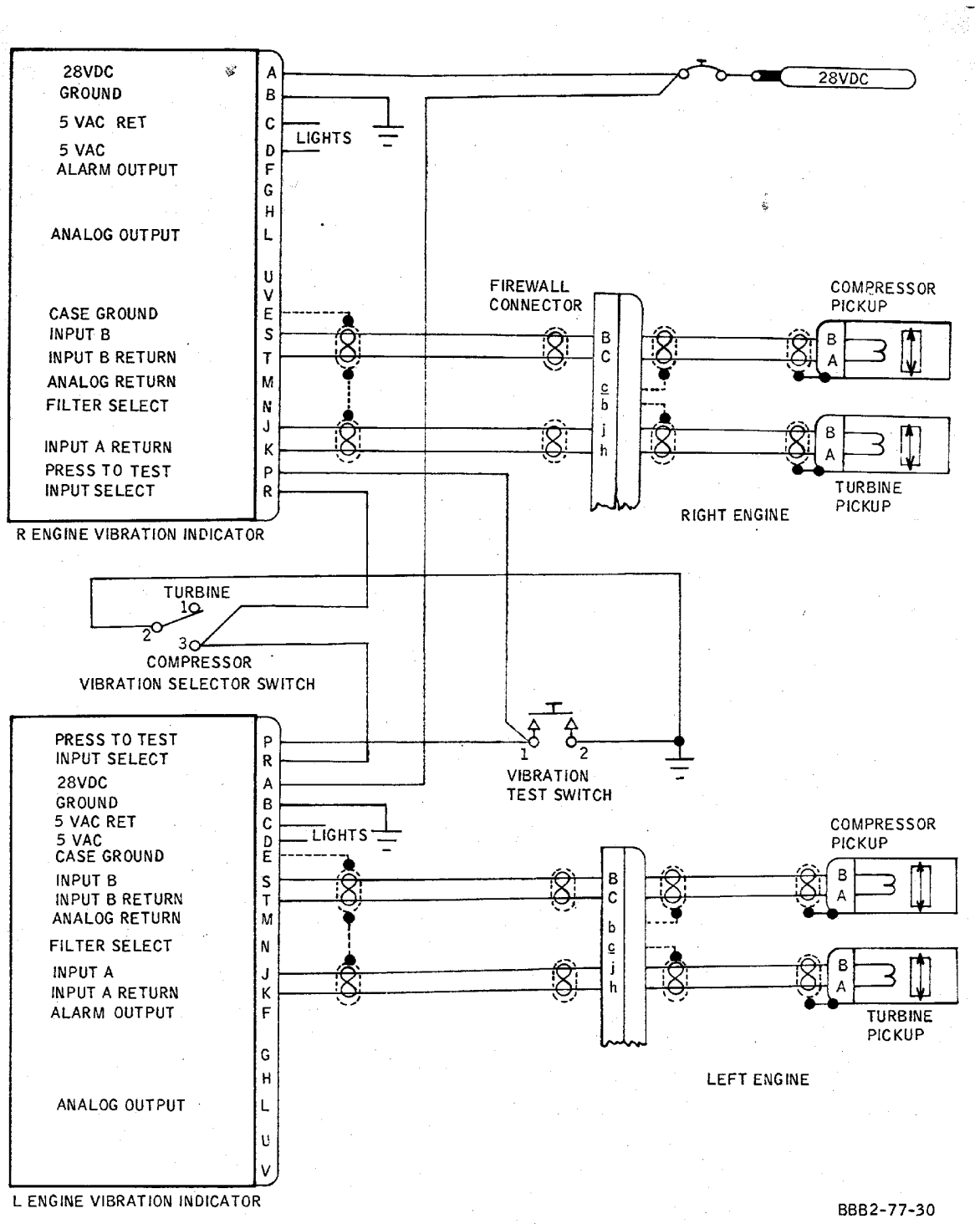
(1) Operation begins when the aircraft buses are energized and the vibration pickup selector switch is placed in the compressor (FWD) or turbine (AFT) position. The power passes through the circuit breaker to the vibration indicator power supply and amplifier sections. The indicator pointer may swing upscale momentarily and then settle back to zero. If the engine is operating the pointer will indicate the actual vibration.

(2) Engine vibration sensed by the compressor or turbine pickup is converted into an electrical signal and is routed through the system wiring to the indicator amplifier section. Each signal is amplified, integrated, filtered, and passed to the meter where it is displayed on the dial as mils of vibration.

(3) Actuating the vibration system test switch will cause the indicator pointer to display an amplitude of 3 mils minimum. When the switch is released the indicator pointer will return to zero or if the engine is operating, to the actual vibration.



Engine Vibration Monitoring (EVM) - System
Figure 1/77-30-00-990-801



Engine Vibration Monitoring (EVM) - Schematic
Figure 2/77-30-00-990-802

ANALYZERS - DESCRIPTION AND OPERATION

1. General

A. The analyzer portion of the engine indicating system consists of the EVM system which, used in addition to other engine indicating systems, provides a means of detecting possible internal engine malfunction.

2. Engine Vibration System

A. Description

(1) The vibration monitoring consists of four vibration pickups, a signal conditioning unit, two vibration indicators, a vibration pickup switch, flight data acquisition unit (FDAU) and a vibration monitor switch. Electrical power supplied to the system from the 115-volt, 400-cycle Alternating Current (AC) bus and the 28-volt DC bus.

(2) Engine Vibration Pickups - Two engine vibration pickups are mounted on the engine: one on the compressor case and the other on the turbine case. The pickups are linear accelerometer transducers which convert the mechanical energy of vibration into electrical signal. The pickups consist of a bobbin coil, a fixed magnet, a magnet sleeve, and magnet compression springs. The components are contained within a non-magnetic stainless steel case provided with an external electrical connector. The pickup has a N_1 and N_2 frequency range of 40 to 209 Hz.

(3) Tracking Filter Signal Conditioning Unit - The signal conditioning unit is mounted in the radio rack in the electrical/electronics compartment of the aircraft. The signal conditioning unit is a transistorized unit consisting of two identical broad-band channel modules, two identical tracking filter channel modules, and a power supply module which are contained in a lightweight case provided with external electrical connections.

(4) Engine Vibration Indicators - The two engine vibration indicators are mounted in the flight compartment and show a dial presentation of engine vibration. The indicator is a hermetically sealed integrally lighted, permanent-magnet-moving-coil type, and is calibrated to display a vibration amplitude of 0 to 5 IN/SEC. The indicator is compensated to correct for varying ambient temperatures. For aircraft with the Wavelabs or CEC EVM system, the indication in the cockpit is displayed as a single vibration amplitude value of 0 to 5 mils.

(5) Engine Vibration Pickup Switch - The engine vibration pickup switch, mounted in the flight compartment, provides selection of either compressor (FWD) or turbine (AFT) pickups for both engines.

(6) Engine Vibration Monitor Switch - The engine vibration monitor switch, mounted in the flight compartment, consists of three indicating modes: TRACK, OVERALL, or TEST to provide the means by which vibration system integrity, operation, and system self test can be checked for both engines.

(7) Engine Vibration High Light - The engine vibration high light is mounted within the overhead annunciator panel. ENGINE VIBRATION HI light will come on to indicate high engine vibration.

(8) Flight Data Acquisition Unit (AIDS) - The FDAU is mounted in the radio rack in the electrical/electronics compartment of the aircraft. The FDAU records broad-band signals of EVM systems.

B. Operation

(1) Operation begins when the aircraft buses are energized and the vibration pickup switch is placed in the compressor (FWD) or turbine (AFT) position. The power passes through circuit breakers to the signal conditioning unit power and amplifier modules. From the signal conditioning unit power is routed to the indicator. The indicator may momentarily go upscale and after approximately two to four seconds return to zero. If the engine is operating, the pointer will indicate actual vibration.

(2) Engine vibration sensed by the compressor or turbine pickup is converted into an electrical signal and is routed through the system wiring to its corresponding amplifier module within the signal conditioning unit. Each signal is amplified, filtered and integrated to velocity terms. The signal is full-wave rectified, averaged and then routed through the system wiring to the indicator where it is displayed on the dial as IN/SEC of vibration.

(3) Broad-band signals are passed through level detectors and lamp driver circuitry which causes the ENGINE VIBRATION HI light to come on to illuminate if one of the four broad-band channels FWD or AFT of left engine or right engine detects vibration amplitude exceeding a preset value of 2.5 IN/SEC.

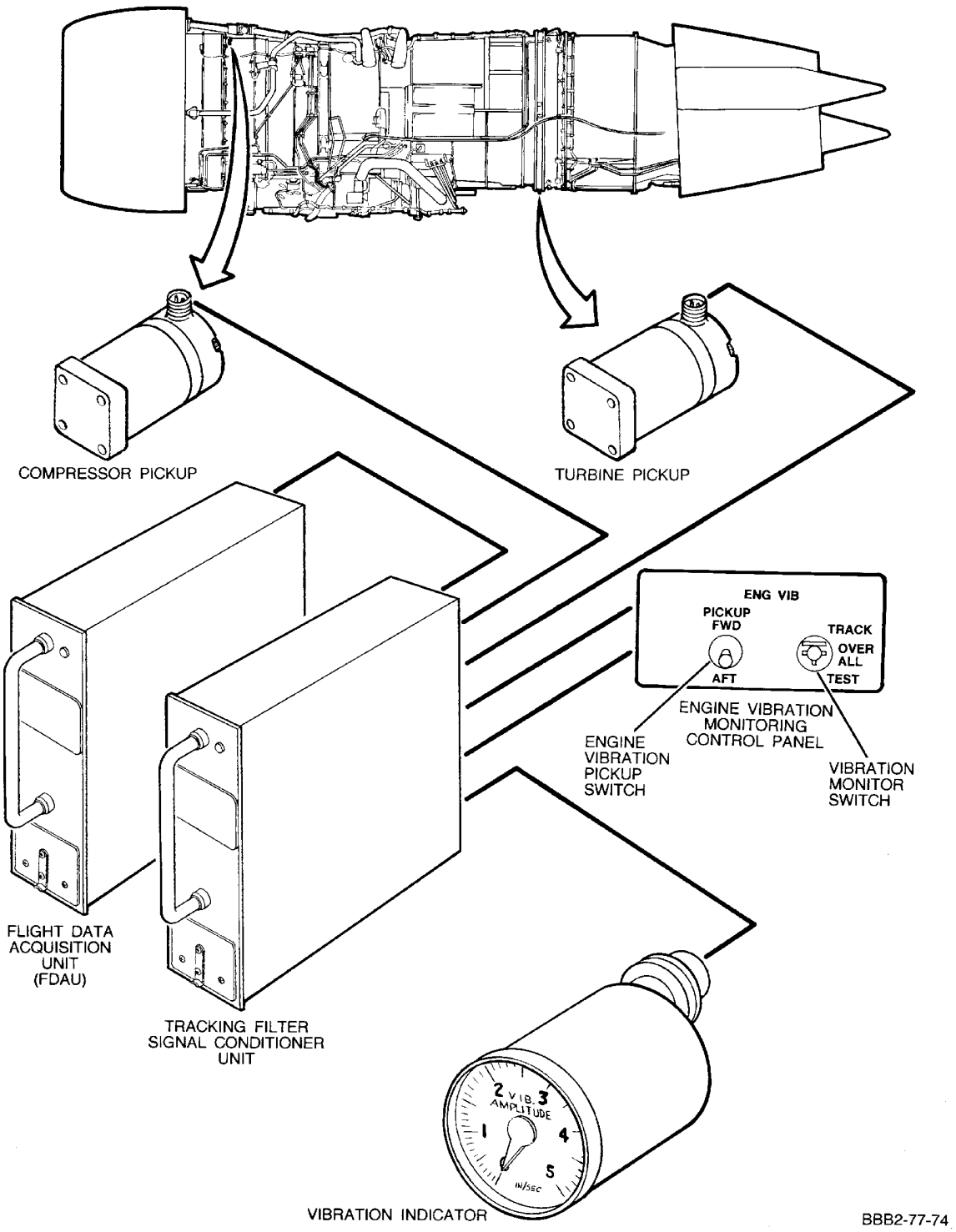
(4) Vibration monitor switch:

(a) TRACK - Measures and displays narrow band N_1 (low pressure) and N_2 (high pressure) engine vibration reading for each engine.

(b) OVERALL - Measures and displays broad-band (all engine related vibrations) engine vibration reading for each engine.

(c) TEST - Actuating the vibration monitor switch to the TEST position causes the indicator pointer to go upscale and at 2.5 IN/SEC the ENGINE VIBRATION HI light comes on. The indicator will continue to upscale to display an amplitude of 4 IN/SEC. When the switch is released, the indicator pointer returns to zero and ENGINE VIBRATION HI light goes out.

(5) Flight Data Acquisition Unit (FDAU) - Broad-band signals from the signal conditioner unit are full wave rectified to provide signals necessary for AIDS recording of EVM systems parameters.



Engine Vibration Monitoring (EVM) System
Figure 1/77-30-00-990-805

ENGINE VIBRATION MONITORING - TROUBLE SHOOTING

1. General

A. This maintenance practice provides trouble shooting procedures for the EVM system. The EVM system is powered by 28-volt DC through a circuit breaker located on the lower EPC circuit breaker panel.

B. The position of the circuit breaker should be checked before beginning trouble shooting procedures.

C. Trouble shooting procedures for both engines are identical.

D. At conclusion of trouble shooting the system should be tested as outlined in PAGEBLOCK 77-32-00/201 Config 1.

2. Trouble Shooting Engine Vibration Monitoring

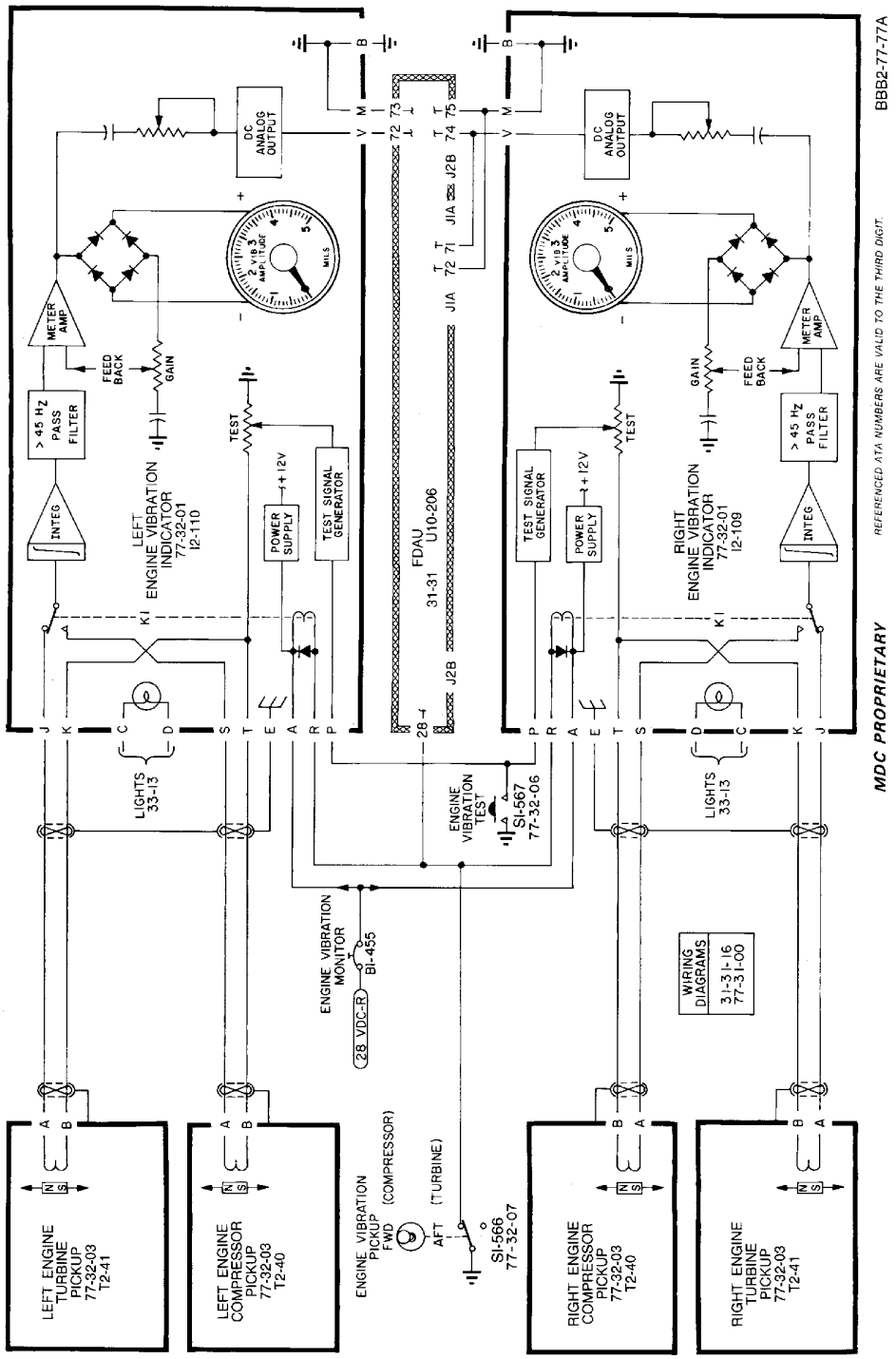
	Possible Causes	Isolation Procedure	Correction
A. VIBRATION SYSTEM INOPERATIVE			
CAUTION: MAKE CERTAIN THAT ELECTRICAL CONNECTORS FOR ENGINE VIBRATION MONITOR (EVM) INDICATORS ARE INSTALLED CORRECTLY. CROSSING OF EVM INDICATOR ELECTRICAL CONNECTORS DURING MAINTENANCE WILL RESULT IN LEFT ENGINE DISPLAYING VIBRATIONS ON RIGHT INDICATOR AND VICE-VERSA. IF NOT CORRECTED, EVM INDICATING INCORRECT READING COULD RESULT IN FLIGHT CREW CONFUSION AND POSSIBILITY OF INADVERTENTLY SHUTTING DOWN GOOD ENGINE DURING EMERGENCY.			
(1)	Defective indicator	With system power on, place vibration selector switch in turbine position. Actuate test switch and hold. Vibration indicator pointer should indicate 3 mils minimum. Release test switch. Place vibration selector switch in compressor position. Actuate test switch and hold. Indicator pointer should indicate 3 mils minimum.	If reading is not obtained, replace indicator. If reading is obtained, refer to step (2).
(2)	Defective system wiring	With system power off, perform continuity check.	Repair wiring.
B. TURBINE SECTION OPERATIVE, COMPRESSOR SECTION INOPERATIVE			
(1)	Defective pickup	With system power off, disconnect pickup electrical connector. Check between pickup pins for resistance of 415 to 565 ohms. *[1] *[2]	If resistance of 415 to 565 ohms is not obtained, replace pickup. If resistance is obtained, refer to step (2).
(2)	Faulty system wiring	With system power off, perform continuity check.	Repair wiring.
C. COMPRESSOR SECTION OPERATIVE, TURBINE SECTION INOPERATIVE			
(1)	Defective pickup.	Ref. 2.B. step (1) and (2).	Replace pickup.
D. INDICATOR POINTER INDICATES BELOW 3 MILS MINIMUM DURING TEST			

(Continued)

	Possible Causes	Isolation Procedure	Correction
CAUTION: MAKE CERTAIN THAT ELECTRICAL CONNECTORS FOR ENGINE VIBRATION MONITOR (EVM) INDICATORS ARE INSTALLED CORRECTLY. CROSSING OF EVM INDICATOR ELECTRICAL CONNECTORS DURING MAINTENANCE WILL RESULT IN LEFT ENGINE DISPLAYING VIBRATIONS ON RIGHT INDICATOR AND VICE-VERSA. IF NOT CORRECTED, EVM INDICATING INCORRECT READING COULD RESULT IN FLIGHT CREW CONFUSION AND POSSIBILITY OF INADVERTENTLY SHUTTING DOWN GOOD ENGINE DURING EMERGENCY.			
(1)	Defective indicator	Substitute with known good indicator. With power on, place selector switch in turbine or compressor position. Actuate test switch. Indicator pointer should indicate 3 mils minimum. Release test switch.	Replace indicator.

*[1] The coil resistance for the Wavelabs Model 750 Vibration Transducer at 75°F (24°C) is 450 ohms to 550 ohms .

*[2] The coil resistance for the CEC Vibration Transducer at 75°F (24°C) is 323 ohms to 575 ohms.



Engine Vibration Monitoring - Schematic
Figure 101/77-32-00-990-801

ENGINE VIBRATION MONITORING - TROUBLE SHOOTING

1. General

A. This maintenance practice provides trouble shooting procedures for the EVM system.

B. The EVM system is powered by 115-volt, 400-cycle AC and 28-volt DC. The 115-volt AC circuit breaker is located on the upper EPC circuit breaker and the 28-volt DC circuit breaker is located on the lower EPC circuit breaker panel.

C. The position of both circuit breakers should be checked before beginning trouble shooting procedures.

D. Trouble shooting procedures for both engines are identical.

E. At conclusion of trouble shooting the system should be tested as outlined in ENGINE VIBRATION MONITORING, SUBJECT 77-32-00, Page 201.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

Table 101

Name and Number	Manufacturer
Megohmmeter	
Capacitance Meter	
Digital ohmmeter	

3. Trouble Shooting Engine Vibration Monitoring

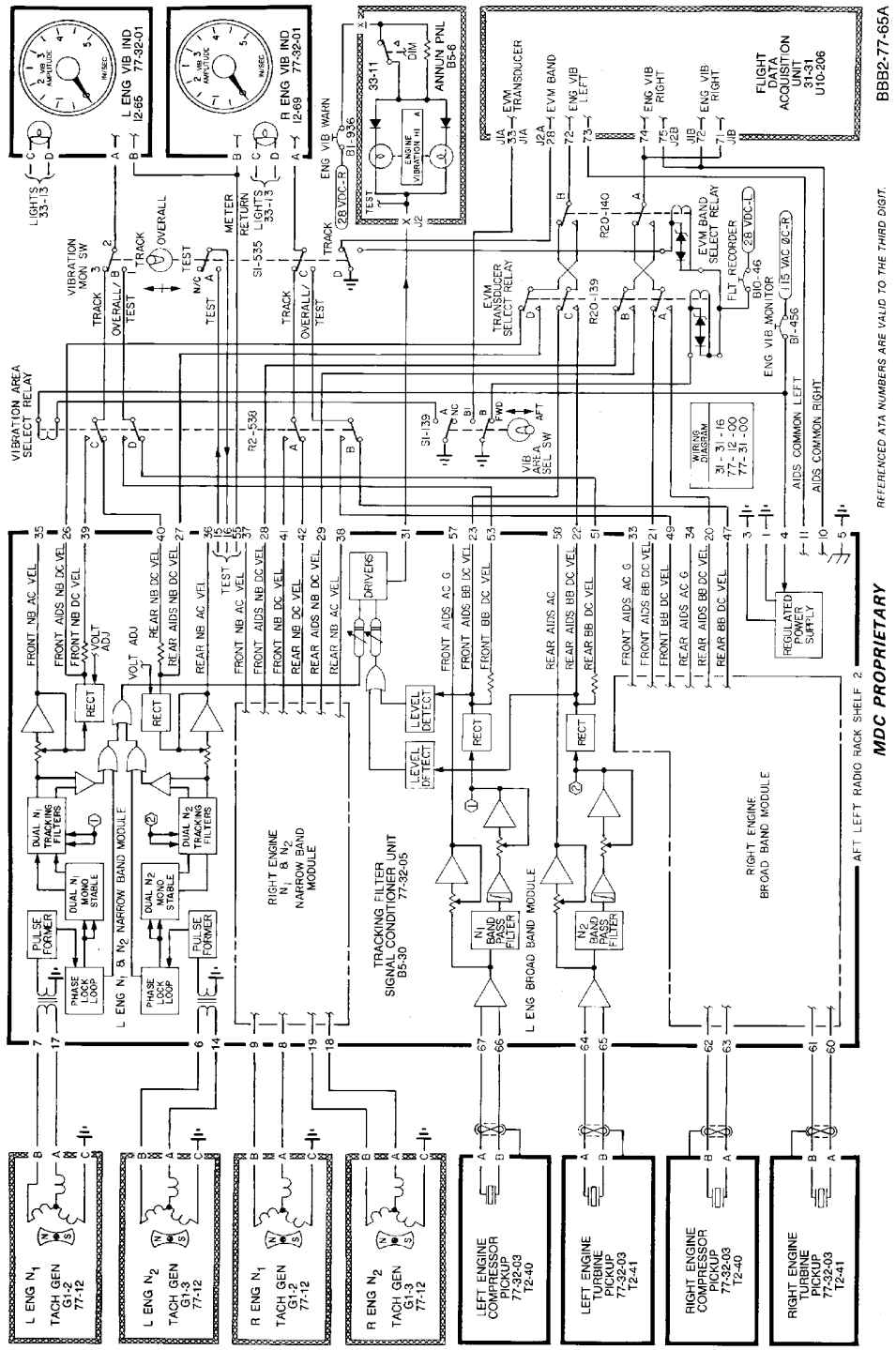
	Possible Causes	Isolation Procedure	Correction
A. VIBRATION MONITORING SYSTEM INOPERATIVE			
(1)	Defective monitor unit	With aircraft power on and circuit breakers closed, place Engine Vibration Pickup switch in FWD position. Place vibration monitor switch in TEST position and hold. Left and right indicators should indicate 4(±.5) IN/SEC. Check that ENGINE VIBRATION HI light on annunciator panel comes on. Place vibration monitor switch in AFT position. Left and right indicators should indicate 4(±.5) IN/SEC. Check that ENGINE VIBRATION HI light on annunciator panel comes on. Release test switch.	If reading is not obtained, replace monitor unit. If reading is obtained, refer to steps (2) and (3).

(Continued)

	Possible Causes	Isolation Procedure	Correction
CAUTION: MAKE CERTAIN THAT ELECTRICAL CONNECTORS FOR ENGINE VIBRATION MONITOR (EVM) INDICATORS ARE INSTALLED CORRECTLY. CROSSING OF EVM INDICATOR ELECTRICAL CONNECTORS DURING MAINTENANCE WILL RESULT IN LEFT ENGINE DISPLAYING VIBRATIONS ON RIGHT INDICATOR AND VICE-VERSA. IF NOT CORRECTED, EVM INDICATING INCORRECT READING COULD RESULT IN FLIGHT CREW CONFUSION AND POSSIBILITY OF INADVERTENTLY SHUTTING DOWN GOOD ENGINE DURING EMERGENCY. **CAUTION:** METER USED TO CHECK RESISTANCE OF INDICATOR MUST HAVE 20,000 OHMS PER VOLT MOVEMENT.			
(2)	Defective indicator	With system power off, disconnect indicator electrical connector. Check between pins A and B of indicator for resistance of 633 to 677 ohms.	If resistance is not obtained, replace indicator. If reading is obtained, refer to step (3).
(3)	Faulty system wiring	With system power off, perform continuity check.	Repair wiring.
B. TURBINE SECTION OPERATIVE, COMPRESSOR SECTION INOPERATIVE			
(1)	Defective compressor pickup	With system power off, disconnect compressor pickup electrical connector, and perform method 1 or 2 as follows:	If resistance or capacitance is not obtained, replace pickup. If resistance or capacitance is obtained, refer to steps (2) and (3).
CAUTION: HANDLE PICKUP WITH EXTREME CARE. DO NOT BUMP, HIT OR STRIKE.			
		(Method 1) Using Megohmmeter set to 100 V, check ohm reading between pins A and B, pin A and shield, and pin B and shield. Readings should be 1,000 Meg ohms (10^9) or greater. (Method 2) Using Capacitance Meter, check capacitance be tween pins A and B for a reading of 80(±2) pF.	
(2)	Defective monitor unit	With system power on, place engine vibration pickup switch in AFT position. Place vibration monitor switch in TEST position and hold. Left and right indicators should indicate 4(±.5) IN/SEC. Check that ENGINE VIBRATION HI light on annunciator panel comes on.	If reading is not obtained, replace monitor unit. If reading is obtained, refer to step (3).

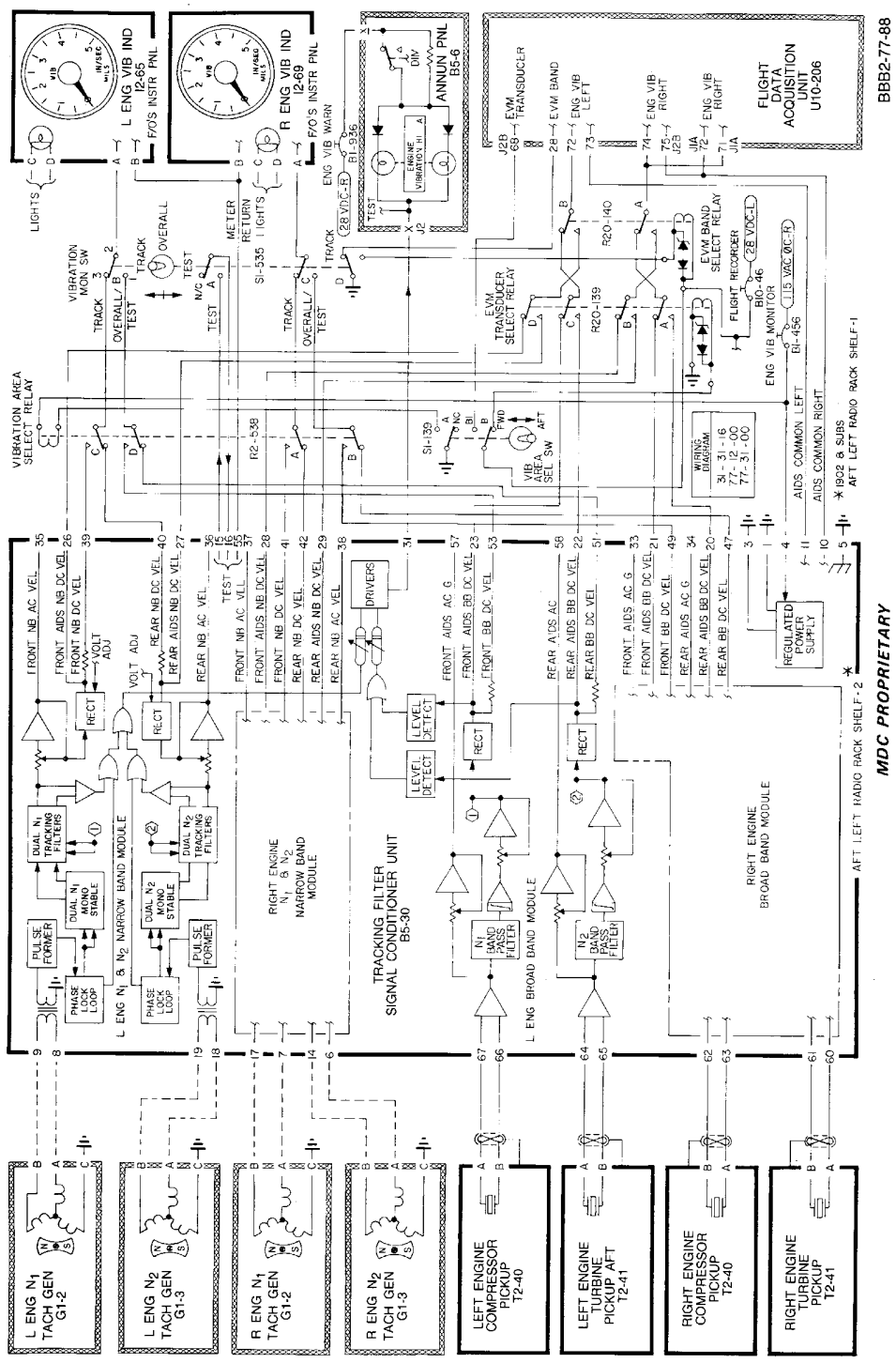
(Continued)

	Possible Causes	Isolation Procedure	Correction
		Release test switch.	
(3)	Faulty system wiring	With system power off, perform continuity check.	Repair wiring.
C. COMPRESSOR SECTION OPERATIVE, TURBINE SECTION INOPERATIVE			
(1)	Defective turbine pickup	With system power off, disconnect compressor pickup electrical connector, and perform method 1 or 2 as follows:	If resistance or capacitance is not obtained, replace pickup. If resistance or capacitance is obtained, refer to steps (2) and (3).
CAUTION: HANDLE PICKUP WITH EXTREME CARE. DO NOT BUMP, HIT OR STRIKE.			
		(Method 1) Using Megohmmeter set to 100 V, check ohm reading between pins A and B, pin A and shield, and pin B and shield. Readings should be 1,000 Meg ohms (10^9) or greater. (Method 2) Using Capacitance Meter, check capacitance be tween pins A and B for a reading of 80(±2) pF.	
(2)	Defective monitor unit	With system power on, place engine vibration pickup switch in AFT position. Place vibration monitor switch in TEST position and hold. Left and right indicators should indicate 4(±.5) IN/SEC. Check that ENGINE VIBRATION HI light on annunciator panel comes on. Release test switch.	If reading is not obtained, replace monitor unit. If reading is obtained, refer to step (3).
(3)	Faulty system wiring	With system power off, perform continuity check.	Repair wiring.
D. INDICATOR POINTER INDICATES BELOW 4(±.5) IN/SEC DURING TEST			
(1)	Defective indicator	With system power off, disconnect indicator electrical connector. Check between pins A and B of indicator for resistance of 633 to 677 ohms.	If resistance is not obtained, replace indicator. If resistance is obtained, refer to steps (2) and (3).
(2)	Defective monitor unit	Perform system self test. Refer to section A. step (1).	If reading is not obtained, replace monitor unit. If reading is obtained, refer to step (3).
(3)	Faulty system wiring	With system power off, perform continuity check.	Repair wiring.



Engine Vibration Monitoring - Schematic
Figure 101/77-32-00-990-803

EFFECTIVITY
WJE 405, 407, 409, 410, 880, 881, 883, 884



Engine Vibration Monitoring - Schematic
Figure 102/77-32-00-990-804

ENGINE VIBRATION MONITORING - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides EVM testing procedures with engines shutdown or operating.

B. The EVM system is powered by 28-volt DC through a circuit breaker located on the lower EPC panel. The system is operative when the electrical buses are energized.

C. The vibration pickup selector switch and the vibration system test switch are common to both engines.

D. Before beginning the test procedure the circuit breaker should be closed.

2. Adjustment/Test Engine Vibration Monitoring

CAUTION: MAKE CERTAIN THAT ELECTRICAL CONNECTORS FOR ENGINE VIBRATION MONITOR (EVM) INDICATORS ARE INSTALLED CORRECTLY. CROSSING OF EVM INDICATOR ELECTRICAL CONNECTORS DURING MAINTENANCE WILL RESULT IN LEFT ENGINE DISPLAYING VIBRATIONS ON RIGHT INDICATOR AND VICE-VERSA. IF NOT CORRECTED, EVM INDICATING INCORRECT READING COULD RESULT IN FLIGHT CREW CONFUSION AND POSSIBILITY OF INADVERTENTLY SHUTTING DOWN GOOD ENGINE DURING EMERGENCY.

CAUTION: TO PREVENT DAMAGE TO VIBRATION MONITORING SYSTEM ADJUSTMENTS SHOULD NOT BE MADE AT FIELD MAINTENANCE LEVEL.

A. Test EVM System

(1) Place vibration pickup selector switch in turbine position.

(2) Energize aircraft electrical buses. (SUBJECT 24-00-00, Page 201)

NOTE: The vibration indicator pointers may momentarily swing upscale and then settle back to zero provided the engines are not operating. If the engines are operating, the indicator pointers will indicate actual vibration.

(3) Actuate vibration system test switch and hold.

(4) Check that each indicator pointer indicates three mils minimum.

(5) Release test switch.

(6) Check that each indicator pointer returns to zero.

NOTE: If the engines are operating each indicator pointer should indicate actual vibration.

(7) Place vibration pickup selector switch in compressor position and perform Paragraph 2.A.(3) through Paragraph 2.A.(6).

(8) Deenergize aircraft electrical buses. (SUBJECT 24-00-00, Page 201)

ENGINE VIBRATION MONITORING - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides EVM test procedures with engines shut down or operating.

B. The EVM system is powered by 115-volt, 400-cycle AC through a circuit breaker (ENGINE VIBRATION MONITOR TEST) located on the upper EPC circuit breaker panel and 28-volt DC through a circuit breaker (ENGINE VIBRATION WARNING) located on the lower EPC circuit breaker panel. The system is operative when the electrical buses are energized.

C. Engine vibration indicators and engine vibration monitoring control panel is located on lower section of first officer's instrument panel. Engine vibration pickup switch and vibration monitor switch are common to both engines.

D. Before beginning the test procedure the circuit breakers should be closed.

2. Adjustment/Test Engine Vibration Monitoring

CAUTION: MAKE CERTAIN THAT ELECTRICAL CONNECTORS FOR ENGINE VIBRATION MONITOR (EVM) INDICATORS ARE INSTALLED CORRECTLY. CROSSING OF EVM INDICATOR ELECTRICAL CONNECTORS DURING MAINTENANCE WILL RESULT IN LEFT ENGINE DISPLAYING VIBRATIONS ON RIGHT INDICATOR AND VICE-VERSA. IF NOT CORRECTED, EVM INDICATING INCORRECT READING COULD RESULT IN FLIGHT CREW CONFUSION AND POSSIBILITY OF INADVERTENTLY SHUTTING DOWN GOOD ENGINE DURING EMERGENCY.

CAUTION: TO PREVENT DAMAGE TO VIBRATION MONITORING SYSTEM ADJUSTMENTS SHOULD NOT BE MADE AT FIELD MAINTENANCE LEVEL.

A. Test EVM System (System Self Test)

(1) Place engine vibration pickup switch in FWD position.

(2) Place vibration monitor switch in TEST position and hold. Left and right vibration indicators should indicate 4(±.5) IN/SEC. Check that ENGINE VIBRATION HI light on overhead annunciator panel is on.

NOTE: ENGINE VIBRATION HI light is set to come on at 2.5 in/sec or more to indicate high engine vibration.

(3) With vibration monitor switch still in TEST position, place vibration pickup switch in AFT position. Left and right vibration indicators should indicate 4(±.5) IN/SEC, and ENGINE VIBRATION HI light on overhead annunciator panel should come on.

NOTE: ENGINE VIBRATION HI light is set to come on at 2.5 in/sec or more to indicate high engine vibration.

B. Engine Vibration Check (with engine running)

NOTE: The following test procedure is to be performed only if engine vibration problem is indicated or an engine vibration problem is reported by the flight crew. The following procedure is to record engine vibration data.

(1) Place part power trim stop in required position. (GENERAL, SUBJECT 71-00-00, Page 501)

(2) Start engine to be tested. (GENERAL, SUBJECT 71-00-00, Page 501)

(3) Place engine vibration pickup switch to FWD position.

(4) Place vibration monitor switch to TRACK position.

(5) Advance throttle until power lever contacts part power stop. Operate engine until engine parameters are stabilized.

(6) Record N_2, N_1, and EPR readings and vibration level.

NOTE: Reference should be made to Table 201 and Table 202 for suggested EVM test data sheet.

(7) Place vibration monitor switch to OVERALL and record vibration level.

(8) Place engine vibration pickup switch to AFT position.

(9) Record N_2, N_1, and EPR readings and vibration level.

(10) Place vibration monitor switch to TRACK and record vibration level.

(11) Place throttle in idle position.

(12) Remove part power stop. (GENERAL, SUBJECT 71-00-00, Page 501)

(13) Advance throttle to takeoff power. Operate engine until parameters are stabilized.

(14) With vibration monitor switch still in TRACK position, place engine vibration pickup switch to FWD position.

(15) Record N_2, N_1, and EPR readings and vibration level.

(16) Place vibration monitor switch to OVERALL and record vibration level.

(17) Place engine vibration pickup switch to AFT position.

(18) Record N_2, N_1, and EPR readings and vibration level.

(19) Place vibration monitor switch to TRACK position and record vibration level.

(20) Place throttle in idle position.

(21) Shut down engine. (GENERAL, SUBJECT 71-00-00, Page 501)

(22) Open circuit breakers.

Table 201 Engine Vibration Monitor System Test Data Sheet (Engines Running)

(Suggested form to record data)

Aircraft S/N_____

Left engine S/N_____
Right engine S/N_____

Part Power Trim Stop:

	Left Engine				Right Engine			
	N_2 RPM	N_1 RPM	EPR	Vibration	N_2 RPM	N_1 RPM	EPR	Vibration
Forward: Tracking								
Overall	------	------	-------		------	------	------	
Aft: Overall								
Tracking	------	------	------		------	------	------	

Table 202 Engine Vibration Monitor System Test Data Sheet (Engines Running)

(Suggested form to record data)

Aircraft S/N_____

Left engine S/N_____
Right engine S/N_____

Table 202 Engine Vibration Monitor System Test Data Sheet (Engines Running) (Continued)

(Suggested form to record data) Takeoff Power:								
	Left Engine				Right Engine			
	N_2 RPM	N_1 RPM	EPR	Vibration	N_2 RPM	N_1 RPM	EPR	Vibration
Forward: Tracking								
Overall	------	------	-------		------	------	------	
Aft: Overall								
Tracking	------	------	------		------	------	------	

ENGINE VIBRATION PICKUPS - MAINTENANCE PRACTICES

1. General

A. This maintenance practices provides removal/installation instructions for the engine vibration pickups. The compressor case pickup is mounted on engine flange B at approximately the 11:00 o'clock position. The turbine case pickup is mounted on engine aft mount flange at approximately the 6:00 o'clock position.

B. Maintenance of the pickups is limited to removal/installation. The removal/installation procedures for pickups on all engines are identical.

C. Access to the pickups is through the upper and aft lower cowl doors.

NOTE: Forward lower cowl door overlaps the aft lower cowl door, and must be opened prior to opening aft lower cowl door.

WARNING: EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN OR INJURY TO PERSONNEL COULD RESULT.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: OPEN UPPER COWL DOOR ONLY AS MUCH AS NECESSARY TO ALLOW HOLD-OPEN RODS TO BE CONNECTED TO ENGINE. OPENING DOOR TOO FAR MAY CAUSE DAMAGE TO PYLON HINGE POINTS.

CAUTION: IF APU IS USED, MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

D. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Lockwire, .020 corrosion-resistant, P05-288	
Ohmmeter	

3. Removal/Installation Engine Vibration Pickups

A. Remove Pickup

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
T	39	B1-455	ENGINE VIBRATION MONITOR

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(4) Disconnect electrical connector from pickup.

CAUTION: VIBRATION PICKUPS ARE EXTREMELY DELICATE. HANDLE CAREFULLY AT ALL TIMES.

(5) Remove pickup from engine mounting bracket.

B. Install Pickup

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
T	39	B1-455	ENGINE VIBRATION MONITOR

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

CAUTION: VIBRATION PICKUPS ARE EXTREMELY DELICATE. HANDLE CAREFULLY AT ALL TIMES.

(3) Check pickup for resistance of 415 to 565 ohms.

(4) Position pickup on mounting bracket with electrical connector pointing down on compressor case, pointing down on turbine case, and install screws.

(5) Connect electrical connector to pickup. Safety electrical connector with P05-288 lockwire.

(6) Remove tools, equipment, loose hardware, and debris from maintenance area.

(7) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
T	39	B1-455	ENGINE VIBRATION MONITOR

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(8) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(9) Close access door (5901C) for left engine or (5902C) for right engine.

(10) Check engine vibration monitoring system. (PAGEBLOCK 77-32-00/201 Config 1)

ENGINE VIBRATION PICKUPS - MAINTENANCE PRACTICES

1. General

A. This maintenance practices provides removal/installation instructions for the engine vibration pickup. The compressor case pickup is mounted on engine flange B at approximately the 11:00 o'clock position. The turbine case pickup is mounted on engine aft mount flange at approximately the 6:00 o'clock position.

B. Maintenance of the pickup is limited to removal/installation. The removal/installation procedures for pickups on all engines are identical.

C. Access to the pickup is through the upper and aft lower cowl doors.

NOTE: Forward lower cowl door overlaps the aft lower cowl door, and must be opened prior to opening aft lower cowl door.

WARNING: EXERCISE CARE TO AVOID STRAKES WHEN WORKING IN ENGINE AREA WITH COWL DOORS OPEN OR INJURY TO PERSONNEL COULD RESULT.

CAUTION: TO PREVENT STRUCTURAL DAMAGE, USE HOLD OPEN RODS ON EACH COWL DOOR.

CAUTION: OPEN UPPER COWL DOOR ONLY AS MUCH AS NECESSARY TO ALLOW HOLD-OPEN RODS TO BE CONNECTED TO ENGINE. OPENING DOOR TOO FAR MAY CAUSE DAMAGE TO PYLON HINGE POINTS.

CAUTION: IF APU IS USED, MAKE CERTAIN RIGHT ENGINE UPPER COWL DOOR IS CLOSED BEFORE OPERATING APU, OR APU EXHAUST WILL IMPINGE DIRECTLY ON COWL DOOR CAUSING EXTENSIVE DAMAGE.

D. For procedures to open cowl doors on all engines, refer to PAGEBLOCK 71-00-00/201.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Lockwire, .020 corrosion resistant, P05-288	
Megohmmeter capacitance meter	

3. Removal/Installation Engine Vibration Pickups

A. Remove Pickup

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP

(Continued)

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 405, 407, 408, 410, 880, 884			
U	41	B1-423	ENGINE START VALVE RIGHT
U	42	B1-422	ENGINE START VALVE LEFT

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
WJE 407, 408			
T	39	B1-936	ENGINE VIBRATION WARNING

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 405, 407-410, 880, 881, 883, 884			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

(2) Open access door (5901C) for left engine or (5902C) for right engine.

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(3) Place thrust reverser control valve in dump position and install lockpin. (PAGEBLOCK 78-00-00/201)

(4) Disconnect electrical connector from pickup.

CAUTION: VIBRATION PICKUPS ARE EXTREMELY DELICATE. HANDLE CAREFULLY AT ALL TIMES.

(5) Remove pickup from engine mounting bracket.

B. Install Pickup

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN BEFORE ATTEMPTING MAINTENANCE PROCEDURES. INADVERTENT ENGINE START OR REVERSER OPERATION COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are open and tagged:

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 405, 407, 408, 410, 880, 884			
U	41	B1-423	ENGINE START VALVE RIGHT
U	42	B1-422	ENGINE START VALVE LEFT

WJE 405, 407, 408, 410, 880, 884 (Continued)

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
WJE 407, 408			
T	39	B1-936	ENGINE VIBRATION WARNING

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 405, 407-410, 880, 881, 883, 884			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THAT THRUST REVERSER HYDRAULIC SYSTEM HAS DEPRESSURIZED BY CHECKING THRUST REVERSER ACCUMULATOR PRESSURE GAGE AFTER CONTROL VALVE ARM HAS BEEN LOCKPINNED IN DUMP POSITION. GAGE SHOULD READ 950 TO 1050 PSI (6550 TO 7239 KPA) (PRECHARGE PRESSURE).

(2) Make certain thrust reverser control valve is in dump position and lockpin is installed. (PAGEBLOCK 78-00-00/201)

CAUTION: VIBRATION PICKUPS ARE EXTREMELY DELICATE. HANDLE CAREFULLY AT ALL TIMES.

(3) Check pickup as follows:

(a) Method 1 - Using Megohmmeter set to 100 V, check ohm reading between pins A and B, pin A and shield and pin B and shield. Readings should be 1,000 meg ohms (10^9) or greater.

(b) Method 2 - Using Capacitance Meter, check capacitance between pins A and B for a reading of 80(±2) pF.

(4) Position pickup on mounting bracket with electrical connector pointing down on compressor case, pointing aft on turbine case, and install screws.

(5) Connect electrical connector to pickup. Safety electrical connector with P05-288 lockwire.

(6) Remove tools, equipment, loose hardware, and debris from maintenance area.

(7) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
U	40	B1-40	ENGINE START PUMP
WJE 405, 407, 408, 410, 880, 884			
U	41	B1-423	ENGINE START VALVE RIGHT
U	42	B1-422	ENGINE START VALVE LEFT

WJE 405, 407, 408, 410, 880, 884 (Continued)

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
WJE 407, 408			
T	39	B1-936	ENGINE VIBRATION WARNING

UPPER EPC, ENGINE - LEFT AC BUS

Row	Col	Number	Name
WJE 405, 407-410, 880, 881, 883, 884			
K	26	B1-424	LEFT ENGINE IGNITION

UPPER EPC, ENGINE - RIGHT AC BUS

Row	Col	Number	Name
L	26	B1-425	RIGHT ENGINE IGNITION

WARNING: MAKE CERTAIN THROTTLE/THRUST REVERSER LEVER POSITION CORRESPONDS WITH THRUST REVERSER DOOR POSITION AND THAT ALL PERSONNEL AND EQUIPMENT ARE WELL CLEAR OF THRUST REVERSER BEFORE OPERATION. ANY TIME THAT THRUST REVERSER CONTROL VALVE IS NOT IN DUMP POSITION, 3000 PSI (20,700 KPA) IS AVAILABLE AND WILL MOVE REVERSER DOORS IN RESPONSE TO THROTTLE/THRUST REVERSER LEVER MOVEMENT REGARDLESS OF WHETHER ANY ELECTRICAL OR HYDRAULIC POWER IS SUPPLIED TO AIRCRAFT.

(8) Remove lockpin from thrust reverser control valve. Stow lockpin. (PAGEBLOCK 78-00-00/201)

(9) Close access door (5901C) for left engine or (5902C) for right engine.

(10) Check engine vibration monitoring system. (PAGEBLOCK 77-32-00/201 Config 3)

TRACKING FILTER SIGNAL CONDITIONING - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions for the signal conditioner unit. The signal conditioner unit is located in the aircraft electrical/electronics compartment mounted in the aft left radio rack.

B. Maintenance of the signal conditioner is limited to removal/installation. Access to the signal conditioner unit is through the electrical/electronics compartment access door 4501A.

2. Removal/Installation Tracking Filter Signal Conditioning

A. Remove Unit

(1) Tag throttle/thrust reverser lever, and open and tag following circuit breakers:

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
WJE 407, 408			
T	39	B1-936	ENGINE VIBRATION WARNING

UPPER EPC, LEFT RADIO BUS

Row	Col	Number	Name
WJE 405, 407-410, 880, 881, 883, 884			
C	14	B10-331	FLIGHT RECORDER

UPPER EPC, RIGHT RADIO BUS

Row	Col	Number	Name
B	7	B10-329	FLIGHT RECORDER

(2) Loosen holddown nut at base of unit.

(3) Pull unit straight forward and remove.

B. Install Unit

(1) Make certain throttle/thrust reverser lever is tagged and following circuit breakers are opened and tagged:

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
WJE 407, 408			
T	39	B1-936	ENGINE VIBRATION WARNING

UPPER EPC, LEFT RADIO BUS

Row	Col	Number	Name
WJE 405, 407-410, 880, 881, 883, 884			
C	14	B10-331	FLIGHT RECORDER

UPPER EPC, RIGHT RADIO BUS

Row	Col	Number	Name
B	7	B10-329	FLIGHT RECORDER

(2) Position unit with electrical connectors toward rear of rack and push firmly into rack.

(3) Tighten holddown nut.

(4) Remove tag from throttle/thrust reverser lever, and remove tags and close following circuit breakers:

LOWER EPC, ENGINE - RIGHT DC BUS

Row	Col	Number	Name
WJE 407, 408			
T	39	B1-936	ENGINE VIBRATION WARNING

UPPER EPC, LEFT RADIO BUS

Row	Col	Number	Name
WJE 405, 407-410, 880, 881, 883, 884			
C	14	B10-331	FLIGHT RECORDER

UPPER EPC, RIGHT RADIO BUS

Row	Col	Number	Name
B	7	B10-329	FLIGHT RECORDER

3. **Adjustment/Test Tracking Filter Signal Conditioning**

A. Test (EVM System Self-Test) Unit

(1) Place engine vibration pickup switch in FWD position.

(2) Place vibration monitor switch in TEST position and hold. Left and right vibration indicators should indicate 4(±.5) IN/SEC. Check that ENGINE VIBRATION HI light on overhead annunciator panel is on.

NOTE: ENGINE VIBRATION HI light is set to come on at 2.5 in/sec or more to indicate high engine vibration.

(3) With vibration monitor switch still in TEST position, place vibration pickup switch in AFT position. Left and right vibration indicators should indicate 4(±.5) IN/SEC, and ENGINE VIBRATION HI light on overhead annunciator panel should come on.

NOTE: ENGINE VIBRATION HI light is set to come on at 2.5 in/sec or more to indicate high engine vibration.

ENGINE DISPLAY PANEL - DESCRIPTION AND OPERATION

1. General

A. The Engine Display Panel indicates EPR, engine high compressor speed (N_2), engine low compressor speed (N_1), and EGT by displaying parameters on a solid state Light Emitting Diode (LED) display. Sensing devices located on each engine continuously transmit signals to the Engine Display Panel in the flight compartment providing indications of failures or malfunctions in engine sensors and engine operating conditions.

B. BIT - A BIT is incorporated in the Engine Display Panel to test equipment to a functional level. During the BIT test each module will operate its own BIT sequence. The processor will do a Random Access Memory (RAM) check to ensure that all bits of the RAM function correctly and an Erasable Programmable Read Only Memory (EPROM) check sum to ensure that the EPROM contents are correct. These two tests are "transparent" and only take a few milliseconds (Refer to PAGEBLOCK 77-42-00/201 for Adjustment/Test).

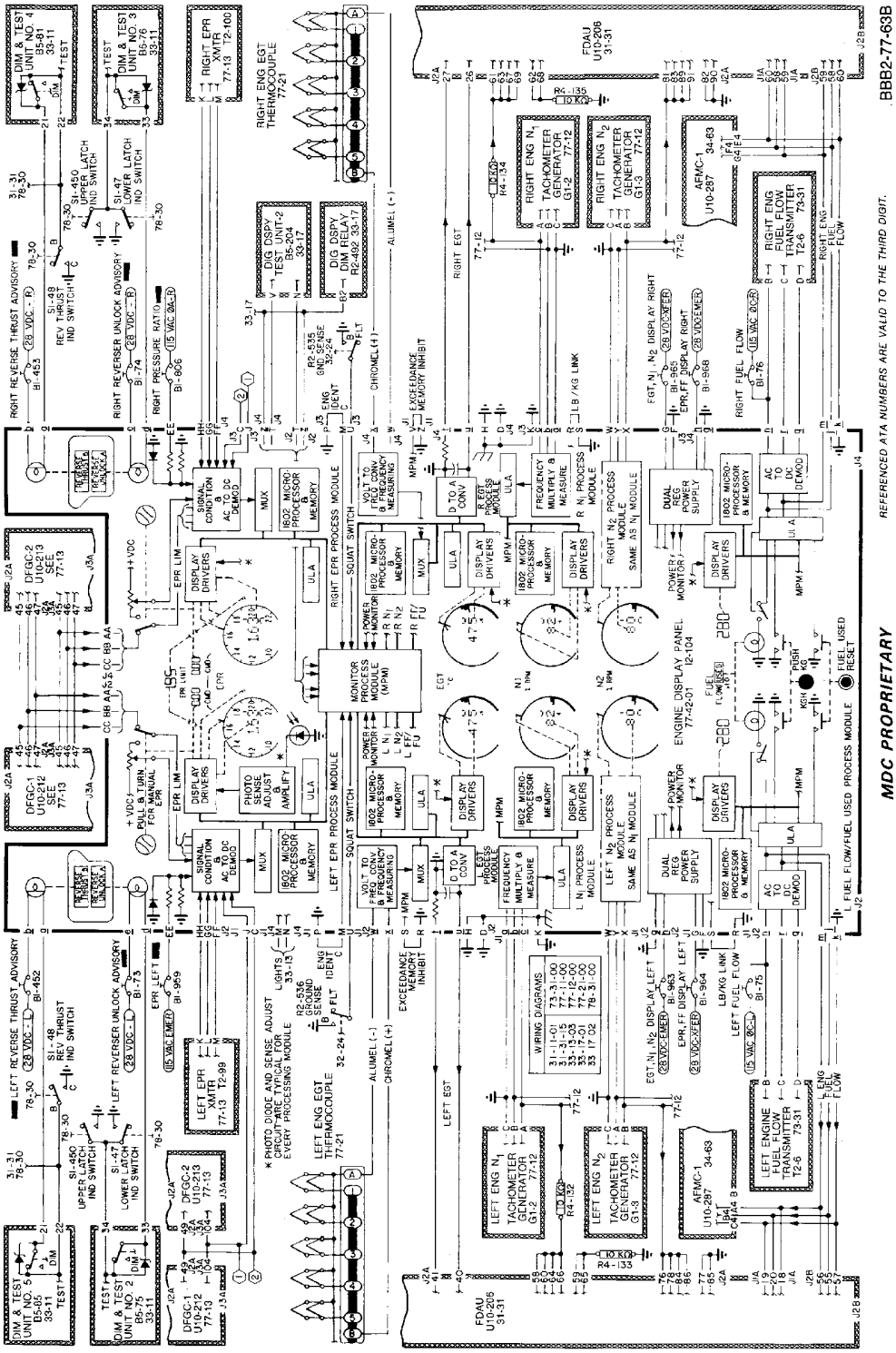
2. Power

A. Engine low pressure compressor speed (N_1 RPM indication) and engine high pressure compressor speed (N_2 RPM indication) are displayed in percentage on the Engine Display Panel. Low compressor speed is derived from an N_1 tachometer generator mounted on the engine front accessory drive case under the inlet bullet. High compressor speed is derived from an N_2 tachometer generator mounted on the right side of the engine accessory gearbox.

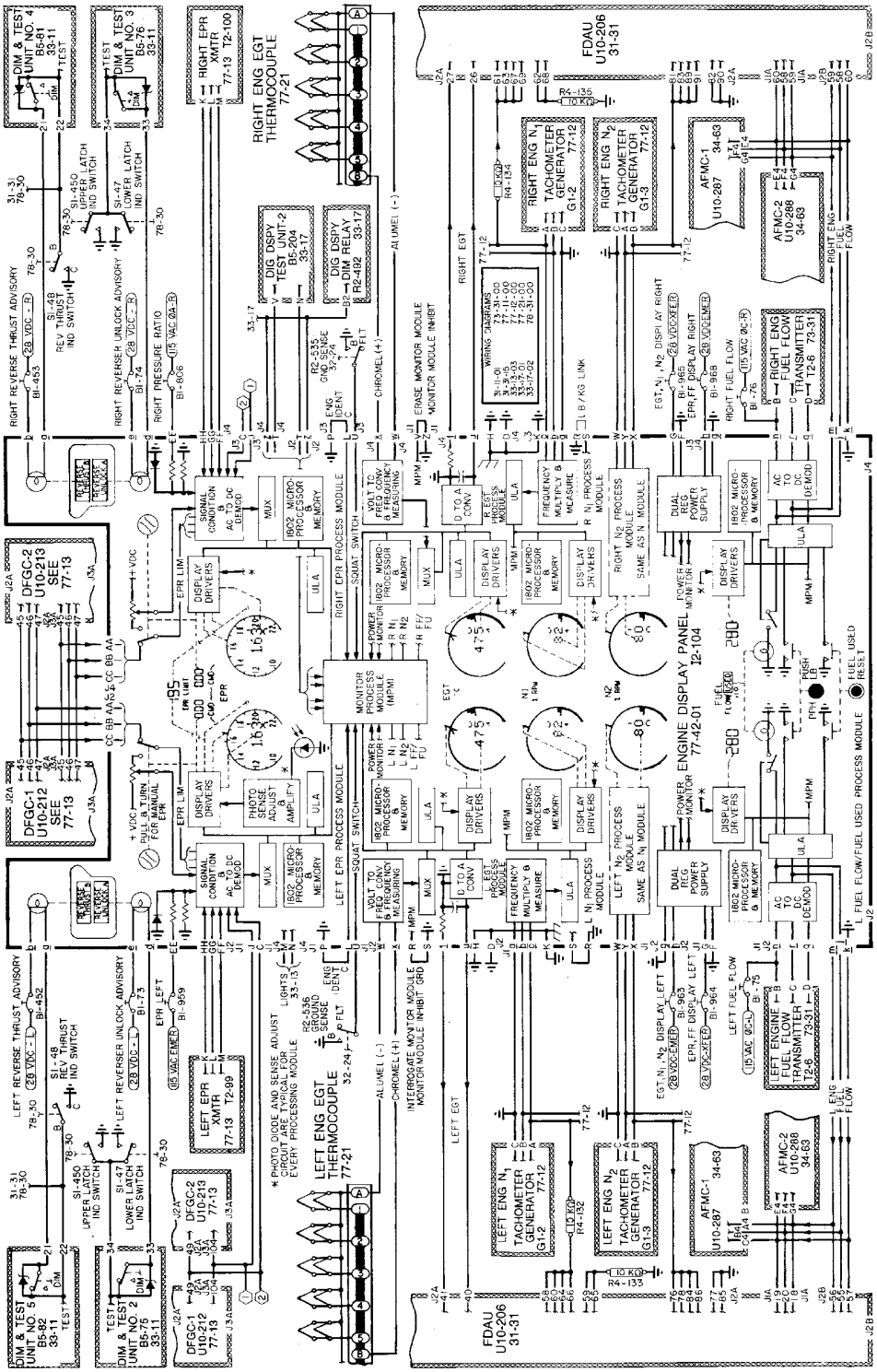
B. The EPR systems senses and measures the pressure differential between engine inlet ram air pressure (P_{t2}) and turbine exhaust gas pressure (P_{t7}). Pressure ratio is displayed in percentage on the Engine Display Panel. For a complete description and operation of power, refer to POWER, SUBJECT 77-10-00, Page 1.

3. Temperature

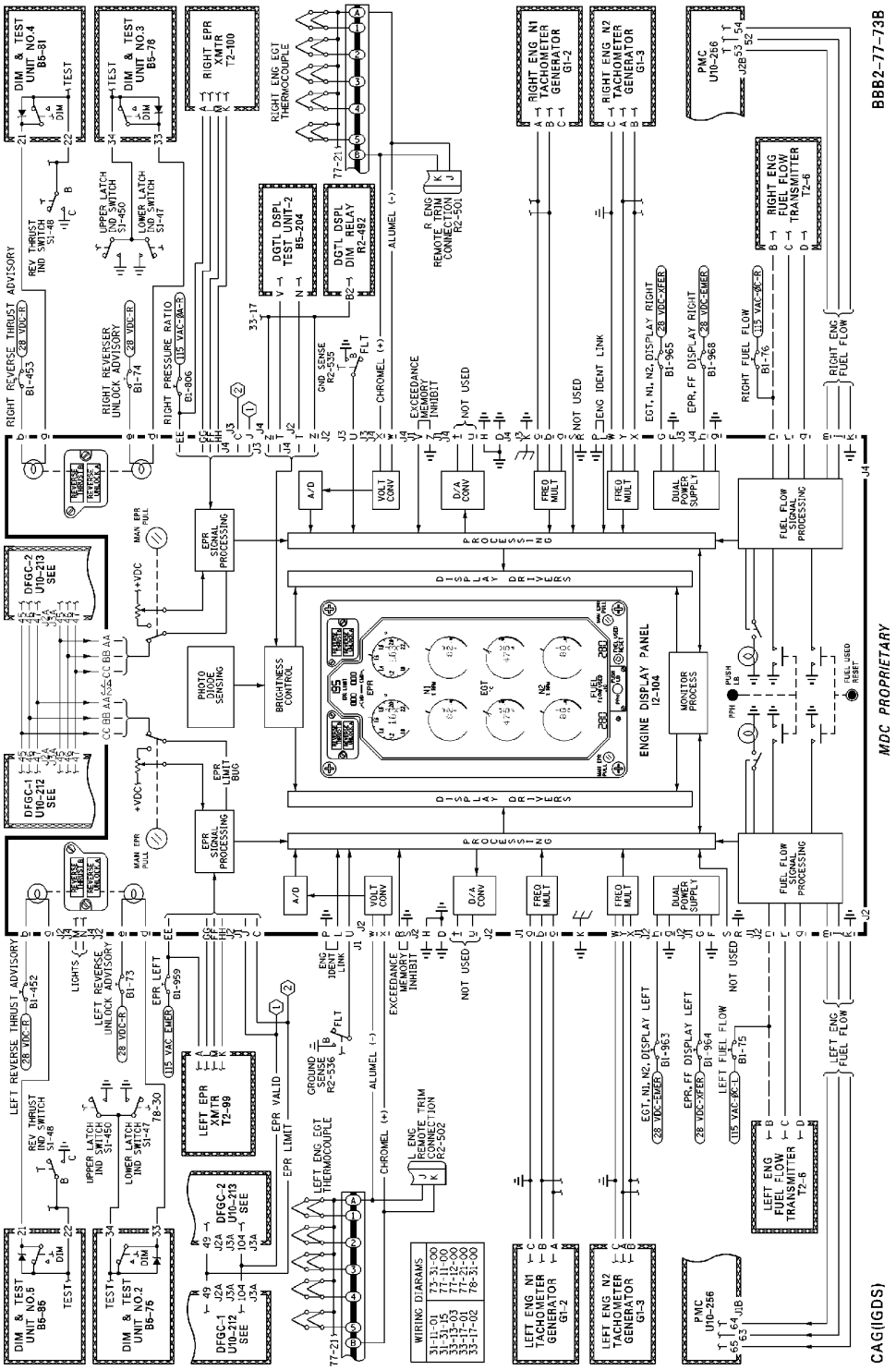
A. Engine EGT is sensed by eight dual-junction, thermocouple probes, mounted in the turbine case around the perimeter of the engine. The EGT, averaged between probes is displayed in degrees Centigrade on the Engine Display Panel. For a complete description and operation of temperature, refer to SUBJECT 77-20-00, Page 1.



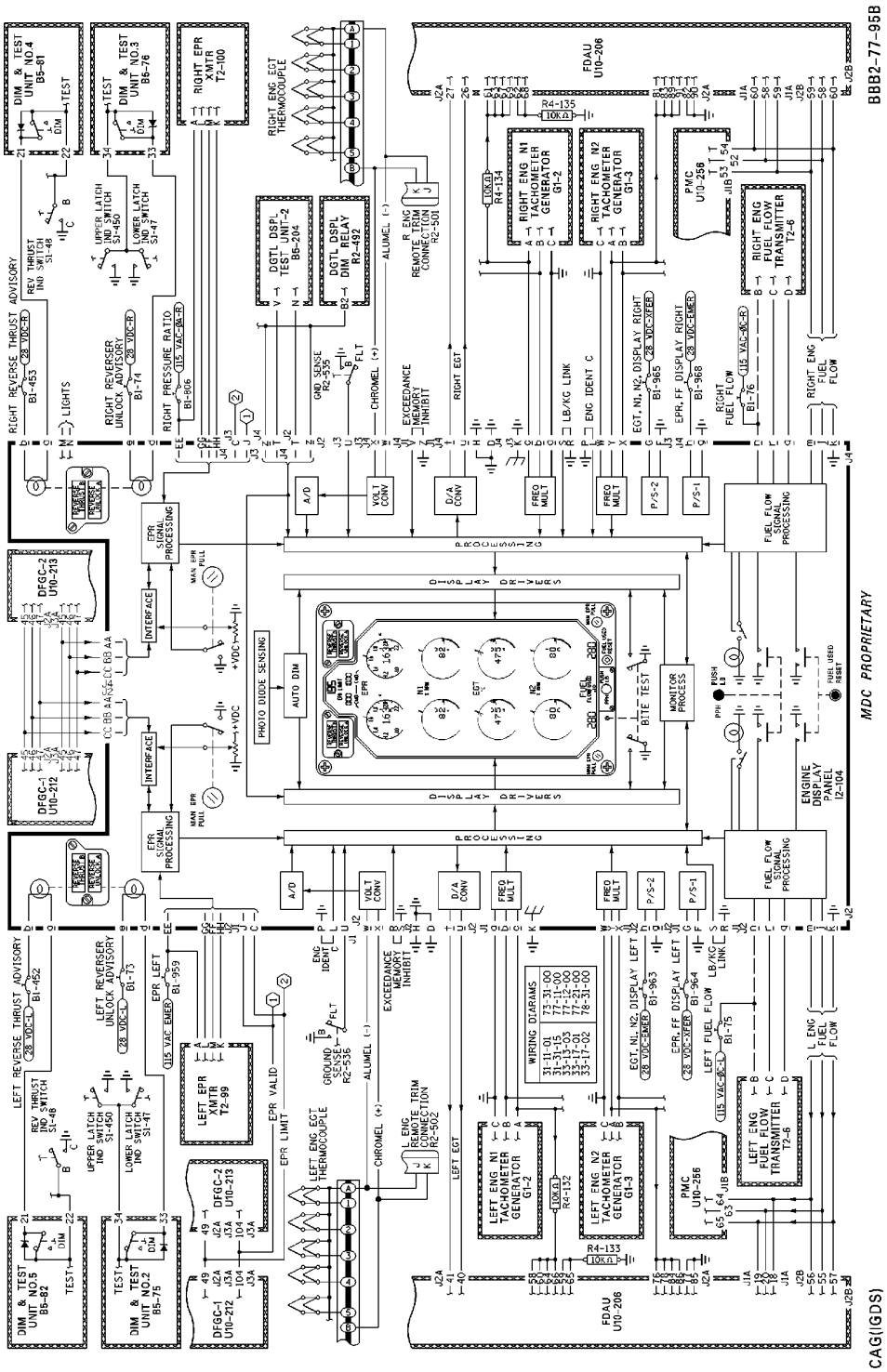
Engine Display Systems - Schematic
Figure 1/77-42-00-990-801 (Sheet 1 of 5)



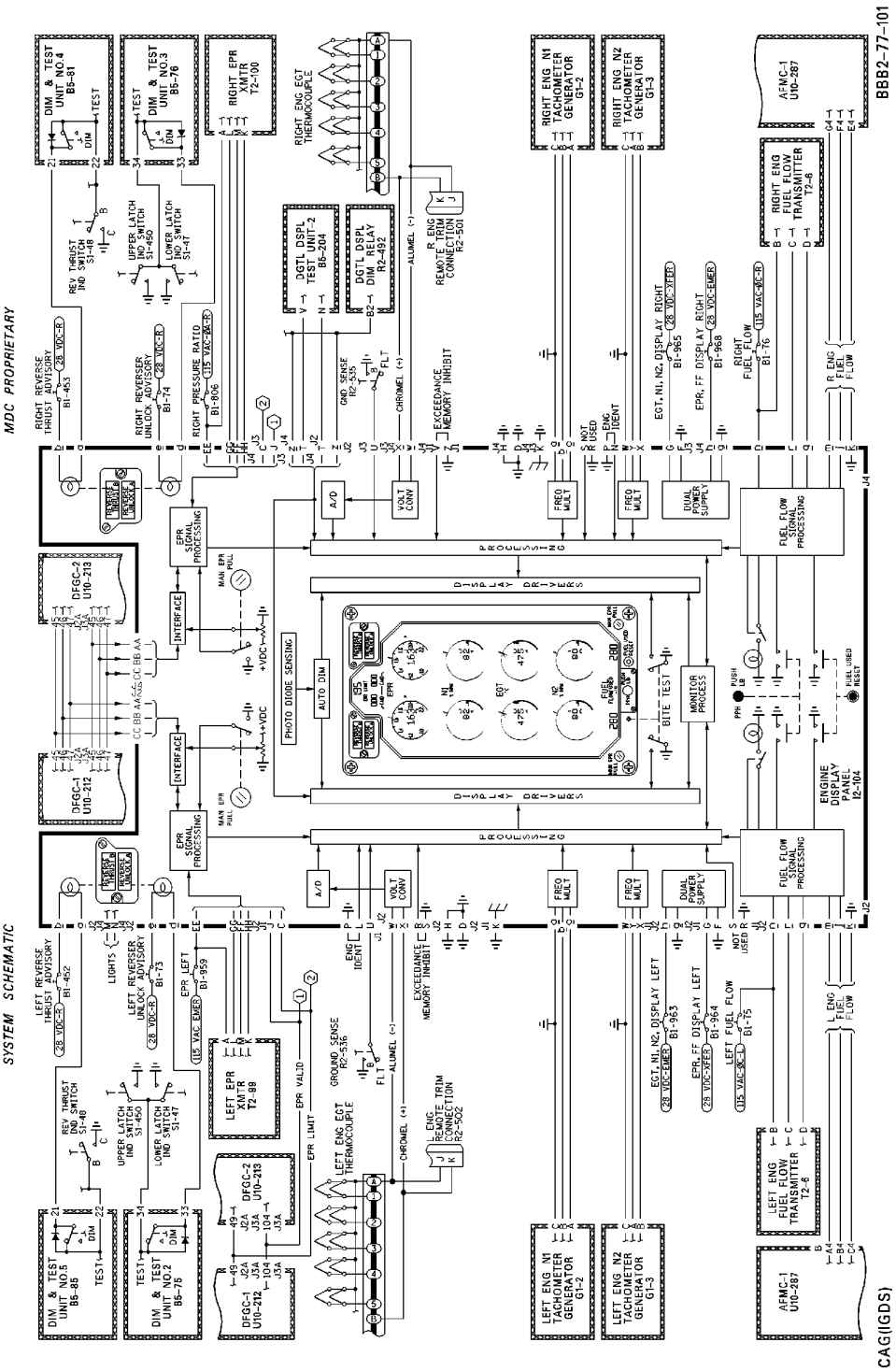
Engine Display Systems - Schematic
Figure 1/77-42-00-990-801 (Sheet 2 of 5)



Engine Display Systems - Schematic
Figure 1/77-42-00-990-801 (Sheet 3 of 5)



Engine Display Systems - Schematic
Figure 1/77-42-00-990-801 (Sheet 4 of 5)



Engine Display Systems - Schematic
Figure 1/77-42-00-990-801 (Sheet 5 of 5)

ENGINE DISPLAY PANEL - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides removal/installation instructions and adjustment/test procedures for the Engine Display Panel. The Engine Display Panel is mounted in center instrument panel in the flight compartment.

B. Maintenance of the Engine Display Panel is limited to removal/installation and adjustment/test procedures.

C. Access to the Engine Display Panel and connectors is at center instrument panel in the flight compartment.

2. Removal/Installation Engine Display Panel

A. Remove Engine Display Panel (Figure 201)

(1) Open and tag following circuit breakers as applicable.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
X	35	B1-965	EGT, N1, N2 DISPLAY RIGHT
X	36	B1-964	EPR, FF DISPLAY LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 401-404, 406, 412, 414, 875-879, 886, 887			
B	15	B1-963	EGT, N1, N2 DISPLAY LEFT
WJE 410			
B	16	B1-963	EGT, N1, N2 DISPLAY LEFT
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
C	15	B1-968	EPR, FF DISPLAY RIGHT

WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

CAUTION: EXERCISE CARE WHEN HANDLING ENGINE DISPLAY PANEL. DO NOT DROP PANEL. INTERNAL DAMAGE COULD RESULT.

(2) Loosen four captive screws on front of Engine Display Panel until panel can be removed, and remove panel from instrument panel.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTORS, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO DISCONNECT PLUGS.

(3) Disconnect electrical connectors.

B. Install Engine Display Panel (Figure 201)

(1) Make certain that following applicable circuit breakers are open and tagged.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
X	35	B1-965	EGT, N1, N2 DISPLAY RIGHT
X	36	B1-964	EPR, FF DISPLAY LEFT

WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887 (Continued)

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 401-404, 406, 412, 414, 875-879, 886, 887			
B	15	B1-963	EGT, N1, N2 DISPLAY LEFT
WJE 410			
B	16	B1-963	EGT, N1, N2 DISPLAY LEFT
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
C	15	B1-968	EPR, FF DISPLAY RIGHT

WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

(2) Check Engine Display Panel for dents, cracked glass, or damaged electrical connector pins.

WJE 401-406, 410, 412, 414, 875-879, 886, 887

(3) Check that FUEL FLOW/USED placard reads "PPH under FLOW and PUSH/LB under USED".

WJE 415, 418, 421, 423, 863-866, 869, 871, 872

(4) Check that FUEL FLOW/USED placard reads "KGH under FLOW and PUSH/KG under USED".

WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887

(5) If incorrect, remove push-button. Then remove placard and install with reverse side facing out, install push-button.

CAUTION: TO PREVENT DAMAGE TO ELECTRICAL CONNECTORS, DO NOT USE ANY TOOL OTHER THAN PLUG PLIERS TO CONNECT PLUGS. WHEN CONNECTING PLUGS, DO NOT OVERTIGHTEN.

(6) Connect electrical connectors.

CAUTION: EXERCISE CARE WHEN HANDLING ENGINE DISPLAY PANEL. DO NOT DROP PANEL. INTERNAL DAMAGE COULD RESULT.

(7) Install Engine Display Panel in instrument panel. Tighten four captive screws.

(8) Remove tools, equipment, loose hardware, and debris from maintenance area.

(9) Remove tags and close following applicable circuit breakers.

LOWER EPC, DC TRANSFER BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
X	35	B1-965	EGT, N1, N2 DISPLAY RIGHT
X	36	B1-964	EPR, FF DISPLAY LEFT

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 401-404, 406, 412, 414, 875-879, 886, 887			
B	15	B1-963	EGT, N1, N2 DISPLAY LEFT
WJE 410			
B	16	B1-963	EGT, N1, N2 DISPLAY LEFT

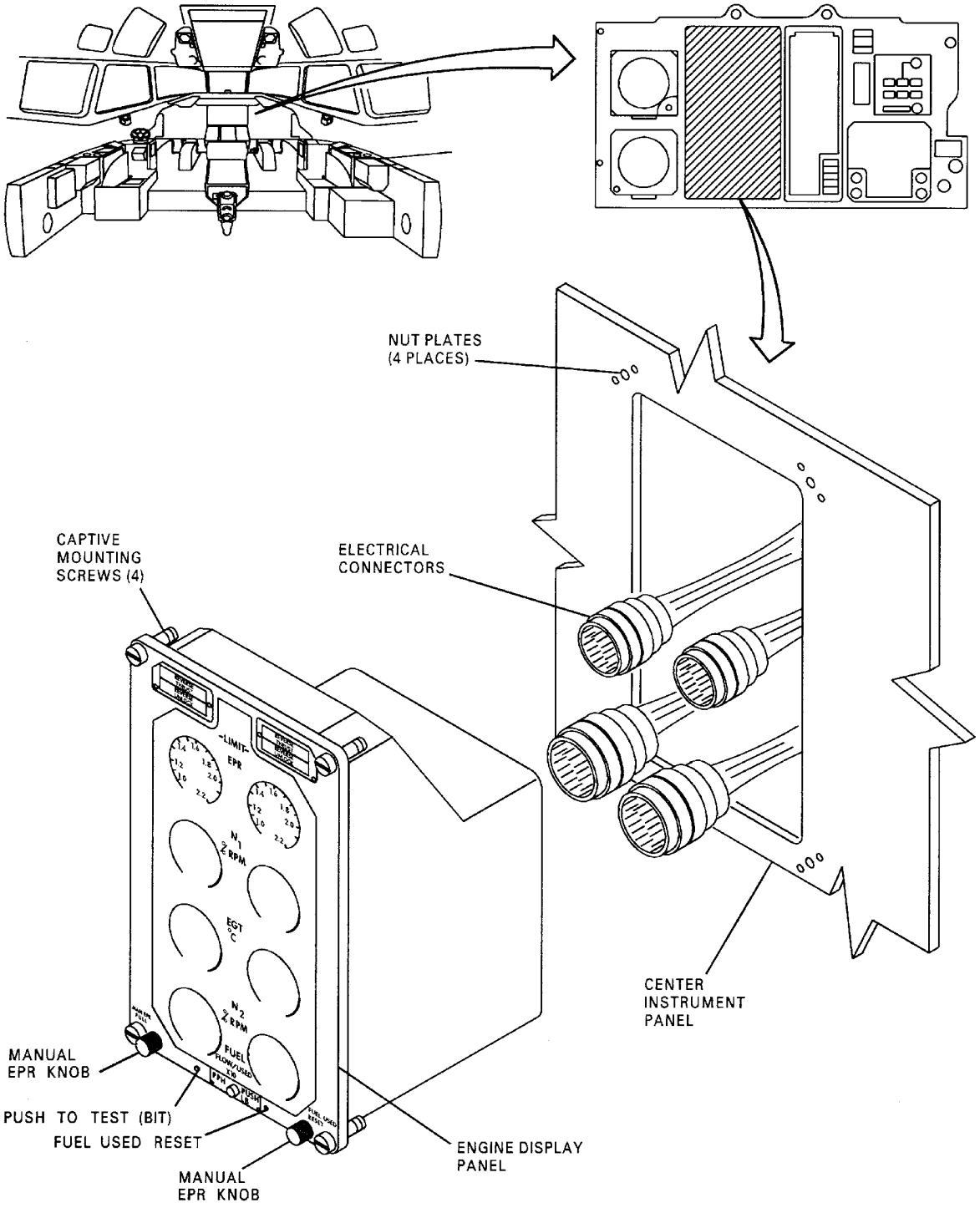
WJE 410 (Continued)

(Continued)

OVERHEAD EMERGENCY DC BUS

Row	Col	Number	Name
WJE 401-404, 406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887			
C	15	B1-968	EPR, FF DISPLAY RIGHT

WJE 401-406, 410, 412, 414, 415, 417-419, 421, 423, 863-866, 869, 871, 872, 875-879, 886, 887



Engine Display Panel - Installation
Figure 201/77-42-00-990-802

3. Adjustment/Test

A. BIT - BIT tests are automatically done at power-up or should be used whenever there has been a crew reported malfunction in any applicable system. A unit should not be removed unless confirmed faulty by a BIT test. BIT test procedures are as follows:

(1) Depress the unlabeled recessed button on lower bezel of display panel. This initiates the On Ground BIT test and displays any faults by means of a failure code on the relevant display. (Figure 201)

(2) Each module operates its own BIT sequence. If a fault is displayed against a parameter, the maintenance personnel should consult the Master Minimum Equipment List (MMEL) to decide whether aircraft can be dispatched with a display inoperative.

(3) If aircraft is to be dispatched with a failed BIT, BIT message can be erased by operation of the aircraft display test push-button.

NOTE: Display test push-button (ANNUN/DIGITAL LTS TEST) is located on overhead panel.

(4) Fault Codes can be displayed as follows:

FAULT CODES

Fault	Code	Module
Prom Check Sum	ROM	N1, N2, EGT and EPR
Prom Check Sum	- 1 -	Fuel Flow
RAM Check	RAM	N1, N2, EGT and EPR
RAM Check	- 2 -	Fuel Flow
Frequency/Digital Convertor	F/D	N1, N2, EGT
Analog/Digital Convertor	A/D	EPR
Engine Identity Input	ENG	N1, N2, EGT
Power Monitor	PWR	N1, N2, EGT and EPR
Power Monitor	- 3 -	Fuel Flow
Monitor Module Fault	- 9 -	Fuel Flow
Engine Identity Input	- 5 -	Fuel Flow
Real Time Clock	- 6 -	Fuel Flow
Exceedance RAM full	- 8 -	Fuel Flow

(5) In addition to BIT test, Engine Display Panel monitors input signals for open circuit conditions. The parameter displays will indicate fault conditions within two seconds of detection. The fault detection will also detect certain short circuit input conditions. Fault indications are as follows:

INPUT SIGNAL FAULT MONITORING

Parameter	Display Indication	
	Counter	Pointer
Actual EPR	---	blank
Limit EPR (BUG)	N/A	Bottom Stop
N1	---	blank
N2	---	blank

INPUT SIGNAL FAULT MONITORING (Continued)

Parameter	Display Indication	
	Counter	Pointer
EGT	---	blank
FF	---	N/A
Limit EPR	---	N/A

(6) In the BIT-initiated tests, after the RAM and ROM tests are completed a predetermined test input will be injected into the input module as near as possible to the normal signal input. This input will be processed and displayed in the same way as a normal signal would be, thus checking the processing and display channel. In the case of N_1, N_2 and EGT, these values are the red line of the engines installed.

Parameter	Test Values			
	Engine Variant			
	-219	-217A	-217C	-217
N1	101.6%	101.6%	101.6%	99.2%
N2	102.5%	102.5%	102.5%	102.5%
EGT	630°C	630°C	630°C	630°C
EPR (actual & limit)	2.20	2.20	2.20	2.20
Fuel Flow	2500 pph	2500 pph	2500 pph	2500 pph
Fuel Flow (metric)	1130 Kg/Hr	1130 Kg/Hr	1130 Kg/Hr	1130 Kg/Hr

NOTE: The engine type which the unit is "programmed" for will be displayed on the FUEL FLOW digits for 2 seconds (i.e., -217) before reverting to the predetermined FUEL FLOW Test Value.

(7) For detailed information of aircraft equipped with ram air temperature system, refer to SUBJECT 34-10-00, Page 1. For detailed information of aircraft equipped with RAT thrust rating system, refer to SUBJECT 34-18-00, Page 1.