

CHAPTER

75

Engine Air

(LEAP-1B ENGINES)

CHAPTER 75
ENGINE AIR

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75-EFFECTIVE PAGES

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ENGINE AIR

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ENGINE AIR - INTRODUCTION

Purpose

The engine air system has these control functions:

- Engine cooling
- Compressor airflow.

Engine Cooling

Engine cooling has these functions:

- High pressure turbine active clearance control (HPTACC)
- Low pressure turbine active clearance control (LPTACC)
- Modulated turbine cooling (MTC)

SIA 001-005 PRE SB 737-CFM-LEAP-1B-75-0010 AND PRE SB 737-CFM-LEAP-1B-75-0011; EEC HARDWARE BLOWER SYSTEM INSTALLED

- Electronic engine control (EEC) cooling.

SIA ALL**Compressor Airflow Control**

The engine air system adjusts the low pressure compressor (LPC) and the high pressure compressor (HPC) air flows for all power conditions. These adjustments prevent an engine stall.

The compressor airflow control system has these functions:

- Variable stator vanes (VSVs)
- Variable bleed valves (VBVs)
- Transient bleed valve (TBV)
- Start bleed/booster anti-ice (SB/BAI).

Abbreviations and Acronyms

- ADIRU - air data inertial reference unit
- CCC - core compartment cooling

- DPC - display processing computer
- EEC - electronic engine control
- EGT - exhaust gas temperature
- HPC - high pressure compressor
- HPT - high pressure turbine
- HPTACC - high pressure turbine active clearance control
- IGV - inlet guide vane
- LPC - low pressure compressor
- LPT - low pressure turbine
- LPTACC - low pressure turbine active clearance control
- LVDT - linear variable differential transformer
- MTC - modulated turbine cooling
- P0 - aircraft static air pressure
- PT - aircraft total air pressure
- RVDT - rotary variable differential transformer
- SB/BAI - start bleed/booster anti-ice
- SCU/SVA - split control unit/servo valve assembly
- TAT - aircraft total air temperature
- TBV - transient bleed valve
- TRA - thrust lever resolver angle
- T3 - compressor discharge air temperature
- T25 - HPC inlet air temperature
- VBVs - variable bleed valves
- VSVs - variable stator vanes

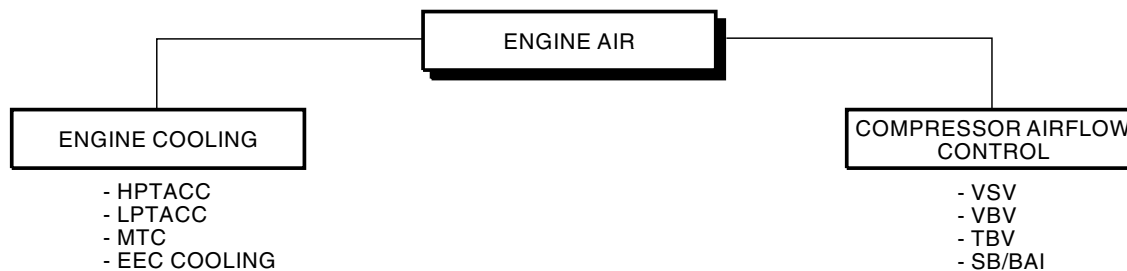
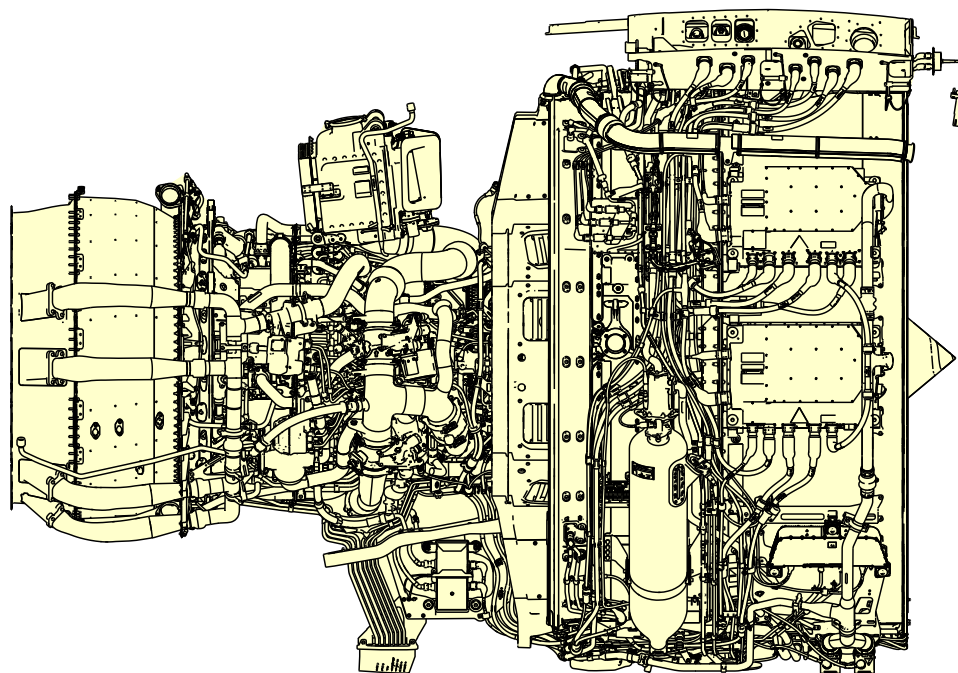
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ENGINE AIR - INTRODUCTION



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ENGINE AIR - INTRODUCTION

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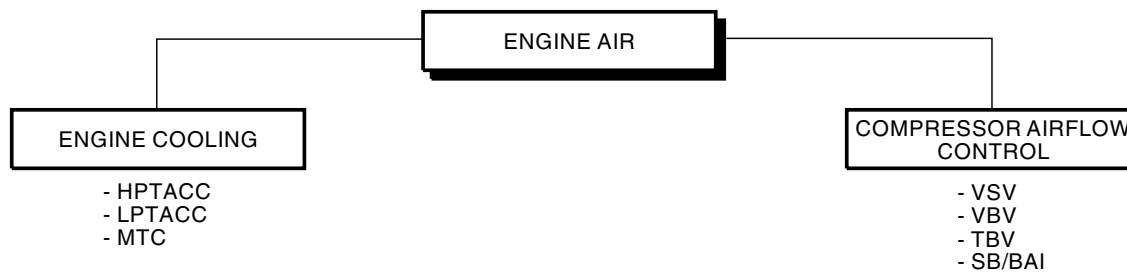
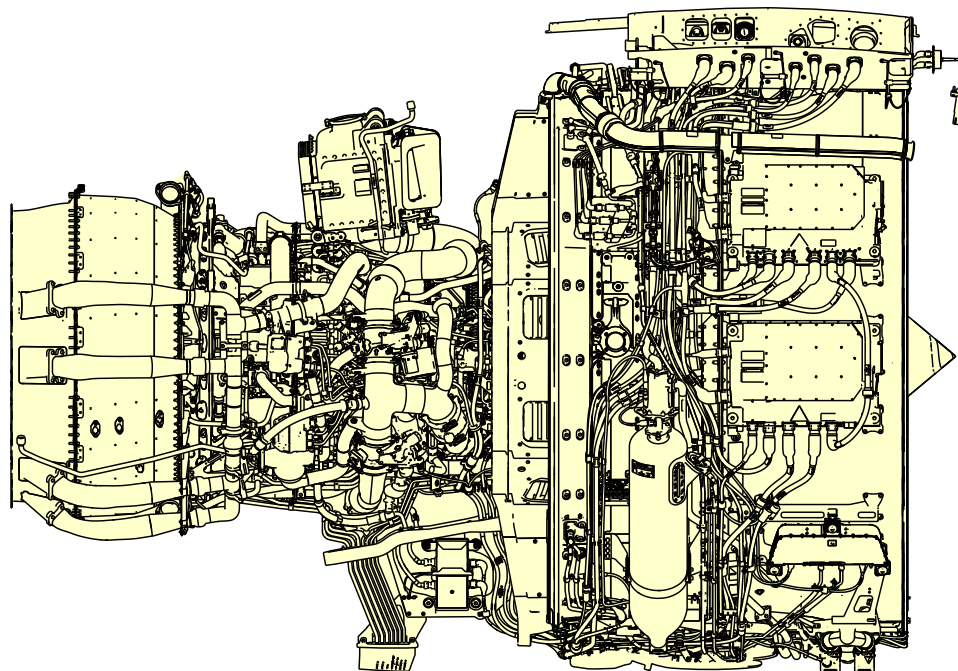
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ENGINE AIR - INTRODUCTION



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ENGINE AIR - INTRODUCTION

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ENGINE AIR - GENERAL DESCRIPTION

General

The EECs send signals to the servos in the split control unit (SCU) to control the engine air system. There are different servos for each of the engine air functions. The SCU servos use fuel pressure to move the engine air system valves and actuators. LVDTs or RVDTs give actuator position information to the EECs for system control feedback. Position data shows on the MDS EPCS maintenance data pages.

The engine air system has two primary subsystems:

- Engine cooling
- Compressor airflow control.

See the engine and fuel control chapter for more information on the EEC. (CHAPTER 73)

The engine cooling subsystem has these functions:

- High pressure turbine active clearance control (HPTACC)
- Low pressure turbine active clearance control (LPTACC)
- Modulated turbine cooling (MTC)

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- EEC cooling.

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The compressor airflow control subsystem has these functions:

- Variable bleed valves (VBV)
- Variable stator vanes (VSV)
- Transient bleed valve (TBV)
- Start bleed/booster anti-ice (SB/BAI).

Engine Cooling Subsystem

The HPTACC system controls cooling air flow to the external parts of the high pressure turbine (HPT) case. This cooling air adjusts the clearance between the HPT shrouds and rotor blades. The smaller clearance helps the engine use less fuel and controls EGT increase during fast acceleration.

The LPTACC system controls cooling air flow to the external parts of the low pressure turbine (LPT) case. This cooling air keeps the clearance between the LPT shrouds and rotor blades small. The smaller clearance helps the engine use less fuel.

The MTC system controls cooling air flow to the HPT first stage to help the engine use less fuel. The MTC system sends maximum cooling air to the HPT first stage during high-power operations. During lower-power operations, the MTC system modulates cooling air flow.

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The EEC cooling system moves air into the EEC channels for cooling when the aircraft is on the ground at low speed, and ambient temperature is high.

SIA ALLCompressor Airflow Control Subsystem

The VBV system controls the amount of air in the primary gaspath. This provides the correct amount of air for combustion. To do this the system uses 2 actuators and 8 doors.

The VSV system makes sure that airflow through the HPC is smooth at all engine speeds. The system controls the first 5 stages of HPC stator vanes (this includes the IGVs). The system also uses 2 actuators and 2 bell crank assemblies.

The TBV system lets air from the 10th stage of compression go to the engine exhaust. This ensures proper operability at all engine speeds.

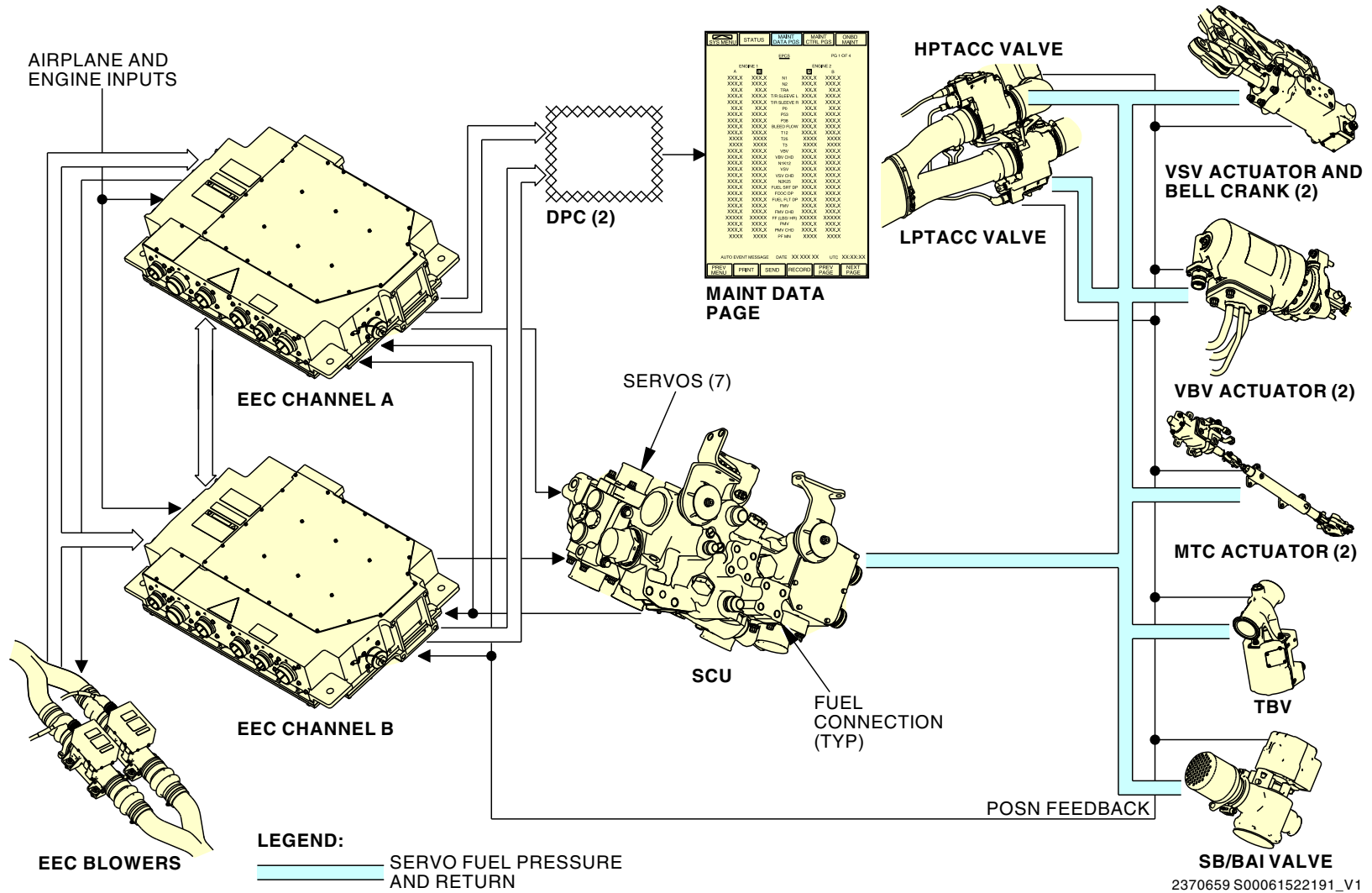
The SB/BAI valve releases 7th stage compressor air during engine air starts (SB). This decreases air loads for the N2 rotor. The valve also provides anti-ice air to the engine booster (LPC) inlet (BAI).

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ENGINE AIR - GENERAL DESCRIPTION



ENGINE AIR - GENERAL DESCRIPTION

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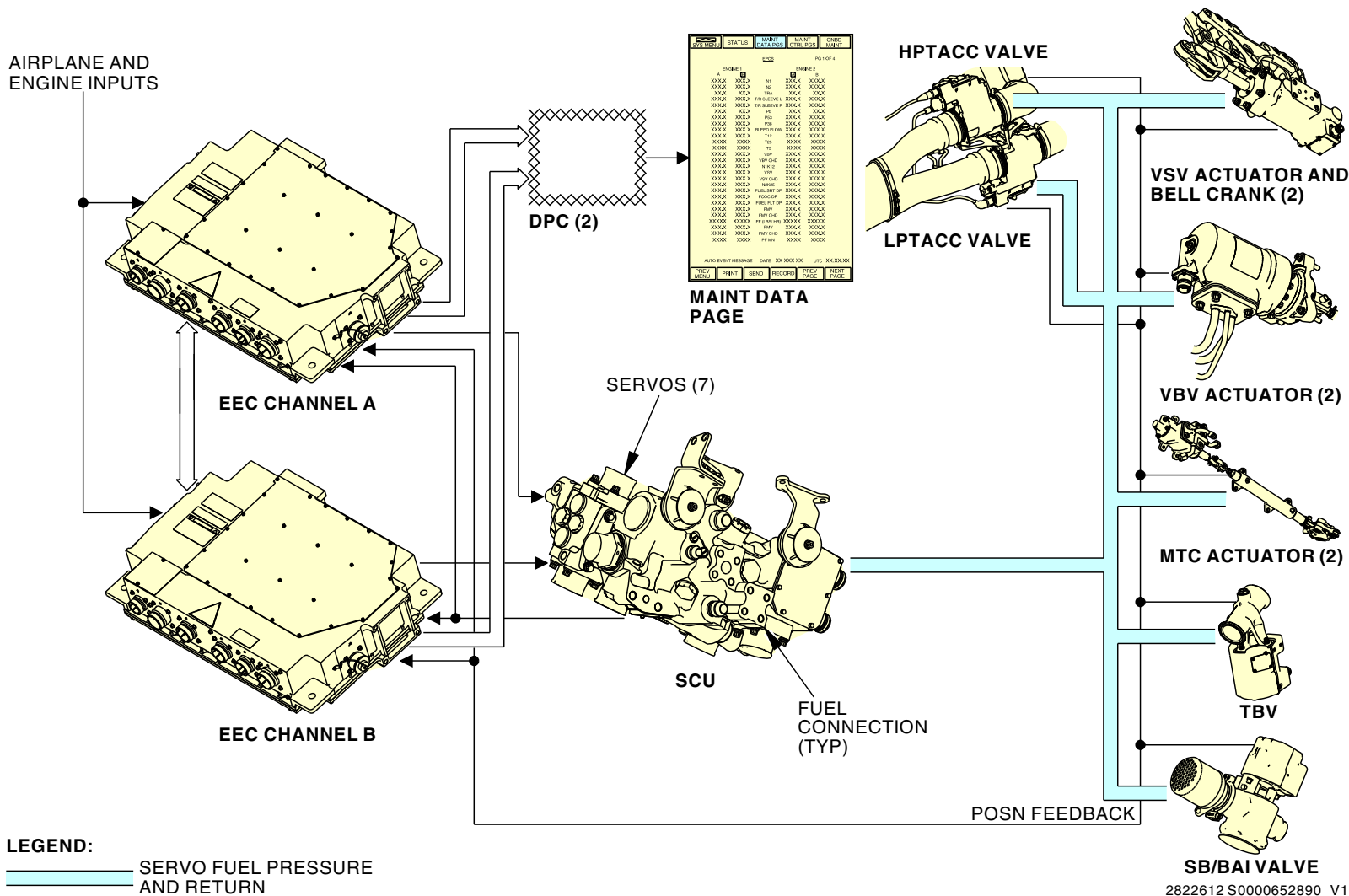
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ENGINE AIR - GENERAL DESCRIPTION



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ENGINE AIR - GENERAL DESCRIPTION

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ENGINE AIR - FUNCTIONAL DESCRIPTION

General

The EECs calculate the position commands for the different engine air components as a function of engine and airplane data. The EEC channel in control sends command signals to the servos in the split control unit (SCU). The actuator or valve provides position sensor feedback to the EECs.

High Pressure Turbine Active Clearance Control (HPTACC)

The HPTACC valve controls the amount of fan air that goes to the HPT air manifold. When the HPTACC valve opens, fan air goes to the high pressure turbine (HPT) case. The EEC channel in control sends a command signal to the SCU. The SCU sends servo fuel pressure to move the actuator in the HPTACC valve. Two linear variable differential transducers (LVDTs) send the actuator position data to both of the EECs for closed-loop control and fault monitoring.

Low Pressure Turbine Active Clearance Control (LPTACC)

The LPTACC valve controls the amount of fan air that goes to the LPT cooling air manifold. From the LPT cooling air manifold, the fan air goes to the low pressure turbine (LPT) case. The EEC channel in control sends a command signal to the SCU. The SCU sends servo fuel pressure to move the actuator in the LPTACC valve. Two linear variable differential transducers (LVDTs) send the actuator position data to both of the EECs for closed-loop control and fault monitoring.

Modulated Turbine Cooling (MTC)

The MTC system controls the amount of cooling air to the first stage of high pressure turbine. This makes the engine use less fuel. The cooling air comes from the engine compressor outlet. The EEC channel in control sends a command signal to the SCU. The SCU sends servo fuel pressure to move the MTC actuators, which each move an internal MTC valve. Each actuator assembly has an LVDT that sends the valve position data to the respective EEC for closed-loop control and fault monitoring.

SIA 001-005 PRE SB 737-CFM-LEAP-1B-75-0010 AND PRE SB 737-CFM-LEAP-1B-75-0011; EEC HARDWARE BLOWER SYSTEM INSTALLED

EEC Cooling

The EEC cooling system helps the EECs to stay cool. This system uses two blower fans for each engine. The fans operate when these two conditions occur:

- Airplane ground speed is below mach 0.1
- Internal EEC temperature is above 70 degrees C.

If one of these conditions does not apply, the fans do not operate because available airflow gives sufficient cooling.

SIA ALL**Variable Bleed Valve (VBVs)**

The VBVs control the amount of LPC discharge air that goes into the fan discharge airflow. The EEC channel in control sends a command signal to the SCU. The SCU sends servo fuel pressure to move the two actuators. The actuators mechanically connect with the bleed valves. Two LVDTs send the position of the actuators to the respective EEC for closed-loop control and fault monitoring.

Variable Stator Vanes (VSVs)

The two VSV actuators control the angle of airflow through the forward stages of the HPC. The EEC channel in control sends a command signal to the SCU. The SCU sends servo fuel pressure to move the two actuators. The actuators mechanically connect with the variable inlet guide vanes and variable stator vanes. LVDTs send the position data of the actuators to the respective EEC for closed-loop control and fault monitoring.

**ENGINE AIR - FUNCTIONAL DESCRIPTION****Transient Bleed Valve (TBV)**

The TBV discharges HPC 10th stage air to the engine exhaust. This improves the stall margin of the compressor. The EEC channel in control sends a command signal to the SCU. The SCU sends servo fuel pressure to move the TBV. RVDTs in the TBV give valve position to the EECs for closed loop control and fault monitoring.

Start Bleed/Booster Anti-Ice (SB/BAI)

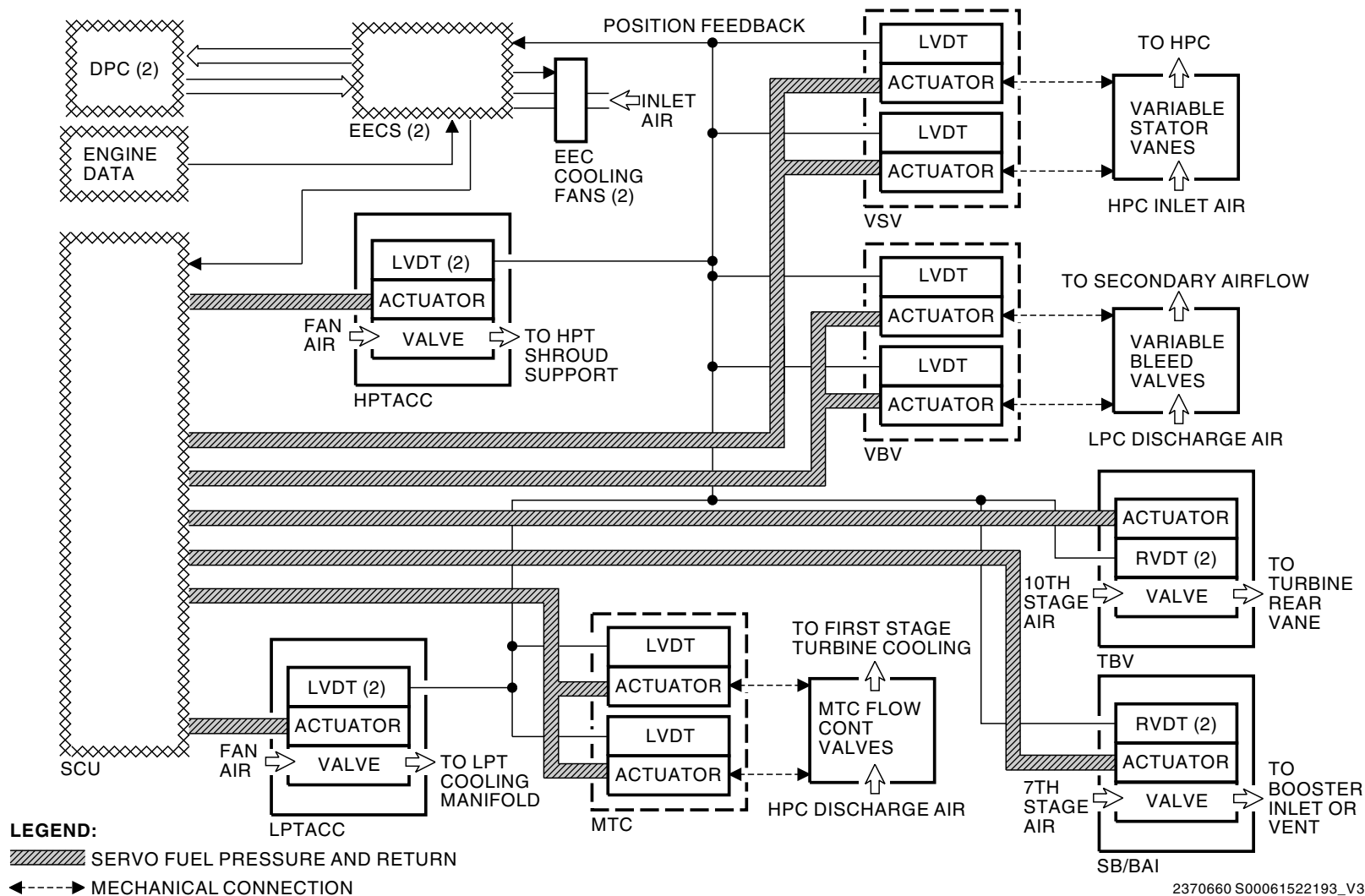
The SB/BAI valve gives these two functions:

- Engine booster anti-ice
- Start bleed.

The EEC channel in control sends a command signal to the SCU. The SCU sends servo fuel pressure to operate the valve. The valve can move to the anti-ice position, start bleed position, or middle closed position. An RVDT gives valve position data to each EEC channel for closed-loop control and fault monitoring.

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ENGINE AIR - FUNCTIONAL DESCRIPTION



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ENGINE AIR - FUNCTIONAL DESCRIPTION

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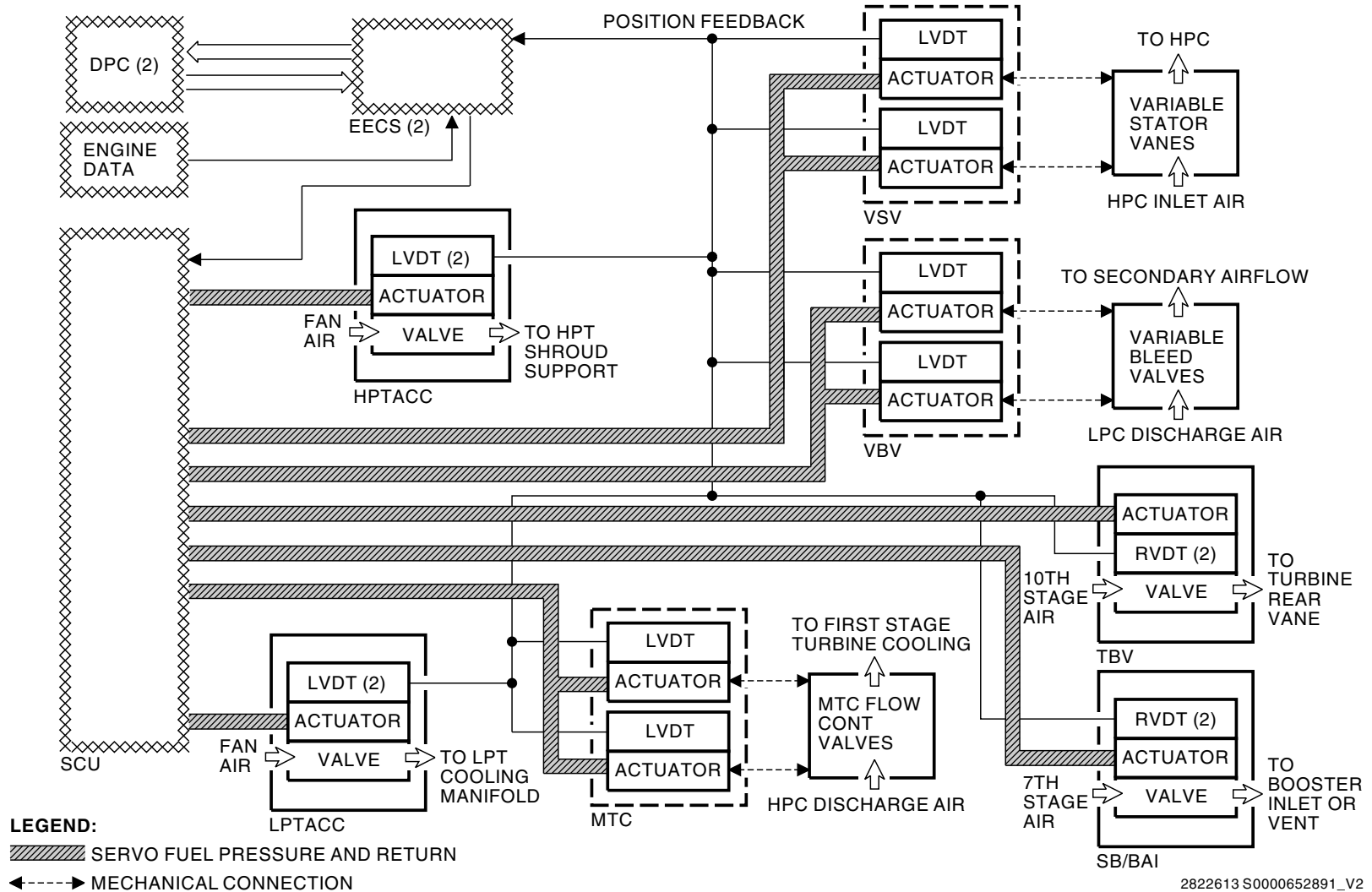
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SIA 001-005 PRE SB 737-CFM-LEAP-1B-75-0010 AND PRE SB 737-CFM-LEAP-1B-75-0011; EEC HARDWARE BLOWER SYSTEM INSTALLED

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ENGINE AIR - FUNCTIONAL DESCRIPTION



ENGINE AIR - FUNCTIONAL DESCRIPTION

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**ENGINE AIR - START BLEED/BOOSTER ANTI-ICE (SB/BAI) VALVE - GENERAL DESCRIPTION****General Description**

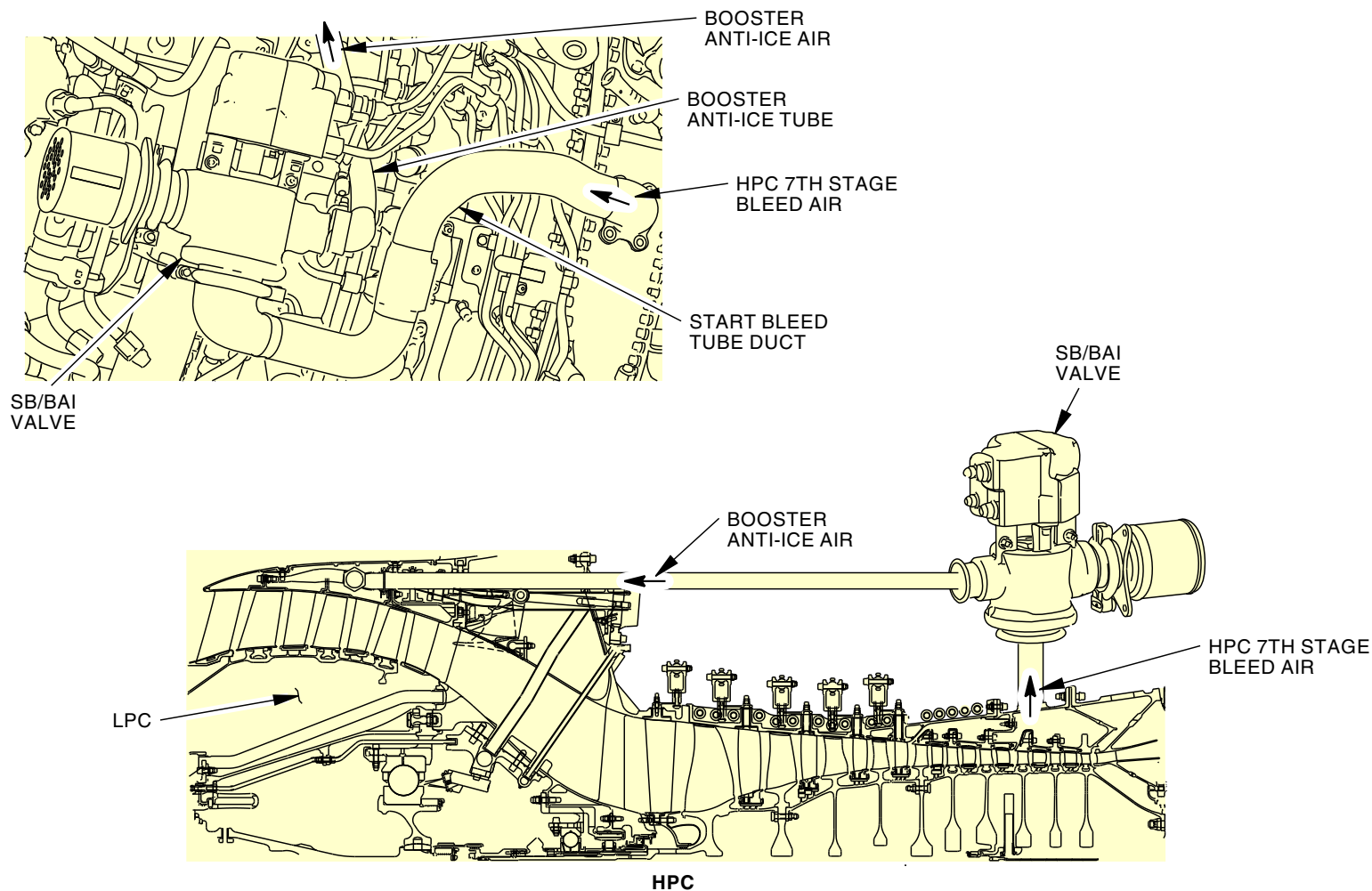
The SB/BAI valve releases 7th stage compressor air during engine air starts (SB). This decreases air loads for the N2 rotor. The valve also provides anti-ice air to the engine booster (LPC) inlet (BAI).

The SB/BAI system has these parts:

- SB/BAI valve
- Start bleed tube duct
- Booster anti-ice air tube.

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ENGINE AIR - START BLEED/BOOSTER ANTI-ICE (SB/BAI) VALVE - GENERAL DESCRIPTION



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ENGINE AIR - START BLEED/BOOSTER ANTI-ICE (SB/BAI) VALVE - GENERAL DESCRIPTION

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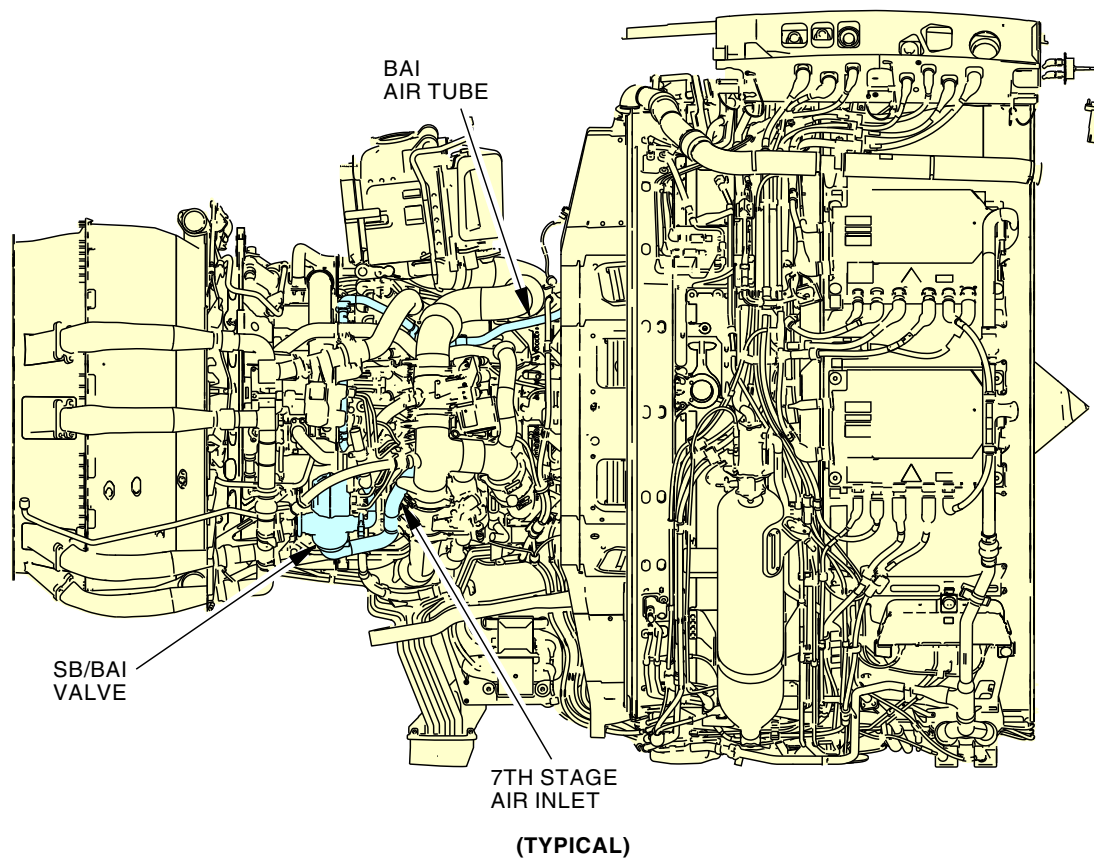
ENGINE AIR - SB/BAI VALVE - COMPONENT LOCATION

General

The start bleed/booster anti-ice valve is on the right side of the combustor case at the 4:00 o'clock position. The forward end of the start bleed tube duct connects to the right side of the compressor case at the 3:00 o'clock position. The aft end of the start bleed tube duct connects to the bottom of the SB/BAI valve. The aft end of the booster anti-ice air tube connects to the SB/BAI valve forward side. The tube then goes to the top of the engine, where it turns forward. The forward end of the booster anti-ice air tube connects to a manifold on the low-pressure compressor booster.

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ENGINE AIR - SB/BAI VALVE - COMPONENT LOCATION



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ENGINE AIR - SB/BAI VALVE - COMPONENT LOCATION

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**ENGINE AIR - SB/BAI VALVE - FUNCTIONAL DESCRIPTION****General**

The start bleed/booster anti-ice (SB/BAI) valve does the start bleed and booster anti-ice functions. Only one function operates at a time.

There is one SB/BAI valve per engine. The valve has a single inlet and two outlets. The inlet to the SB/BAI valve air is from the 7th stage of the high pressure compressor. One outlet is for start bleed. The other outlet is for booster anti-ice.

SB/BAI Valve Operation

The start bleed function of the SB/BAI valve operates during in-flight starts. The booster anti-ice (BAI) function prevents ice at the booster (LPC) inlet.

The SB/BAI valve has an internal ball mechanism. The internal ball mechanism has 3 primary positions:

- Directs bleed air to the start bleed outlet (CW rotation)
- Directs bleed air to the booster anti-ice outlet (CCW rotation)
- No bleed air flow from the valve (middle position).

During an inflight engine start, the EEC channel in control sends a signal to the split control unit (SCU). The SCU then gives cw rotate servo fuel pressure to the SB/BAI valve. This pressure makes the internal ball mechanism go to the start bleed position. The start bleed position of the valve causes the valve to release the 7th stage bleed air to the ambient under cowl area.

The EEC activates the BAI function when all of these occur:

- The engine is running
- EEC detects conditions for icing to exist
- $N1 < 2616 \text{ RPM (59.5\%)}$.

The EEC channel in control sends a signal to the SCU. The SCU then sends ccw rotate servo fuel pressure to the SB/BAI valve. This pressure makes the internal ball mechanism go to the BAI position. The BAI position of the valve causes the valve to release the 7th stage bleed air to the booster splitter (LPC inlet). This increases heat in the area of the splitter to prevent ice.

The SB/BAI valve has one RVDT that has two channels. Each channel of this RVDT gives valve position data to one EEC channel. The SB/BAI valve position shows on the EPCS maintenance data page.

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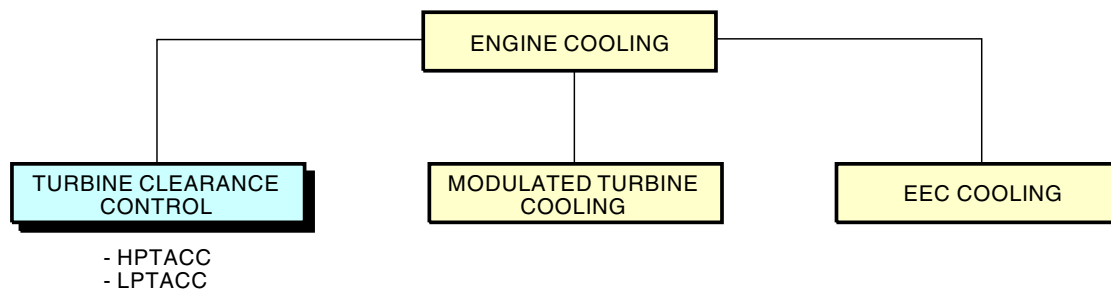
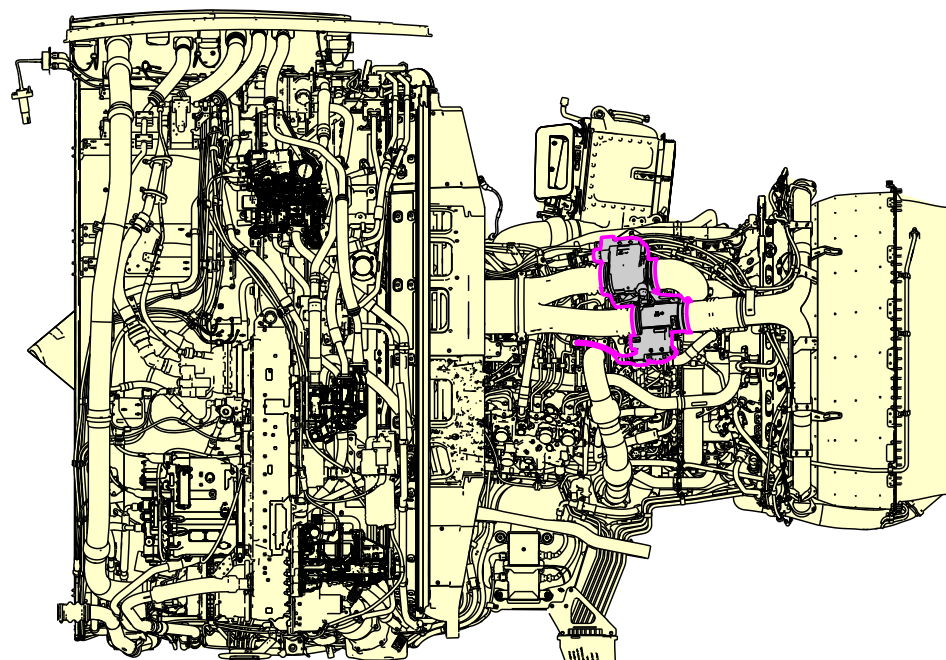
**ENGINE AIR - TURBINE CLEARANCE CONTROL - INTRODUCTION****General**

The engine cooling system has these two turbine clearance control subsystems:

- High pressure turbine active clearance control (HPTACC)
- Low pressure turbine active clearance control (LPTACC).

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ENGINE AIR - TURBINE CLEARANCE CONTROL - INTRODUCTION



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ENGINE AIR - TURBINE CLEARANCE CONTROL - INTRODUCTION

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**ENGINE AIR - HIGH PRESSURE TURBINE ACTIVE CLEARANCE CONTROL (HPTACC) - GENERAL DESCRIPTION****General Description**

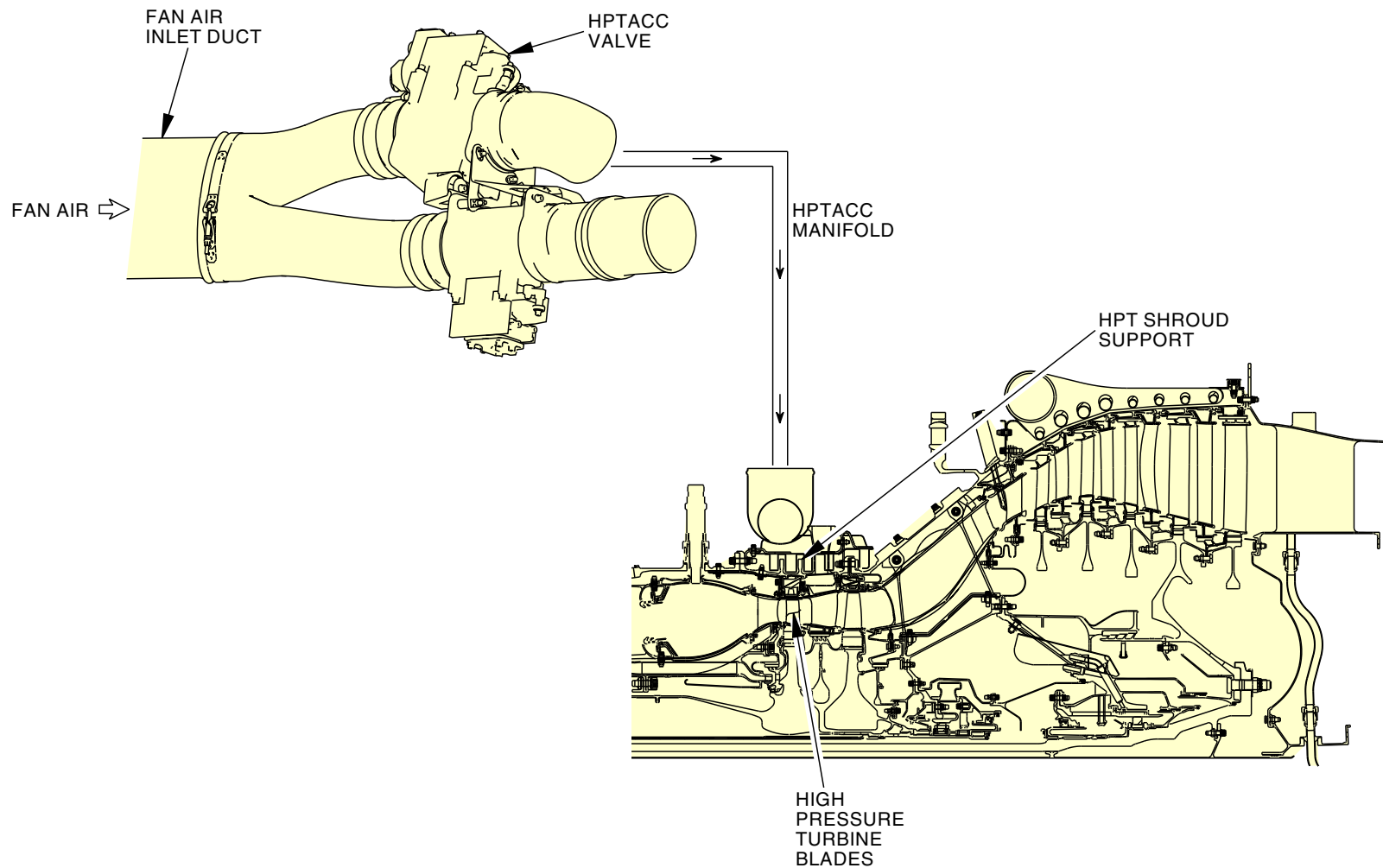
The HPTACC system controls cooling air flow to the external parts of the high pressure turbine (HPT) case. This cooling air adjusts the clearance between the HPT shrouds and rotor blades. The smaller clearance helps the engine use less fuel and controls EGT increase during fast acceleration.

The HPTACC system has these parts:

- Fan air inlet duct
- HPTACC valve
- HPTACC manifold.

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ENGINE AIR - HIGH PRESSURE TURBINE ACTIVE CLEARANCE CONTROL (HPTACC) - GENERAL DESCRIPTION



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ENGINE AIR - HIGH PRESSURE TURBINE ACTIVE CLEARANCE CONTROL (HPTACC) - GENERAL DESCRIPTION

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ENGINE AIR - HPTACC - COMPONENT LOCATION

Component Locations

The ACC system components are on the left side of the engine. The HPTACC system and the LPTACC system use these components of the ACC system:

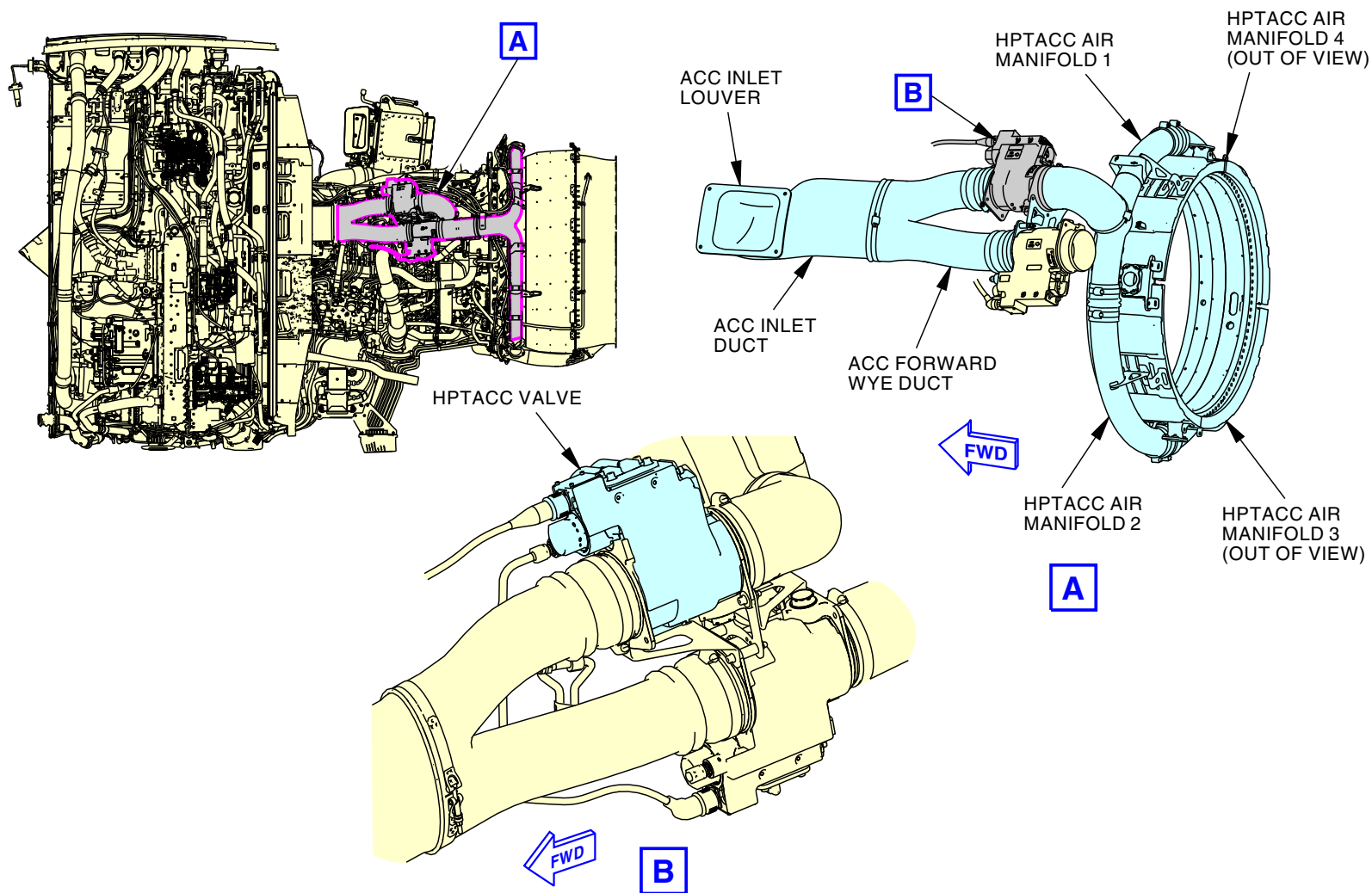
- ACC inlet louver
- ACC inlet duct
- ACC forward wye duct.

The HPTACC valve is on the left side of the engine. HPT air manifold 1 and 2 are on the left side of the engine aft of the HPTACC valve. HPT air manifold 3 and 4 are on the right side of the engine aft of the HPTACC valve.

Open the left fan cowl and thrust reverser to get access to the ACC system components and the HPTACC valve.

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ENGINE AIR - HPTACC - COMPONENT LOCATION



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ENGINE AIR - HPTACC - COMPONENT LOCATION

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**ENGINE AIR - HPTACC - FUNCTIONAL DESCRIPTION****General**

The EECs use airplane and engine data to control the high pressure turbine active clearance control (HPTACC) valve. Fan air decreases the temperature of the HPT shroud support and increases engine efficiency.

The EEC uses this data to control the HPTACC system:

- High pressure compressor inlet temperature (T25)
- High pressure compressor discharge temperature (T3)
- N1 RPM
- N2 RPM
- Ambient pressure (P0)
- HPTACC valve position.

The EEC channel in control sends a command signal to a servo in the split control unit (SCU). The SCU sends servo fuel pressure to move the HPTACC valve. This controls the amount of air that goes to the HPT air manifold.

The HPTACC valve assembly has two LVDTs. One LVDT sends an electrical signal to EEC channel A. The other LVDT sends an electrical signal to EEC channel B. The EEC uses signals from the LVDTs to monitor the position of the HPTACC valve.

See the engine fuel and control section for more information on how the EEC gets P0 pressure. (SECTION 73-21)

Air Flow

Fan air enters the HPTACC system through these components:

- ACC inlet louver
- ACC inlet duct
- ACC forward wye duct.

Hose clamps connect the individual HPTACC components together. The four segments of the HPTACC manifold connect with HPTACC connect boots.

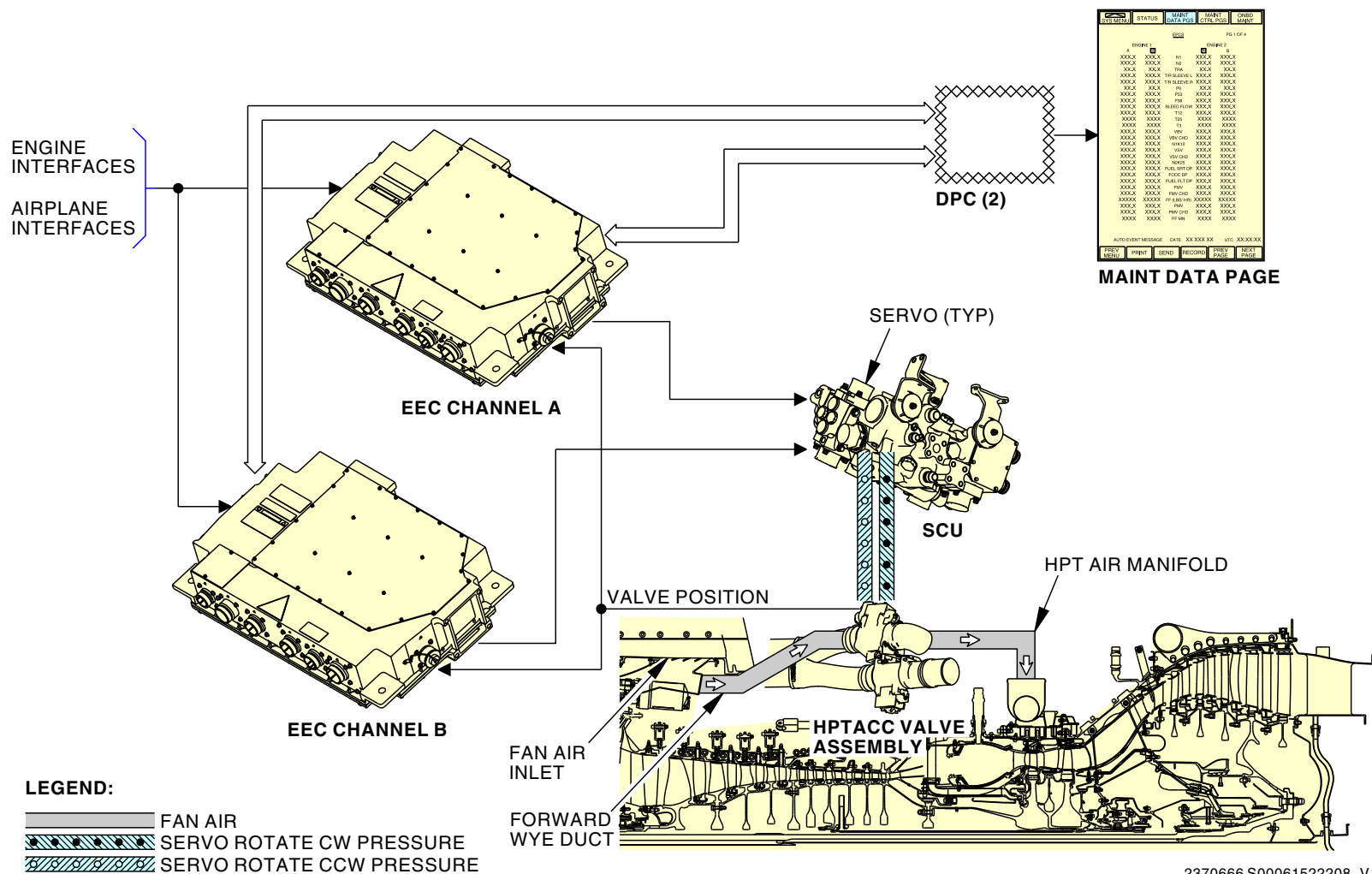
75-21-00

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ECCN 9E991 BOEING PROPRIETARY - See title page for details

ENGINE AIR - HPTACC - FUNCTIONAL DESCRIPTION



ENGINE AIR - HPTACC - FUNCTIONAL DESCRIPTION



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75-22-00

**ENGINE AIR - LOW PRESSURE TURBINE ACTIVE CLEARANCE CONTROL (LPTACC) - GENERAL DESCRIPTION****General Description**

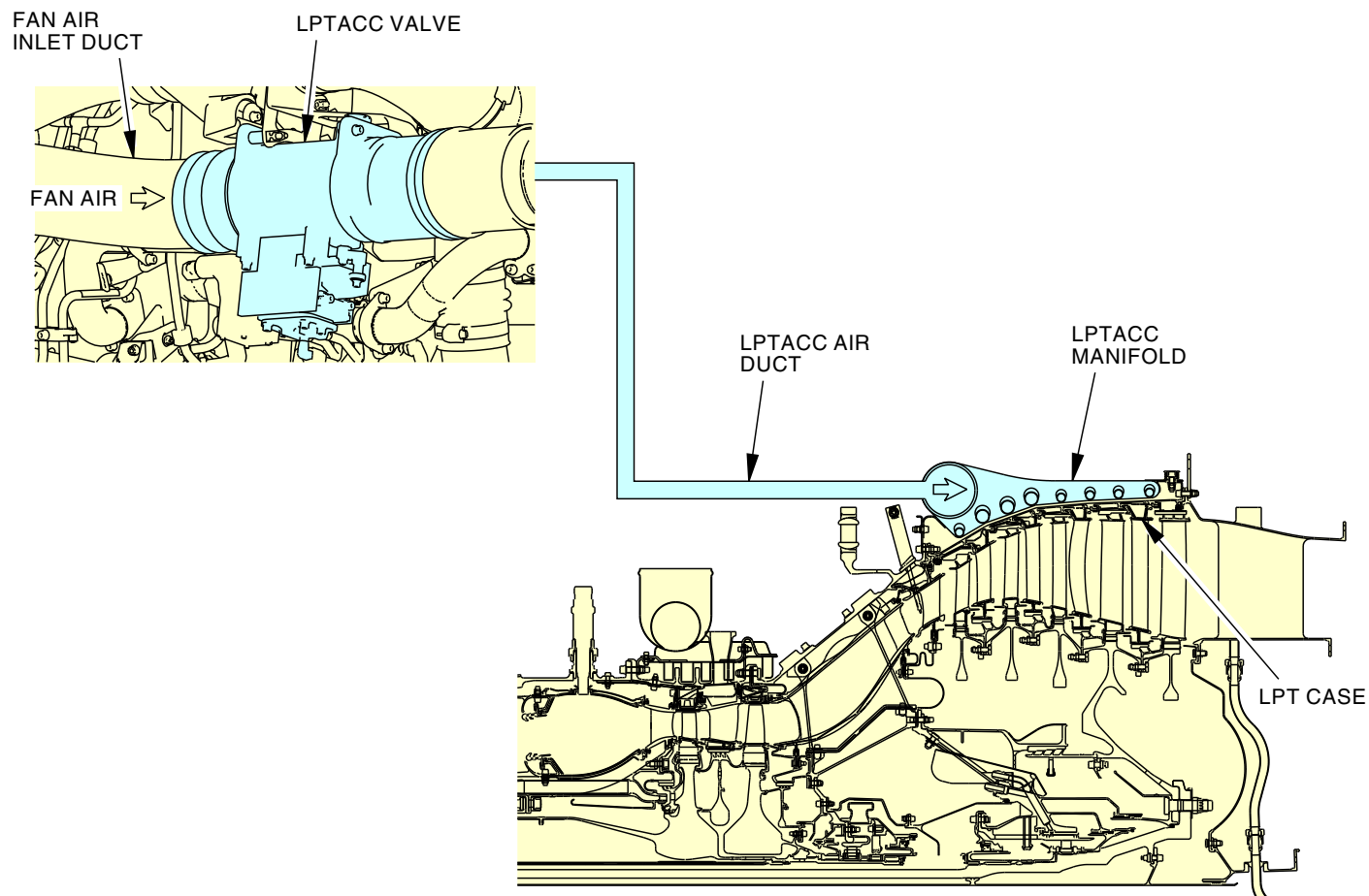
The LPTACC system controls cooling air flow to the external parts of the low pressure turbine (LPT) case. This cooling air keeps the clearance between the LPT shrouds and rotor blades small. The smaller clearance helps the engine use less fuel.

The LPTACC system has these parts:

- Fan air inlet duct
- LPTACC valve
- LPTACC manifold.

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ENGINE AIR - LOW PRESSURE TURBINE ACTIVE CLEARANCE CONTROL (LPTACC) - GENERAL DESCRIPTION



2370667 S00061522212_V1

ENGINE AIR - LOW PRESSURE TURBINE ACTIVE CLEARANCE CONTROL (LPTACC) - GENERAL DESCRIPTION

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EFFECTIVITY

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ENGINE AIR - LPTACC - COMPONENT LOCATIONS

Component Locations

Most of the components of the low pressure turbine active clearance control (LPTACC) system are on the left side of the engine. They are on the high pressure compressor (HPC) case. Aft looking forward, these components are at the 9:00 o'clock position:

- Inlet louver
- Inlet duct
- Forward wye duct
- LPTACC valve
- LPTACC valve duct.

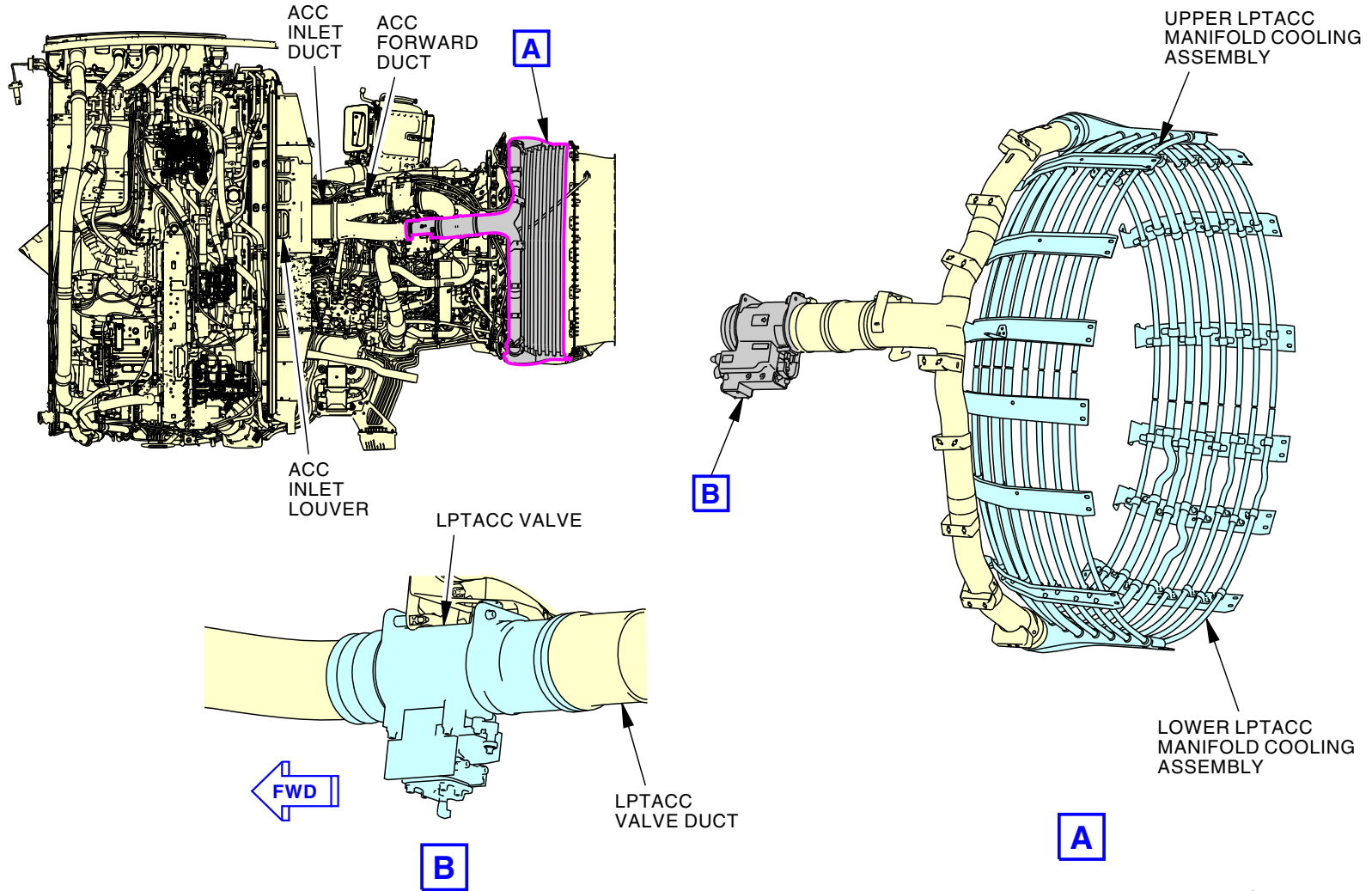
There are two manifold cooling assemblies around the low pressure turbine (LPT) case.

- Upper manifold assembly
- Lower manifold assembly.

Open the left fan cowl and thrust reverser to get access to the LPTACC system components.

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ENGINE AIR - LPTACC - COMPONENT LOCATIONS



2370668 S00061522214_V1

ENGINE AIR - LPTACC - COMPONENT LOCATIONS

**ENGINE AIR - LPTACC - FUNCTIONAL DESCRIPTION****General**

The low pressure turbine active clearance control (LPTACC) system controls the low pressure turbine (LPT) blade tip clearance. The LPTACC valve increases or decreases the amount of fan air that goes to the LPT case. This air cools the LPT case. Cooling the LPT case keeps the clearance with the LPT blade tips to a minimum. This increases fuel efficiency.

The electronic engine controls (EECs) use this data to control the LPTACC valve:

- Total air pressure (PT)
- Ambient pressure (P0)
- Total air temperature (TAT)
- N1
- Exhaust gas temperature (EGT).

Control

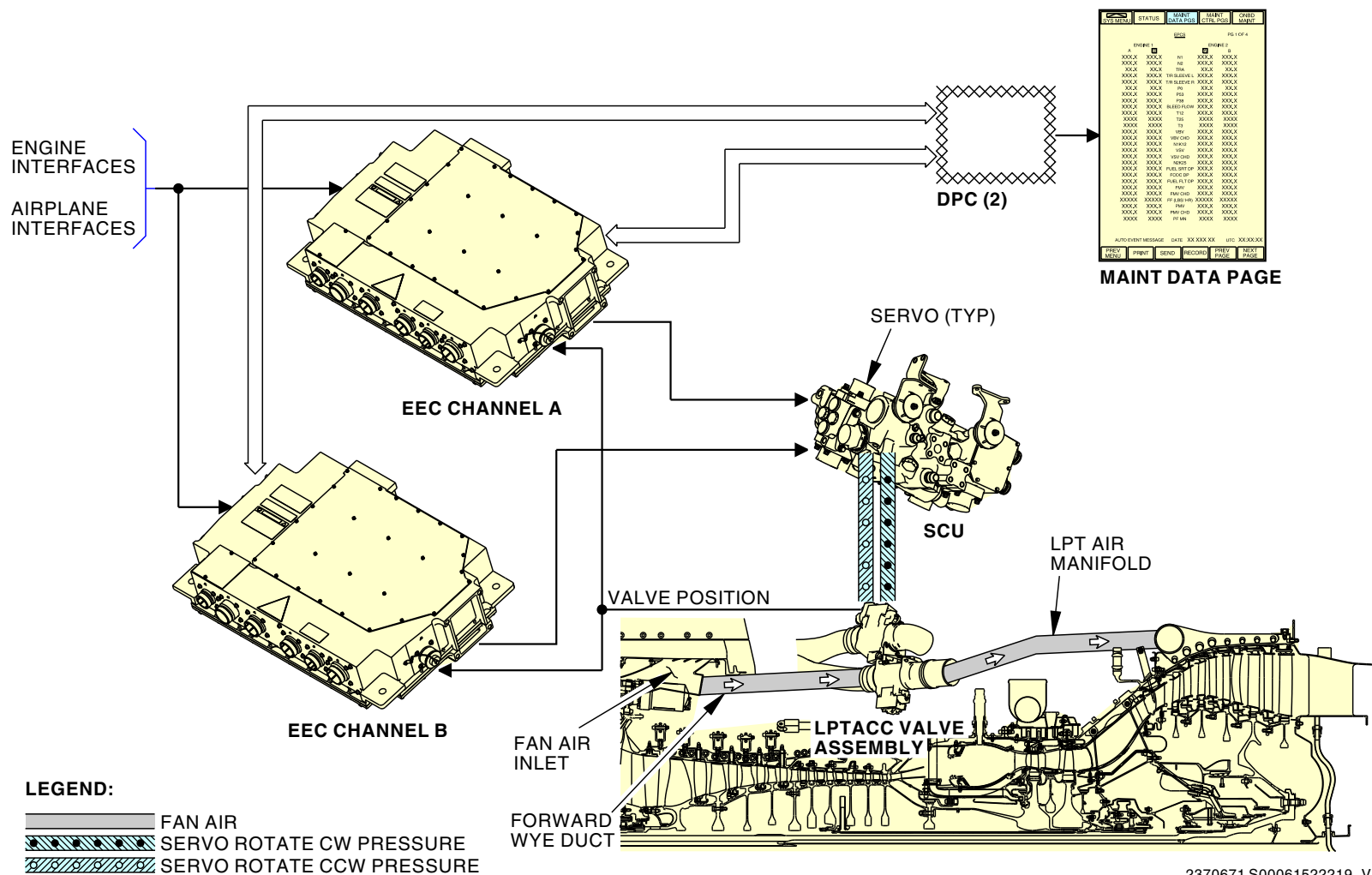
The EEC channel in control sends a signal to a servo in the split control unit (SCU). The SCU send servo fuel pressure to the LPTACC valve to open or close the valve.

See the engine fuel and control section for more information on how the EEC gets P0, PT and TAT data. (SECTION 73-21)

The LPTACC valve has two LVDTs. The EECs use the LVDTs to monitor the position of the LPTACC actuator. One LVDT sends the signal to EEC channel A. The other LVDT sends the signal to EEC channel B.

EFFECTIVITY	
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ENGINE AIR - LPTACC - FUNCTIONAL DESCRIPTION



2370671 S00061522219 V1

ENGINE AIR - LPTACC - FUNCTIONAL DESCRIPTION



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75-23-00

**ENGINE AIR - MODULATED TURBINE COOLING (MTC) - GENERAL DESCRIPTION****General Description**

The modulated turbine cooling (MTC) system controls cooling air flow to the HPT first stage to help the engine use less fuel. The MTC system sends maximum cooling air to the HPT first stage during high-power operations. During lower-power operations, the MTC system modulates cooling air flow.

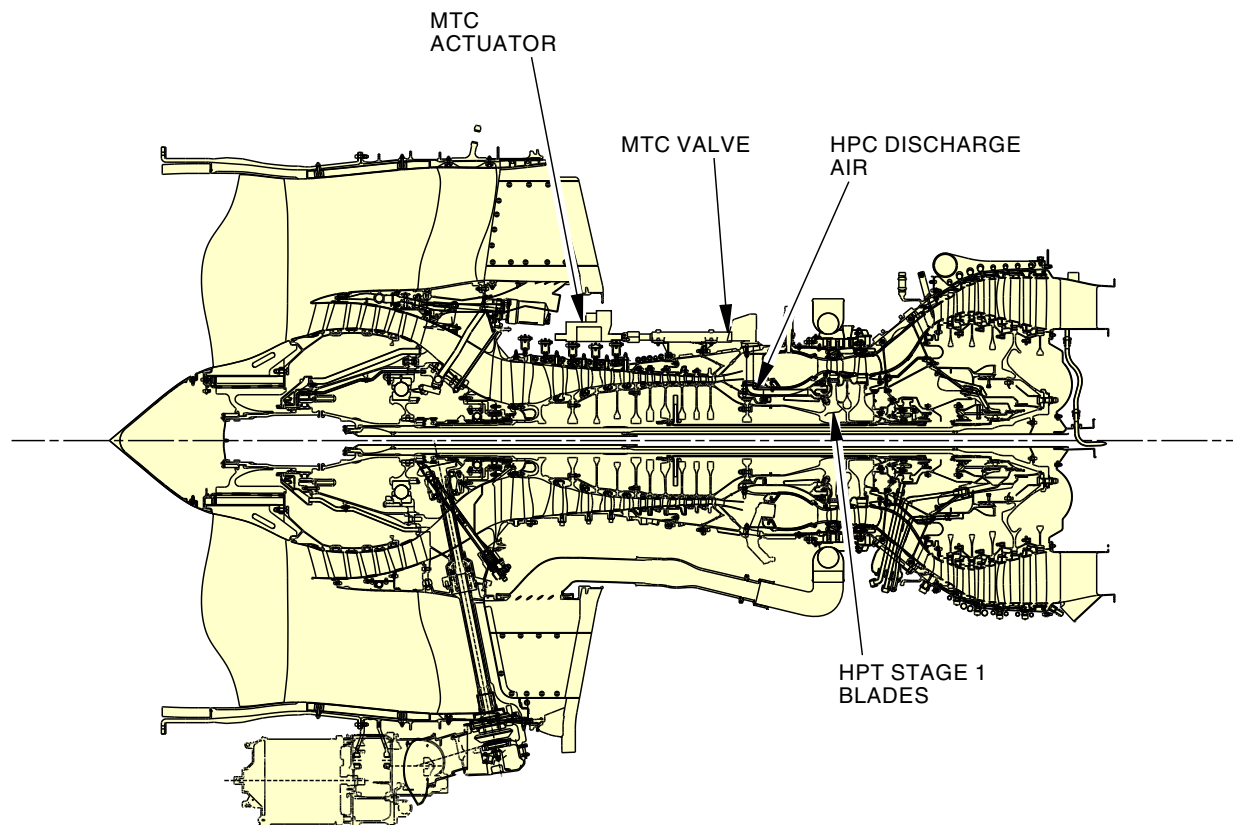
The MTC system has these parts:

NOTE: For Post LEAP-1B Service Bulletin 72-0124, the left side MTC valve and actuator (aft looking forward) are removed.

- Two MTC actuators
- Two MTC valves.

EFFECTIVITY	
SIA ALL	

ENGINE AIR - MODULATED TURBINE COOLING (MTC) - GENERAL DESCRIPTION



2564562 S0000612540_V1

ENGINE AIR - MODULATED TURBINE COOLING (MTC) - GENERAL DESCRIPTION

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SIA ALL

EFFECTIVITY

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ECCN 9E991 BOEING PROPRIETARY - See title page for details



ENGINE AIR - MTC - COMPONENT LOCATION

Component Locations

There are two modulated turbine cooling (MTC) actuators and two MTC valves. The actuators are under the thrust reverser cowl over the front high pressure compressor case. They are at the 2:00 and 8:00 positions when you see the engine from the rear. The valves are on the combustor case, and are also at the 2:00 and 8:00 o'clock positions. Components downstream of the valves are inside the engine.

NOTE: For Post LEAP-1B Service Bulletin 72-0124, the left side MTC valve and actuator (aft looking forward) are removed.

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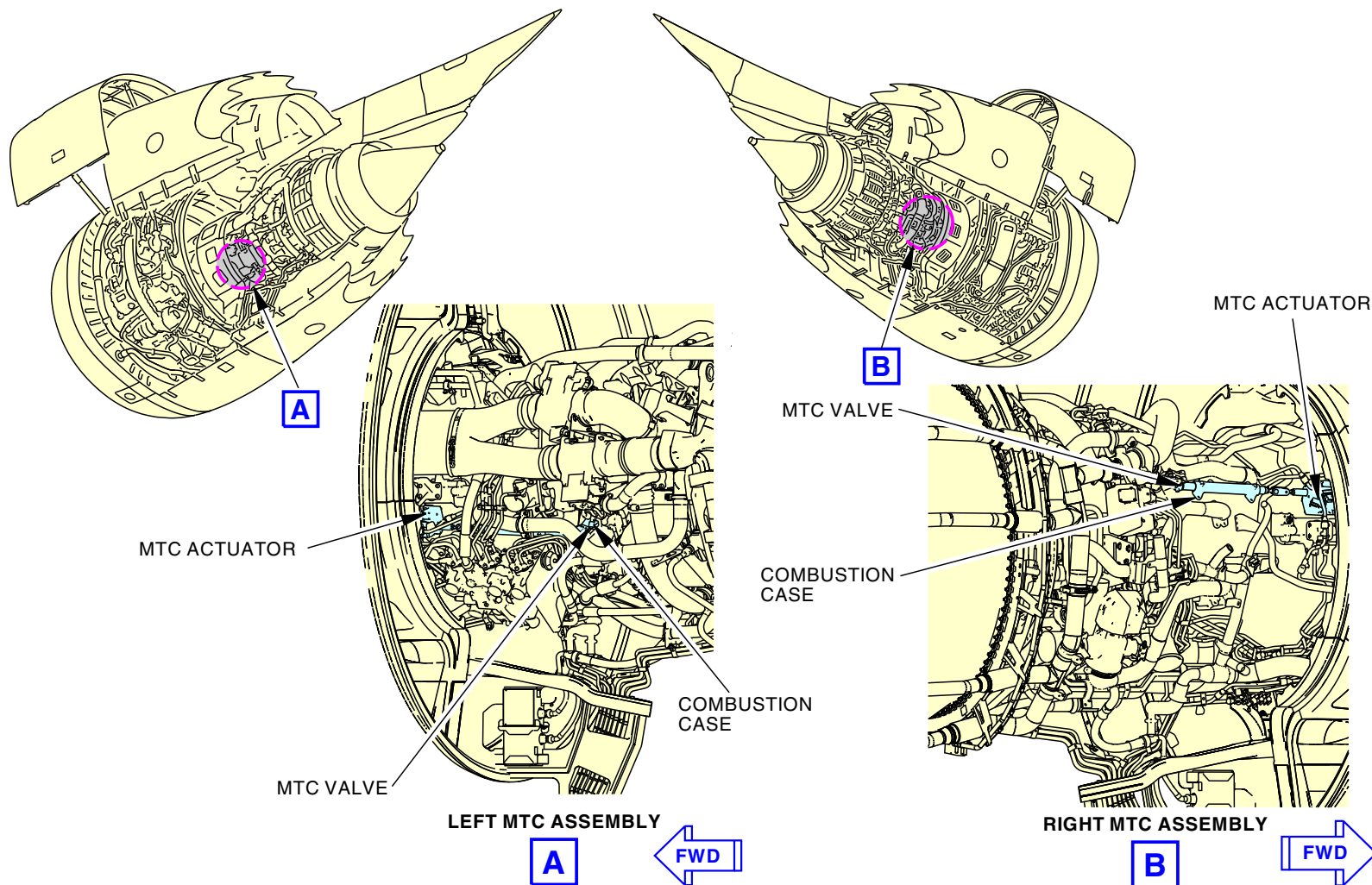
EFFECTIVITY	
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ENGINE AIR - MTC - COMPONENT LOCATION



2564580 S0000612580_V1

ENGINE AIR - MTC - COMPONENT LOCATION

**ENGINE AIR - MTC - FUNCTIONAL DESCRIPTION****Cooling Air Flow**

The modulated turbine cooling (MTC) system uses compressor discharge air to cool the high pressure turbine (HPT). The MTC valves control the amount of cooling air flow. Each MTC valve assembly has one actuator that operates it. At high power settings, the engine makes the most internal heat. At low engine power settings, the engine makes less internal heat. The MTC system gives less cooling air flow at low engine power settings.

NOTE: For Post LEAP-1B Service Bulletin 72-0124, the left side MTC valve and actuator (aft looking forward) are removed.

Operation

The MTC system gives the most cooling air to the HPT stage 1 blades during these phases of flight:

- Takeoff
- Climb.

The EEC channel in control sends a signal to the servo in the split control unit (SCU). The SCU then gives servo fuel pressure to the MTC actuators. The actuators extend and retract to control how much cooling air goes to the first stage of the HPT.

When the MTC valve is open, valve openings let compressor discharge air in. This gives cool air to the HPT stage 1 blades. When the MTC valve is closed, it stops MTC air. Each actuator has an LVDT that gives actuator position feedback to an EEC channel.

You can see the MTC actuator positions on the EPCS maintenance data page.

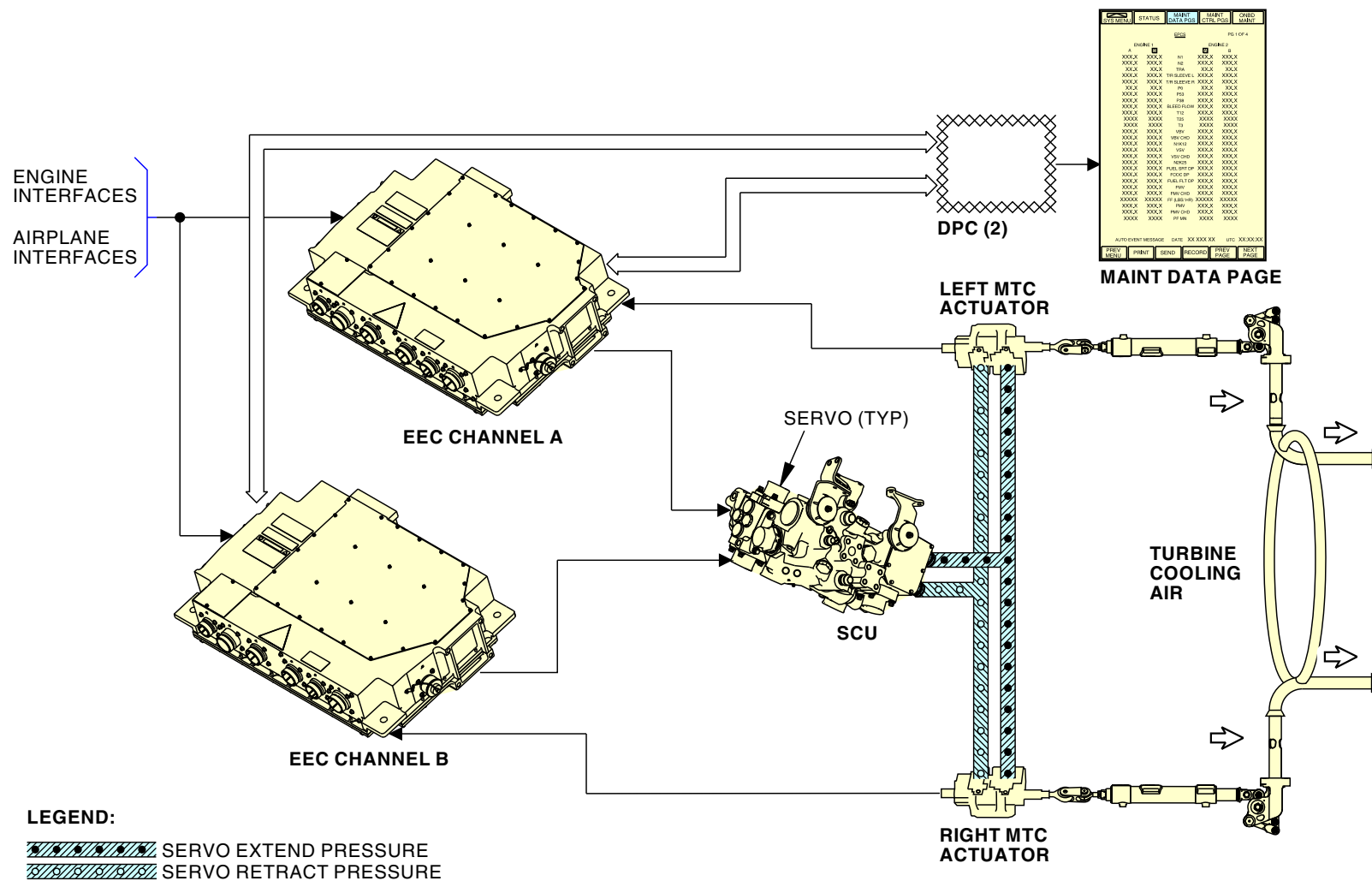
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ENGINE AIR - MTC - FUNCTIONAL DESCRIPTION



2564602 S0000612663_V1

ENGINE AIR - MTC - FUNCTIONAL DESCRIPTION



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75-31-00

**ENGINE AIR - VARIABLE STATOR VANE (VSV) SYSTEM - GENERAL DESCRIPTION****General Description**

The variable stator vanes (VSV) system controls the angular position of these variable stator vanes:

- HPC Inlet guide vanes (IGV)
- HPC stator vane stage 1
- HPC stator vane stage 2
- HPC stator vane stage 3
- HPC stator vane stage 4.

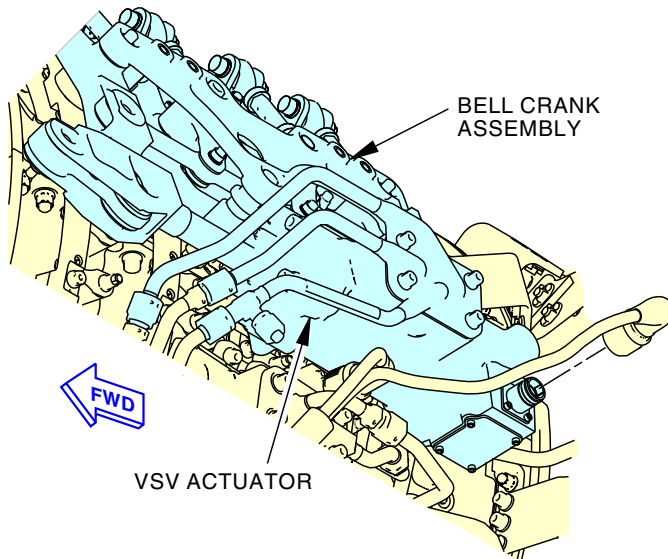
The VSV system makes sure that airflow through the HPC is smooth at all engine speeds.

The VSV system has these parts:

- Two VSV actuators
- Two bellcrank assemblies
- Four actuation rings (not shown)
- Variable stator vanes.

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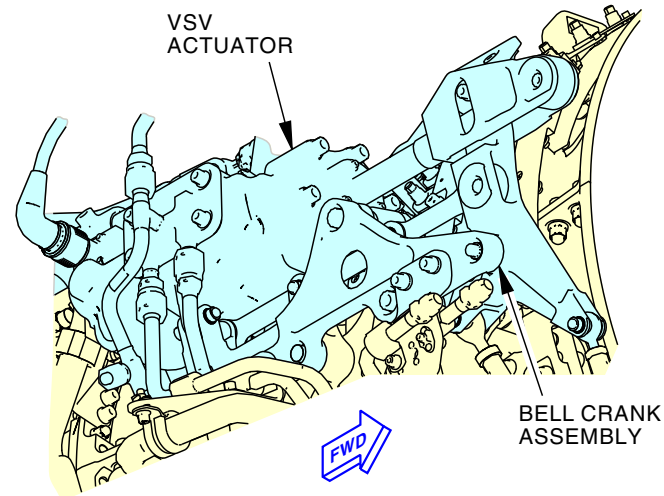
ENGINE AIR - VARIABLE STATOR VANE (VSV) SYSTEM - GENERAL DESCRIPTION



VSV ACTUATOR

BELL CRANK ASSEMBLY

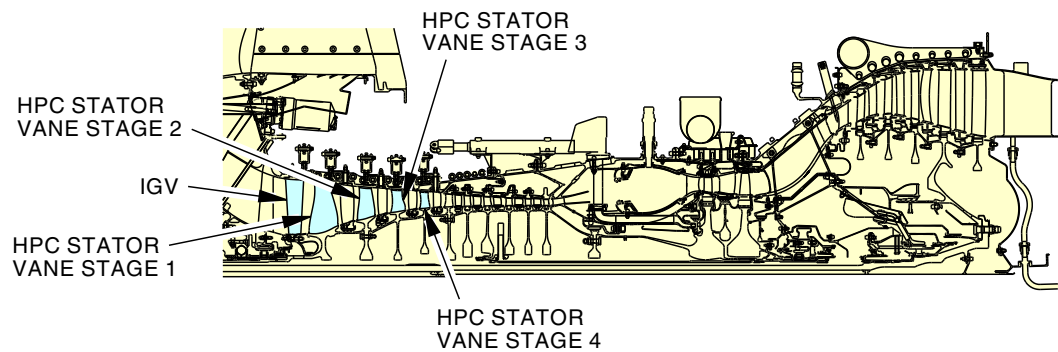
LEFT VSV ASSEMBLY



VSV ACTUATOR

BELL CRANK ASSEMBLY

RIGHT VSV ASSEMBLY



HPC STATOR VANE STAGE 2

IGVS

HPC STATOR VANE STAGE 1

HPC STATOR VANE STAGE 3

HPC STATOR VANE STAGE 4

ENGINE AIR - VARIABLE STATOR VANE (VSV) SYSTEM - GENERAL DESCRIPTION

2370676 S00061522233_V1



ENGINE AIR - VSV SYSTEM - COMPONENT LOCATION

Component Locations

The variable stator vane (VSV) system has 2 VSV actuators and 2 bellcrank assemblies. One actuator and one bellcrank are on the high pressure compressor (HPC) case at these positions:

- 3:00 o'clock position
- 9:00 o'clock position.

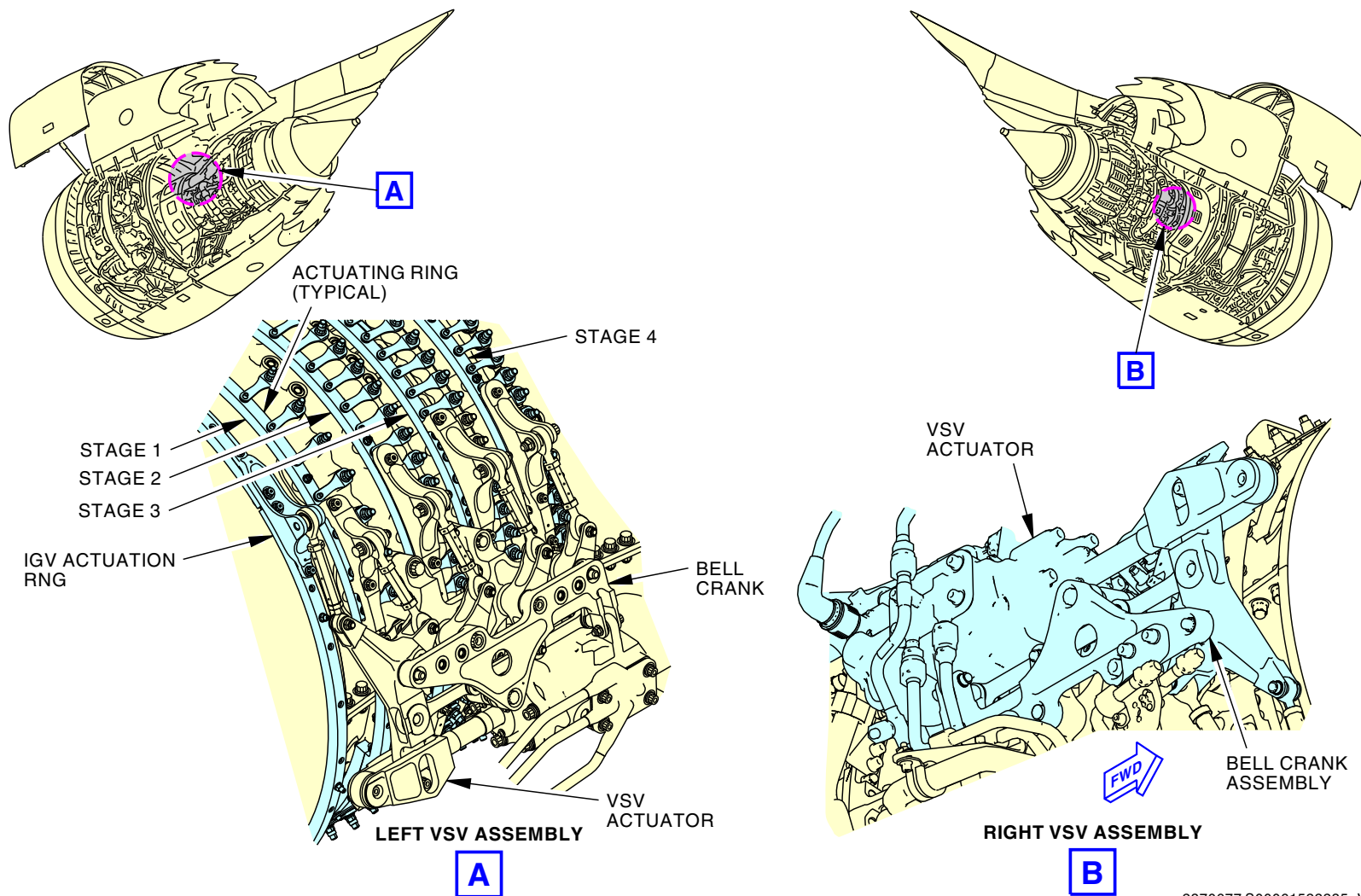
The actuators and bellcranks are connected to actuation rings. The actuation rings go around the HPC case. The actuation rings connect to and adjust the angles of these parts of the HPC:

- HPC inlet guide vanes (not shown)
- HPC stator vanes stage 1 (not shown)
- HPC stator vanes stage 2 (not shown)
- HPC stator vanes stage 3 (not shown)
- HPC stator vanes stage 4(not shown).

You open the fan cowls and thrust reversers to get access to the VSV system components.

SIA ALL	EFFECTIVITY
	D633AM102-SIA

ENGINE AIR - VSV SYSTEM - COMPONENT LOCATION



2370677 S00061522235_V1

ENGINE AIR - VSV SYSTEM - COMPONENT LOCATION

75-31-00

**ENGINE AIR - VSV SYSTEM - FUNCTIONAL DESCRIPTION****General**

The variable stator vanes (VSVs) system controls the angular position of these parts of the engine:

- Variable stator vanes
- Inlet guide vanes.

The VSV system adjusts the angle of air flow between the vanes and the rotating blades in the HPC. This gives better compressor operation and helps to prevent an HPC stall.

The electronic engine controllers (EECs) use this data to control the VSVs position:

- Ambient pressure (P0)
- N2 speed
- HPC inlet air temperature (T25)
- VSV actuator position feedback.

Control

The EEC usually gets P0 from the pressure subsystem box, and engine data from engine sensors. These inputs are used to calculate the commanded VSVs position. The EEC channel in control gives a signal to the split control unit (SCU). The SCU gives servo fuel pressure to the two VSV actuators. Each actuator connects to a bellcrank assembly. The two actuator and bellcrank assemblies operate together to move the HPC variable stator vanes through 4 actuation rings. They also move the IGVs through one actuation ring. Each actuator has an LVDT. The EECs use the LVDTs to monitor the position of the VSV actuators. One LVDT gives an electrical signal to channel A of the EEC. The other LVDT gives an electrical signal to channel B.

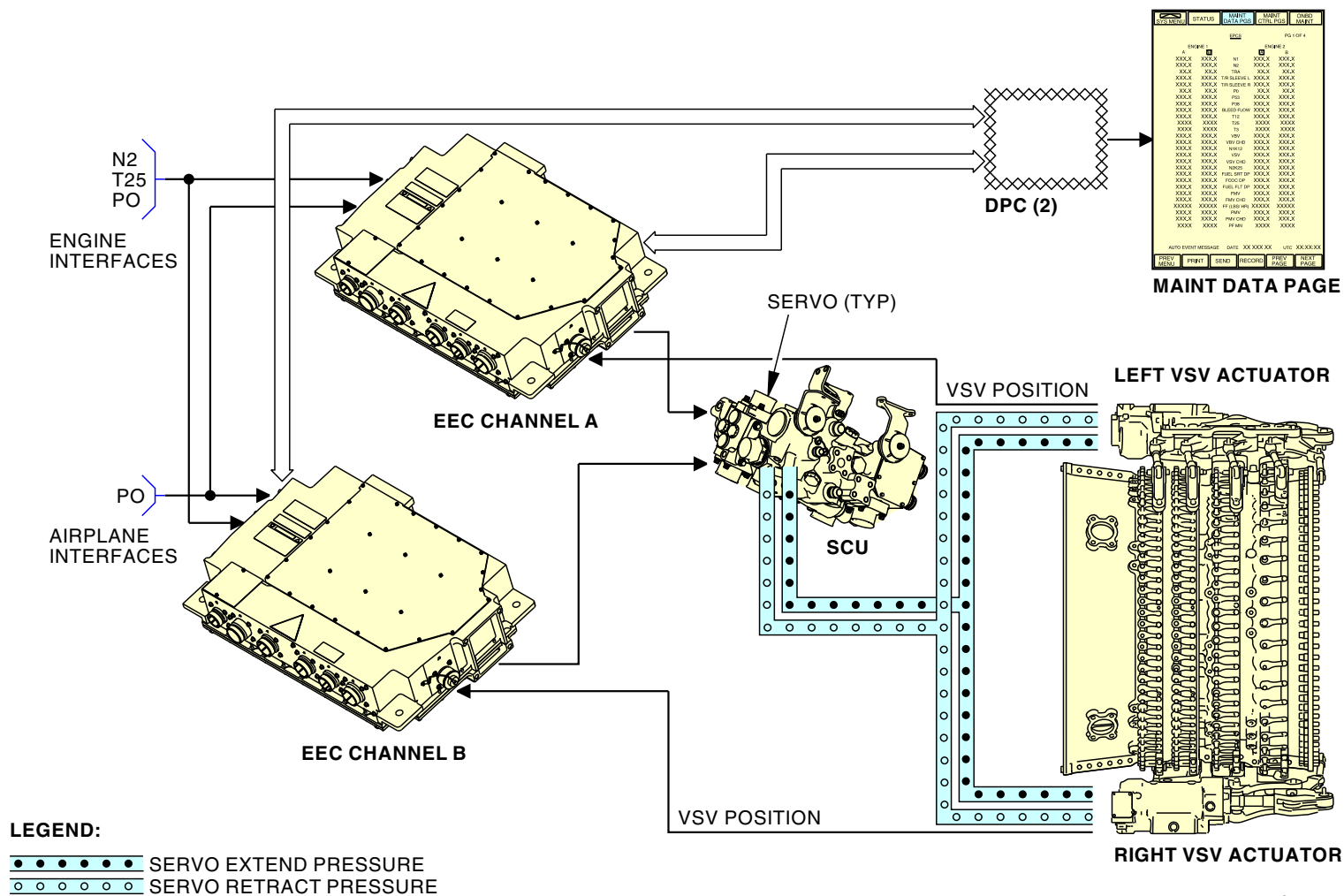
See the engine fuel and control section for more information on how the EEC gets P0 data. (SECTION 73-21)

Operation

The VSVs and IGVs are in their closed position when N2 is at idle. They move to a more open position when N2 increases. If N2 speed decreases, the EEC makes the VSVs and IGVs go to a more closed position.

EFFECTIVITY	
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ENGINE AIR - VSV SYSTEM - FUNCTIONAL DESCRIPTION



2370679 S0006152239_V1

ENGINE AIR - VSV SYSTEM - FUNCTIONAL DESCRIPTION



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**ENGINE AIR - VARIABLE BLEED VALVE (VBV) SYSTEM - GENERAL DESCRIPTION****General Description**

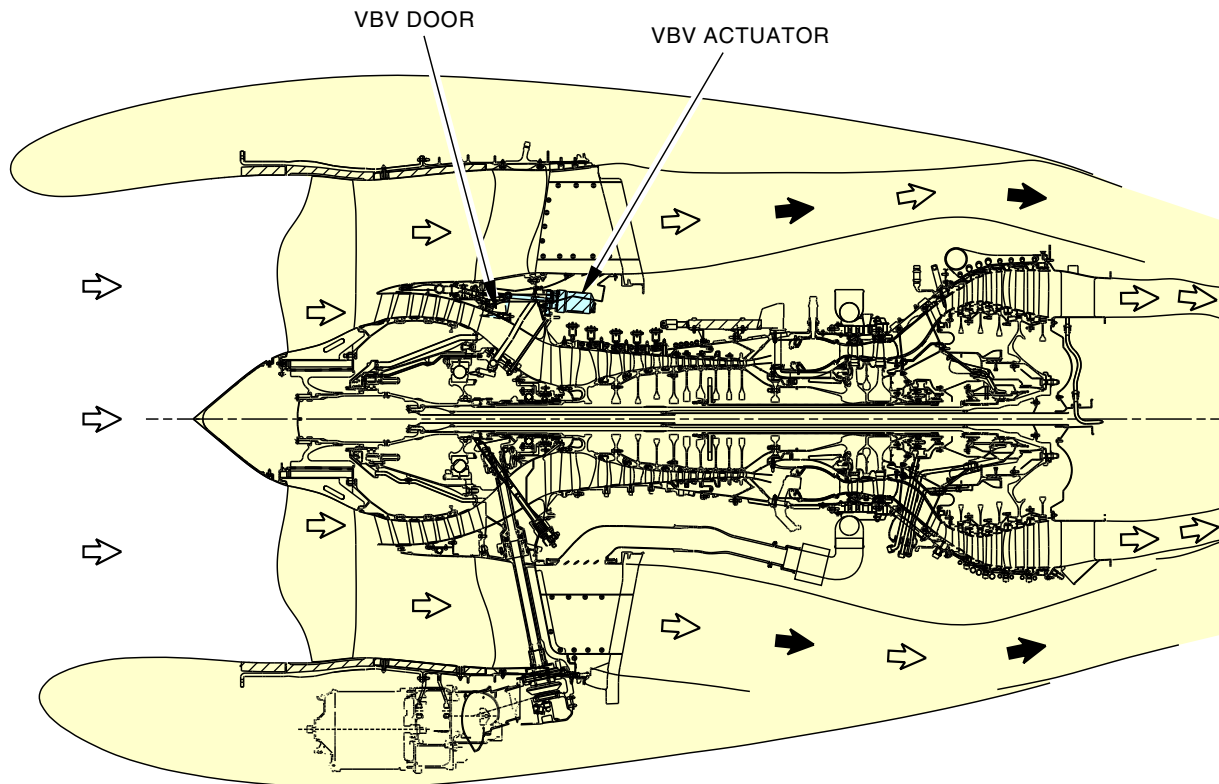
The Variable Bleed Valve (VBV) system lets part of the Low Pressure Compressor (LPC) discharge air go to the secondary airflow. This controls the amount of air that goes into the High Pressure Compressor (HPC).

The VBV system has these parts:

- VBV actuator (2)
- Actuation ring
- VBV door (8).

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ENGINE AIR - VARIABLE BLEED VALVE (VBV) SYSTEM - GENERAL DESCRIPTION



2370680 S00061522243_V1

ENGINE AIR - VARIABLE BLEED VALVE (VBV) SYSTEM - GENERAL DESCRIPTION

75-32-00

75-32-00-001

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EFFECTIVITY

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ECCN 9E991 BOEING PROPRIETARY - See title page for details



ENGINE AIR - VBV SYSTEM - COMPONENT LOCATION

Component Locations

The right Variable Bleed Valve (VBV) actuator is on the rear face of the fan hub at the 3:00 o'clock position.

The left VBV actuator is on the rear face of the fan hub at the 7:00 o'clock position.

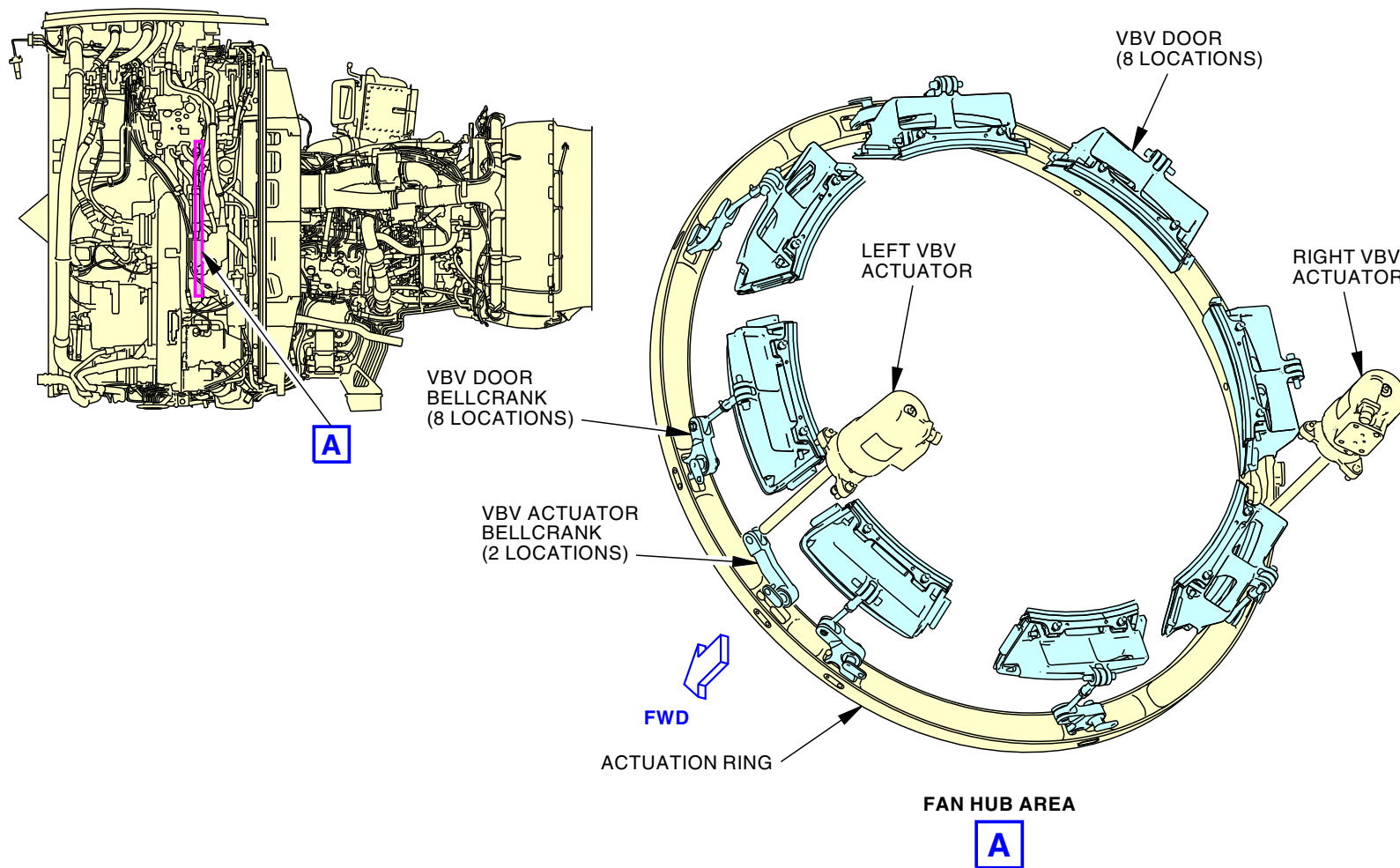
These VBV components are also in the fan hub area:

- Actuation ring
- VBV door (8)
- VBV door bellcrank (8)
- VBV actuator bellcrank (2).

You open the two fan cowls and thrust reverser cowls to get access to the VBV system components.

EFFECTIVITY	
SIA ALL	

ENGINE AIR - VBV SYSTEM - COMPONENT LOCATION



2370681 S00061522245_V1

ENGINE AIR - VBV SYSTEM - COMPONENT LOCATION

75-32-00



ENGINE AIR - VBV SYSTEM - DOORS

General Description

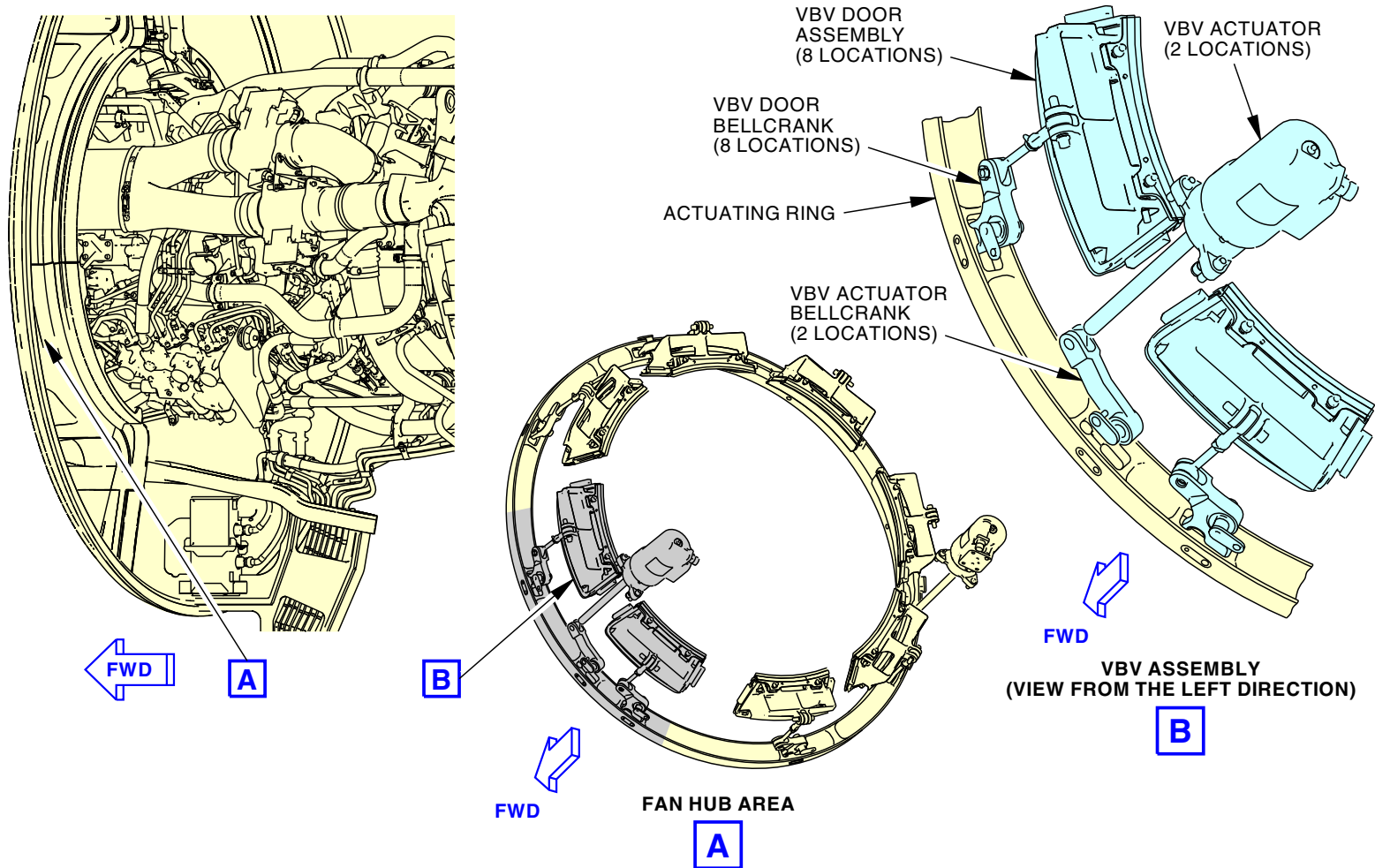
The VBV doors control the quantity of Low Pressure Compressor (LPC) air that mixes with the fan discharge air flow.

Physical Description

There are eight VBV doors. Each door connects to the actuation ring through a bellcrank. There are two VBV actuators. There are also two VBV actuator bellcranks. Each VBV actuator connects to an VBV actuator bellcrank. The VBV actuator bellcranks connect to the VBV actuating ring.

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ENGINE AIR - VBV SYSTEM - DOORS



2370683 S00061522249_V1

ENGINE AIR - VBV SYSTEM - DOORS

75-32-00

**ENGINE AIR - VBV SYSTEM - FUNCTIONAL DESCRIPTION****General**

The Variable Bleed Valve (VBV) system lets part of the Low Pressure Compressor (LPC) discharge air bypass into the secondary airflow. This controls the amount of air that goes into the High Pressure Compressor (HPC). During a fast deceleration, the VBV system increases the LPC stall margin. At low engine speed and during the thrust reverser operation, the VBV system keeps Foreign Object Debris (FOD) out of the HPC. This prevents damage to the engine and improves engine stability.

The Electronic Engine Controls (EECs) use these data to control the VBVs:

- P0
- PT
- TAT
- T25
- VSV position
- N1 speed
- N2 speed
- Thrust lever resolver angle (TRA).

Control

The EECs normally get P0, PT and TAT from the ADIRUs through the DPCs. The EECs get N1, N2, T25, and VSV position from engine sensors. TRA comes from the thrust lever resolver. P0 data also comes from the pressure subsystem box. The EECs use this data to schedule an angular position for the VBV doors. The EEC channel in control sends a command signal to the Split Control Unit (SCU). The SCU sends servo fuel pressure to move the two VBV actuators. The actuators connect with the eight VBV doors through an actuation ring.

Each actuator has an LVDT. The EEC uses the LVDTs to monitor the position of the actuators. One LVDT sends an electrical signal to channel A of the EEC. The other LVDT sends an electrical signal to channel B.

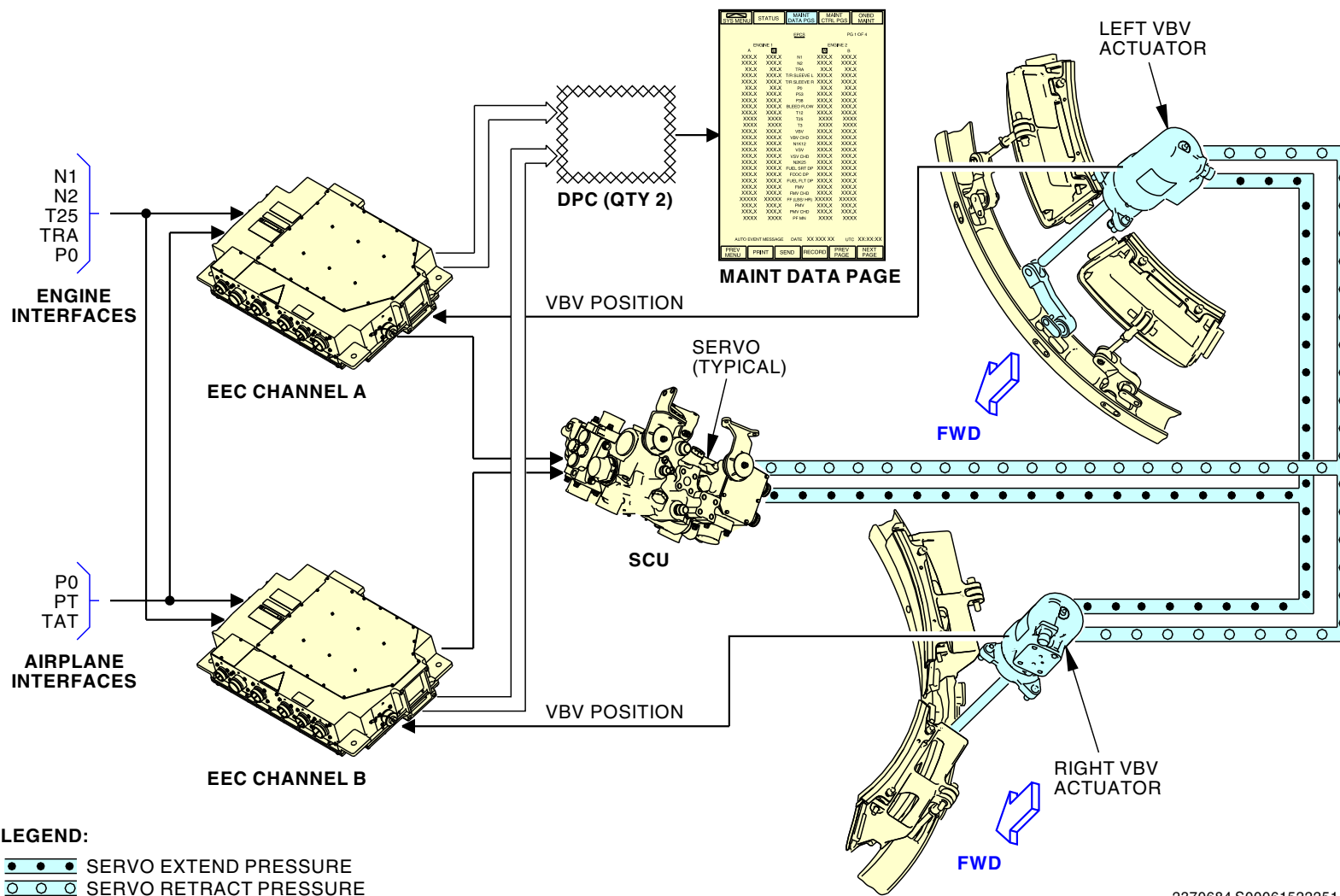
Operation

In general, during steady state operation, the VBVs doors go more closed as N1 speed increases. The VBV doors are closed when N1 speed is above 80 percent.

The EEC commands the VBV doors to be more open during these conditions:

- Rapid engine deceleration
- Thrust reverser operation
- Potential icing conditions.

ENGINE AIR - VBV SYSTEM - FUNCTIONAL DESCRIPTION



2370684 S00061522251_V1

ENGINE AIR - VBV SYSTEM - FUNCTIONAL DESCRIPTION

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LEAP-1B ENGINES

737-7/8/8200/9/10 SYSTEM DESCRIPTION SECTION

ENGINE AIR - VBV SYSTEM - FUNCTIONAL DESCRIPTION

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Sep 15/2021

**ENGINE AIR - TRANSIENT BLEED VALVE (TBV) - GENERAL DESCRIPTION****General Description**

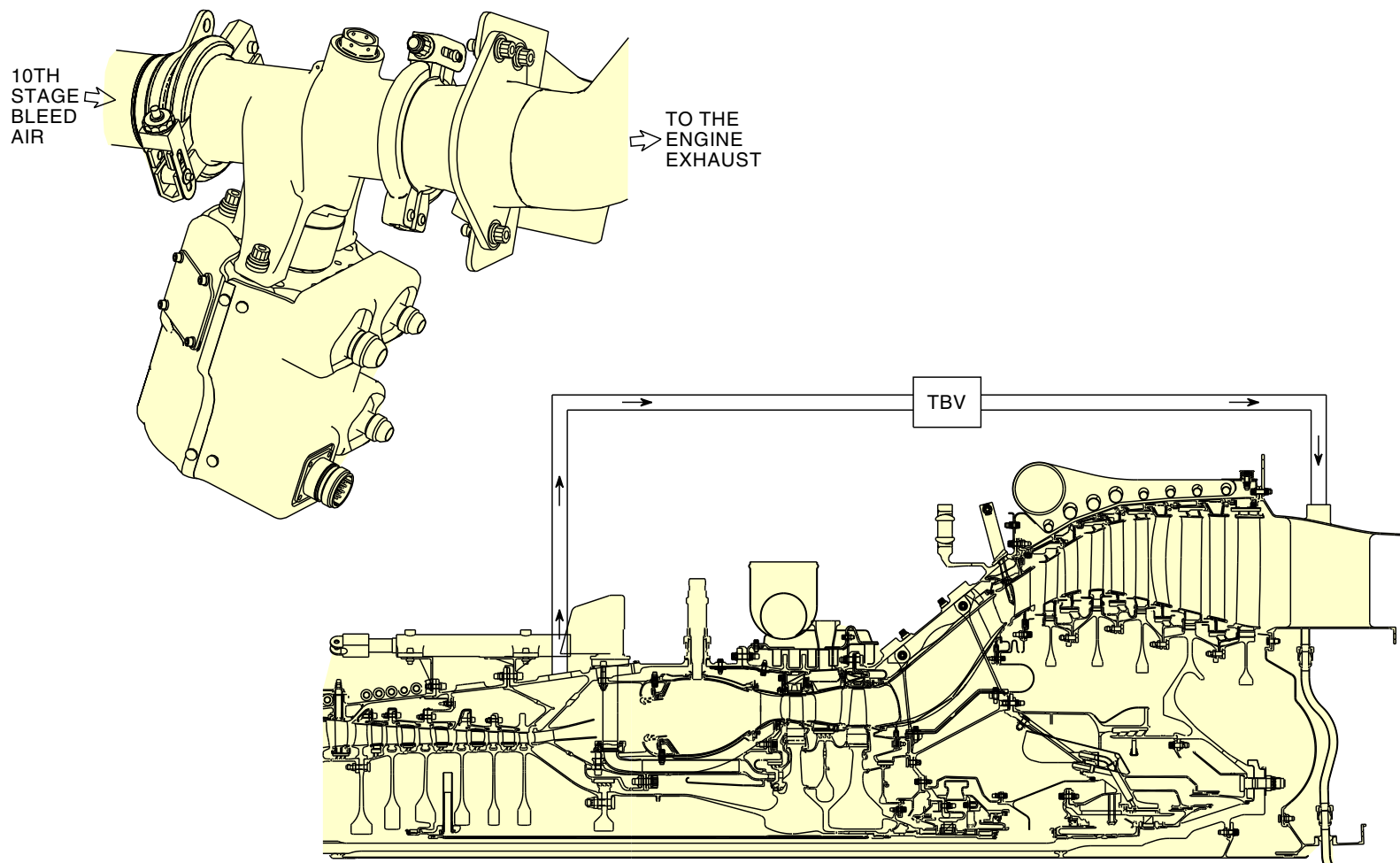
The TBV system lets air from the 10th stage of compression go to the engine exhaust. The TBV system helps the engine to operate properly at all speeds.

The TBV system has these parts:

- TBV valve
- TBV manifold.

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ENGINE AIR - TRANSIENT BLEED VALVE (TBV) - GENERAL DESCRIPTION



2370672 S00061522223_V1

ENGINE AIR - TRANSIENT BLEED VALVE (TBV) - GENERAL DESCRIPTION



ENGINE AIR - TBV - COMPONENT LOCATION

Component Locations

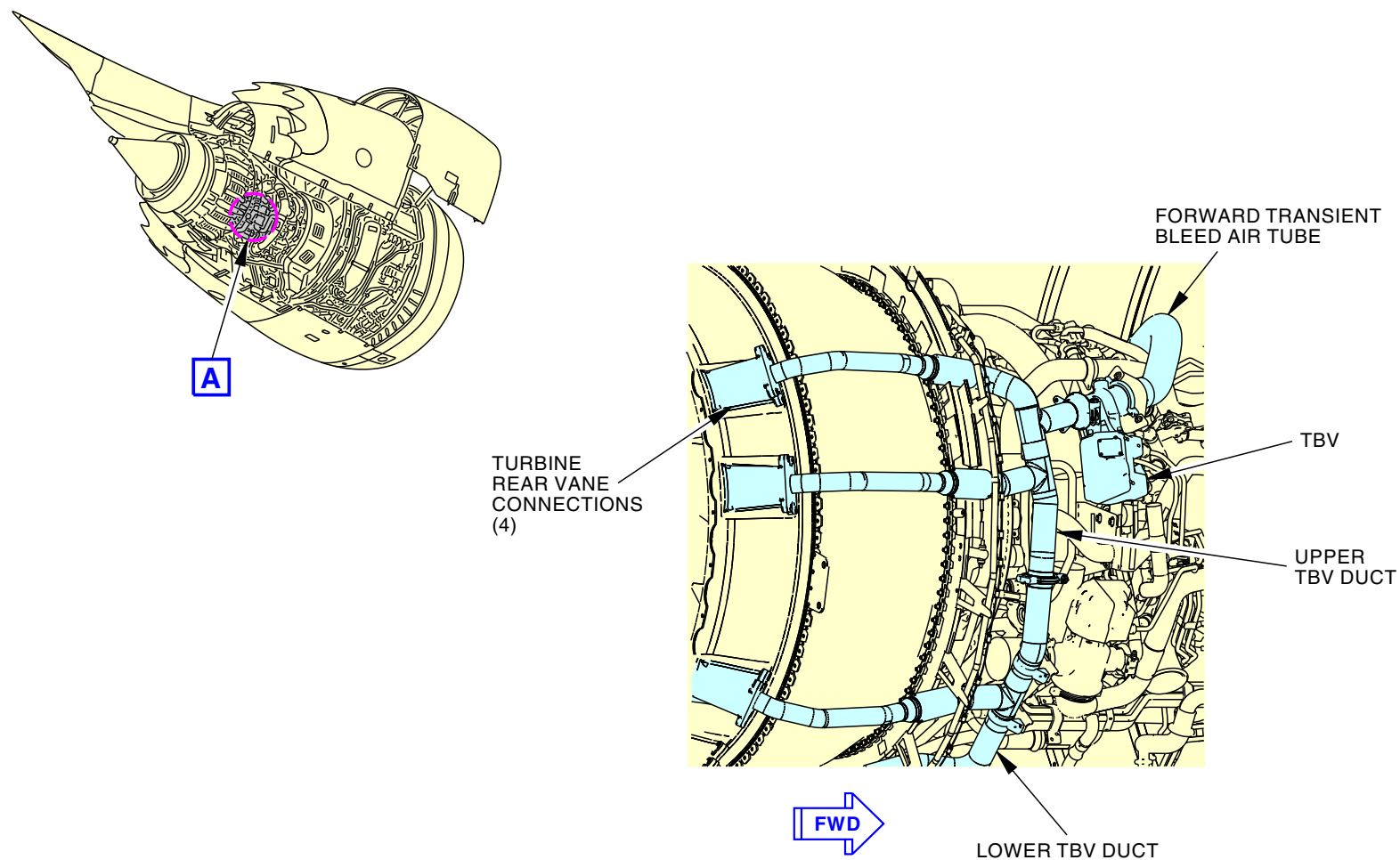
Most of the transient bleed valve (TBV) system components are on the right side of the engine. You open the right fan duct cowl and right thrust reverser cowl to get access to the TBV system components.

These are the components of the TBV system:

- Forward transient bleed air tube
- TBV
- Upper TBV duct
- Lower TBV duct
- Turbine rear vane connections.

The forward end of the forward transient bleed air tube connects near the top of the combustor case. The aft end of the forward transient bleed air tube connects to the TBV. The TBV is on the right side of the combustor case. The upper and lower TBV ducts connect to the TBV air outlet. They are immediately forward of the exhaust section. The four turbine rear vane connections are on the right side of the exhaust section. They connect to the upper and lower TBV ducts.

ENGINE AIR - TBV - COMPONENT LOCATION



2370673 S0006152225_V2

ENGINE AIR - TBV - COMPONENT LOCATION

75-33-00

**ENGINE AIR - TBV - FUNCTIONAL DESCRIPTION****General**

The transient bleed valve (TBV) lets air from the high pressure compressor (HPC) 10th stage go to the turbine rear vane, into the exhaust gas path. The TBV system helps to prevent an HPC stall during engine starts and during engine acceleration/deceleration.

The electronic engine controllers (EECs) use these parameters to control the transient bleed valve (TBV) position:

- N2 speed
- T25.

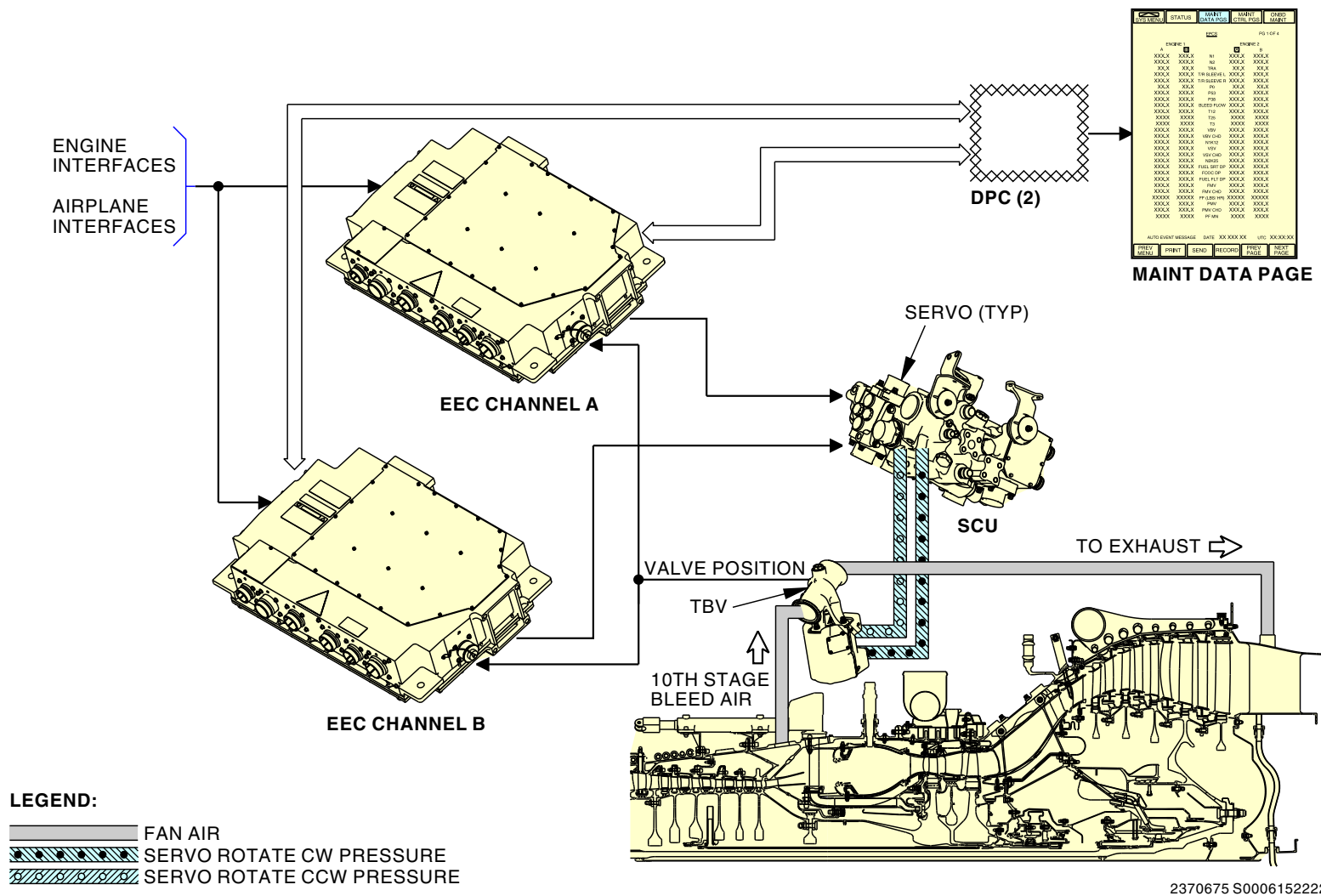
Operation

The EEC channel in control sends a signal to the servo in the split control unit (SCU). The servo sends fuel pressure to rotate the valve to the open or closed position.

Position sensors in the TBV send valve position back to the EECs.

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ENGINE AIR - TBV - FUNCTIONAL DESCRIPTION



2370675 S00061522229_V1

ENGINE AIR - TBV - FUNCTIONAL DESCRIPTION

