

CHAPTER

74

Ignition

(LEAP-1B ENGINES)

CHAPTER 74
IGNITION

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A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

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**CHAPTER 74
IGNITION**

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**IGNITION - INTRODUCTION****General**

The ignition system supplies electrical sparks in the combustion chamber for combustion. Each engine has two ignition systems that operate independently. The ignition system usually operates manually. However, the ignition system will operate automatically when the electronic engine control (EEC) detects a possible engine flameout or other condition.

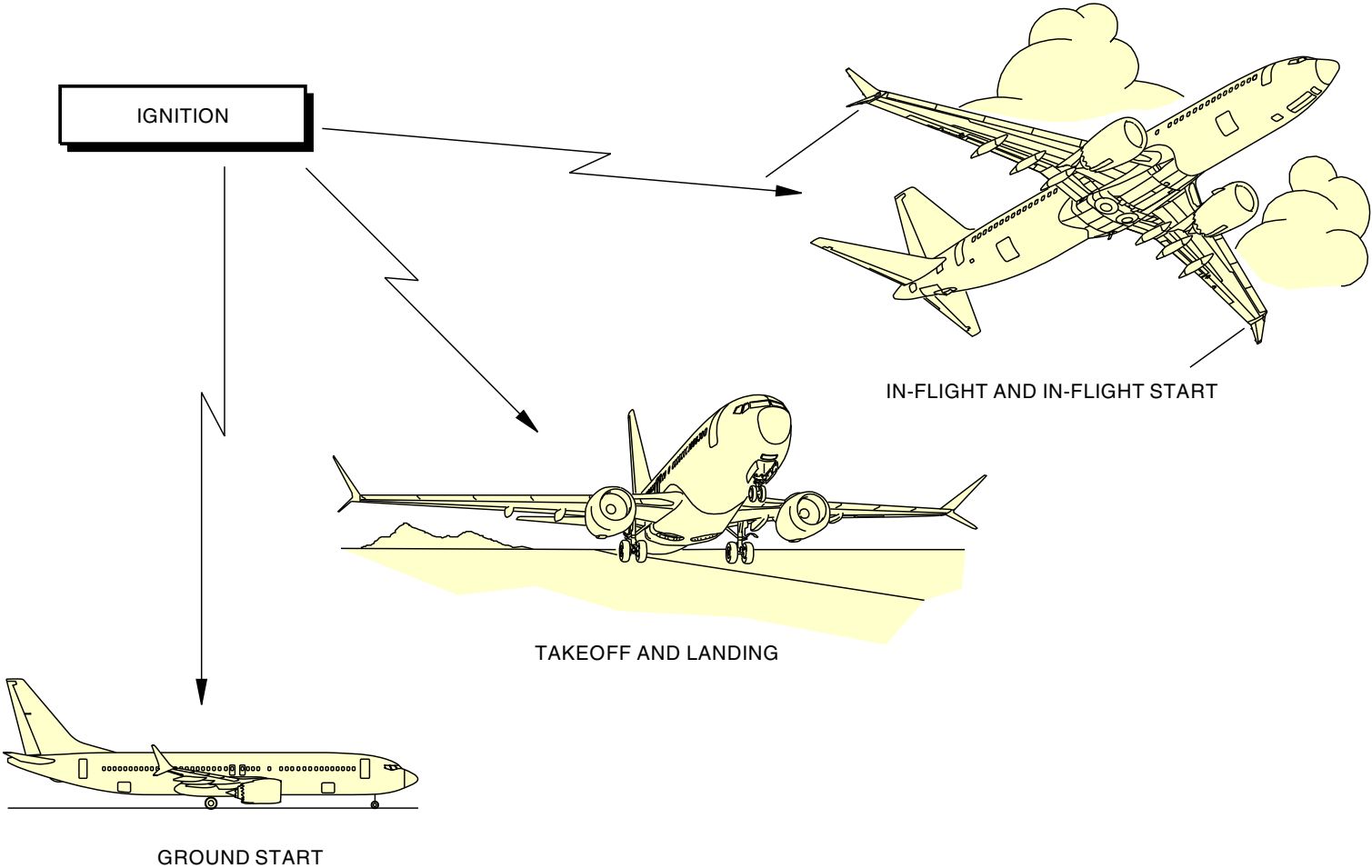
You use ignition during these times:

- Ground start
- Takeoff and landings
- In-flight (during heavy turbulence or bad weather)
- In-flight start.

Abbreviations and Acronyms

- AUTO - automatic
- DU - display unit
- CONT - continuous
- DPC- display processing computer
- EEC - electronic engine control
- FLT - flight
- GRD - ground
- IGN - ignition
- L - left
- MDS - MAX display system
- R - right

IGNITION - INTRODUCTION



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IGNITION - INTRODUCTION

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IGNITION - GENERAL DESCRIPTION

General

These are the components of the ignition system:

- Ignition selector switch (P5)
- Engine start switch (P5)
- Start lever (P8)
- Display processing computers (DPC)
- Electronic engine control (EEC).

The start lever controls ignition system power to the EECs. The start switch and the ignition selector switch supply inputs to the DPCs. The DPCs send the start switch and the ignition switch position to the EECs. The EECs give power to the selected ignition exciter(s) during starting or automatic ignition operation. The ignition exciters supply power to the engine igniters.

Start Lever Switch Module

The engine start lever in the control stand has internal switches. Some of those switches control electrical power to the EECs for engine ignition. The EECs get 115v ac power for ignition only when the start lever is in the IDLE position.

Engine Start Switch

There are four engine start switch positions:

- GRD (ground start)
- AUTO
- CONT (continuous ignition)
- FLT (flight).

Ignition Selector Switch

There are three ignition selector switch positions:

- IGN L (left spark igniter)
- BOTH (both spark igniters)

- IGN R (right spark igniter).

Ignition Power

EEC channel A normally gets electrical power for the upper ignition exciter from the ac transfer bus. EEC channel B gets electrical power for the lower ignition exciter from the ac standby bus. EEC channel A can get electrical power for the upper ignition exciter from the ac standby bus if you pull the ignition power control circuit breaker. The EECs have logic that controls when 115v ac electrical power goes to the appropriate ignition exciter. The ignition exciter converts the 115v ac into high energy pulses that fire the ignition igniter.

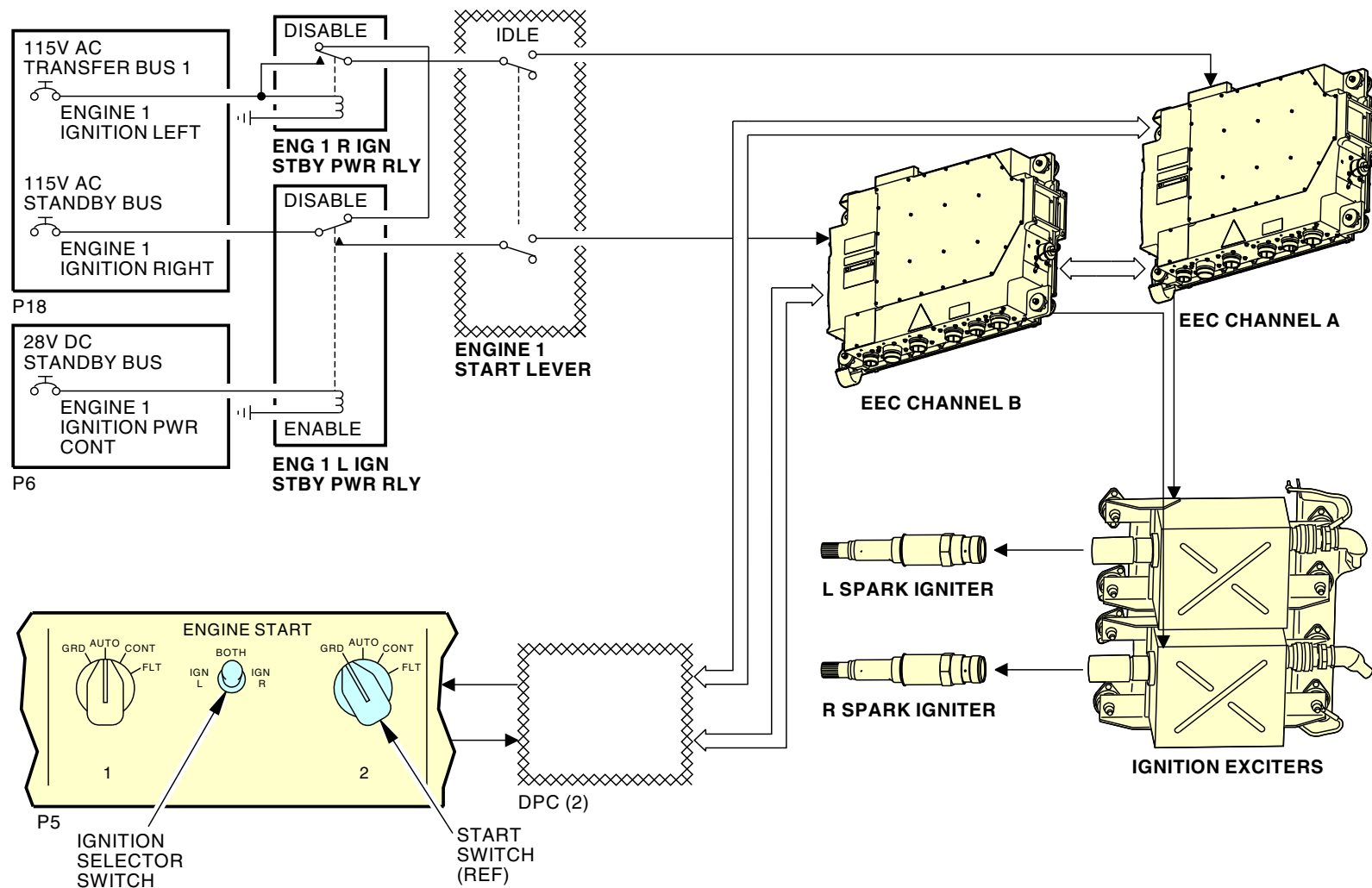
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IGNITION - GENERAL DESCRIPTION



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IGNITION - GENERAL DESCRIPTION

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**IGNITION - ENGINE COMPONENT LOCATION****General**

Each engine has a right and a left ignition system. These are the components of each ignition system:

- Ignition exciter
- Ignition lead
- Air manifold
- Ignition igniter.

Component Locations

There are two ignition exciters on each engine. They are on the bottom of the aft fan case.

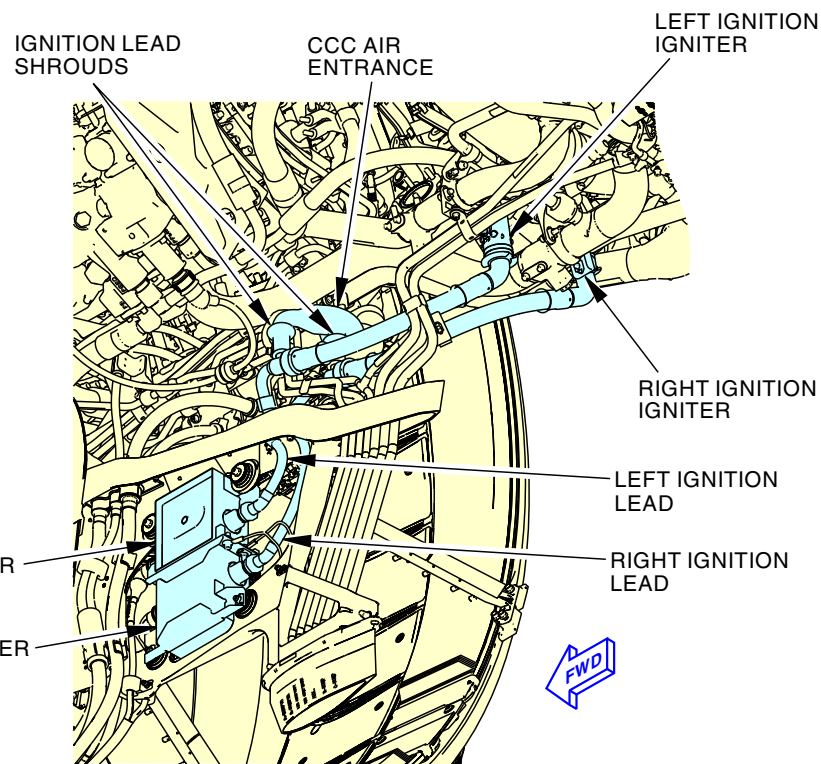
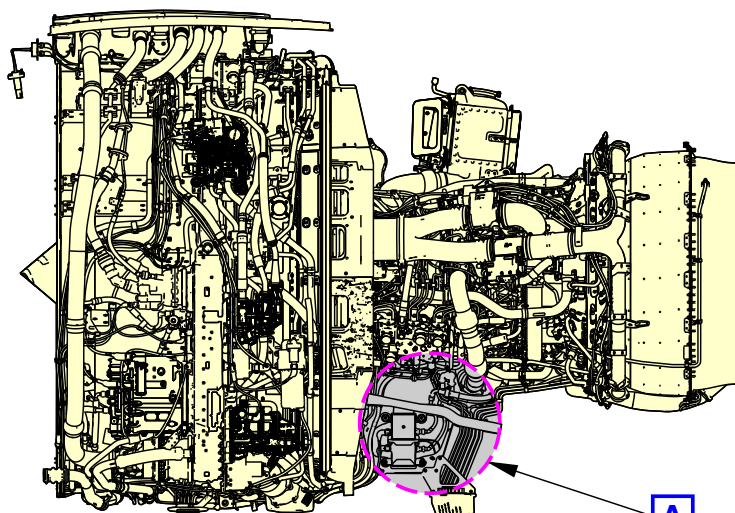
There are two igniters on each engine. The left ignition igniter is on the left side of the combustor near the 6:00 o'clock position. The right ignition igniter is on the right side of the combustor at the 5:00 o'clock position.

There are two ignition leads on each engine. They go from the ignition exciters to the ignition igniters.

The core compartment cooling (CCC) air manifold cools the ignition leads and igniters. This cooling air goes into the ignition leads near the ignition exciters and exits at the igniter cooling shroud.

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IGNITION - ENGINE COMPONENT LOCATION



IGNITION - ENGINE COMPONENT LOCATION

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**IGNITION - FLIGHT COMPARTMENT COMPONENT LOCATIONS****General**

These components which control the ignition system are in the flight compartment:

- Engine start switches
- Ignition selector switch
- Start levers.

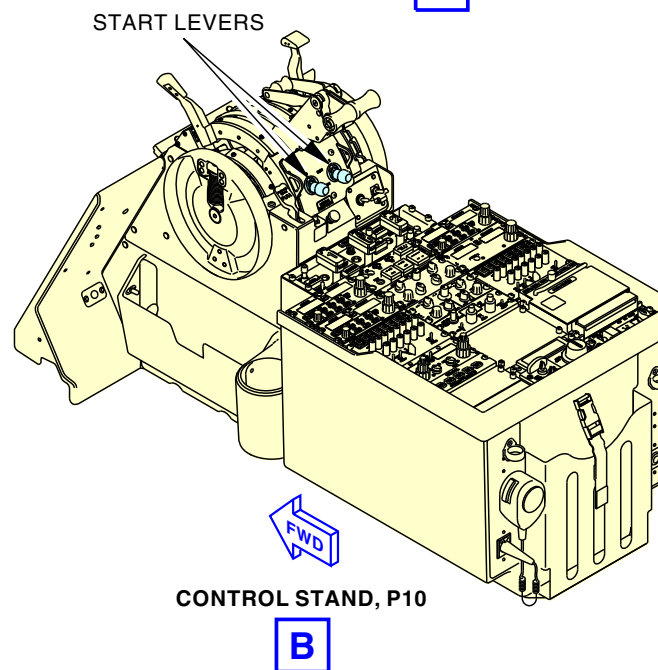
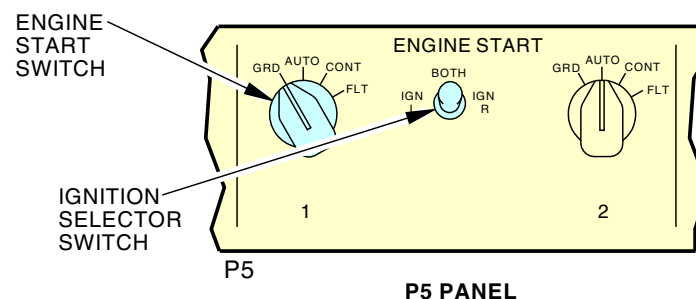
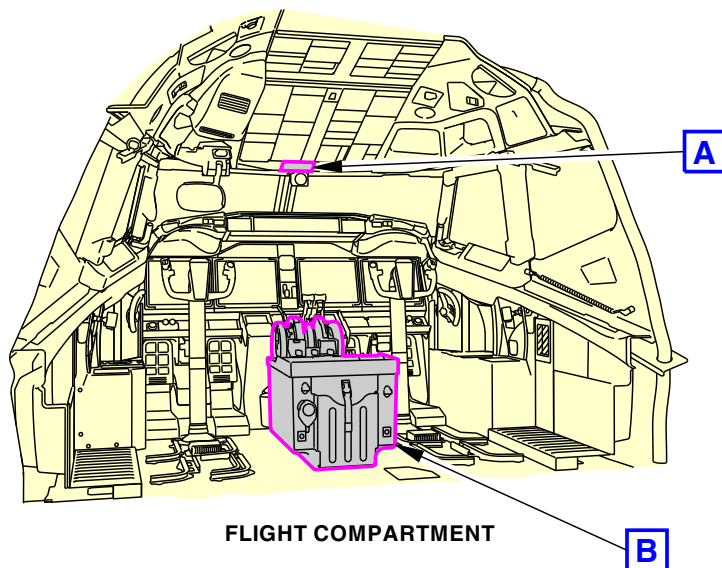
Component Locations

The ignition selector switch and engine start switches are on the forward overhead panel (P5).

The start levers are on the control stand.

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IGNITION - FLIGHT COMPARTMENT COMPONENT LOCATIONS



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IGNITION - FLIGHT COMPARTMENT COMPONENT LOCATIONS

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**IGNITION - IGNITION EXCITER****Purpose**

The ignition exciters supply power to the ignition igniters.

General

The ignition exciters change 115v ac to 20,000v dc. The output of the ignition exciter is 14.5 to 16 joules. The ignition igniter uses this power to ignite the fuel/air mixture in the combustion chamber. Usually, only one ignition exciter per engine operates at a time.

Physical Description

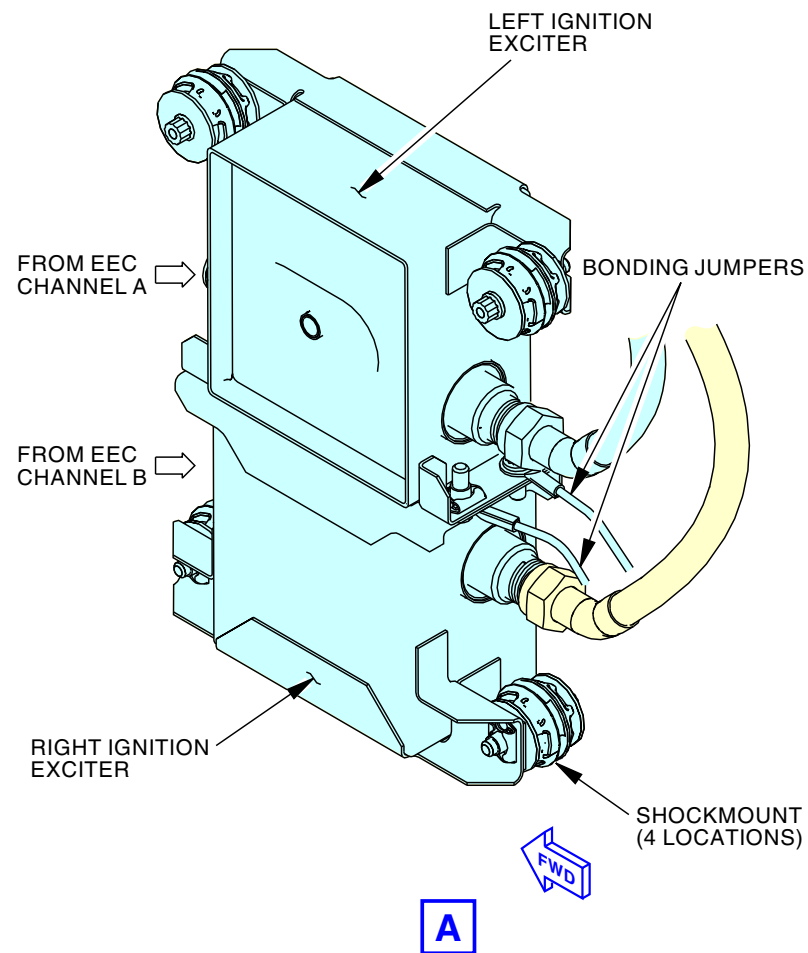
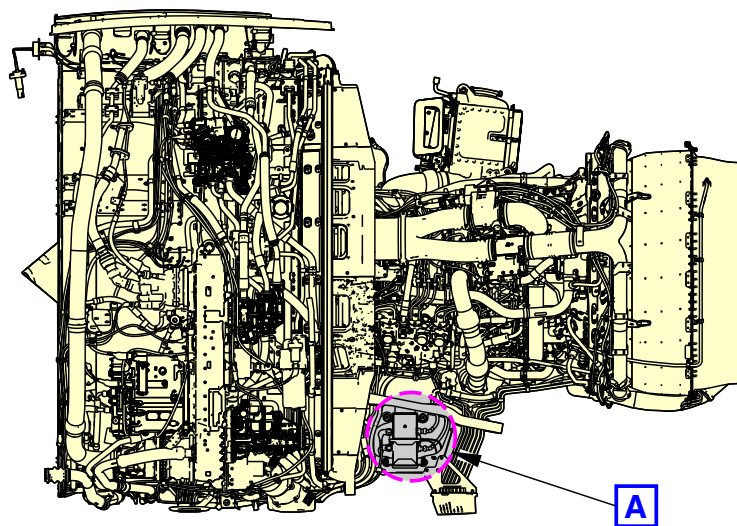
A 115v ac electrical connector attaches to the forward face of the ignition exciter. The ignition lead attaches to the aft face of the ignition exciter.

The ignition exciters are in the lower bifurcation section of the bottom of the aft fan case. The two exciters connect together with a bracket. They attach to the fan case with four shock mounts. Two shock mounts are on the top of the left (upper) ignition exciter. Two more shock mounts are on the bottom of the right (lower) ignition exciter.

Each ignition exciter has a bond jumper that attaches to the engine.

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IGNITION - IGNITION EXCITER



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IGNITION - IGNITION EXCITER

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**IGNITION - DISTRIBUTION - IGNITION LEADS AND SPARK IGNITERS****Purpose**

The ignition igniters supply an electrical spark to ignite the fuel/air mixture in the combustion chamber.

The ignition leads transmit power from the ignition exciters to the ignition igniters.

General Description

Each ignition igniter has its own ignition lead. Cooling air flows around each ignition lead and igniter plug to decrease the temperature of the lead and the plug.

Ignition Lead Cooling

Each ignition lead goes into an air manifold at the 6:00 o'clock position at the aft end of the fan case. From the air manifold to the igniter plug, the ignition lead is inside of the igniter lead shroud.

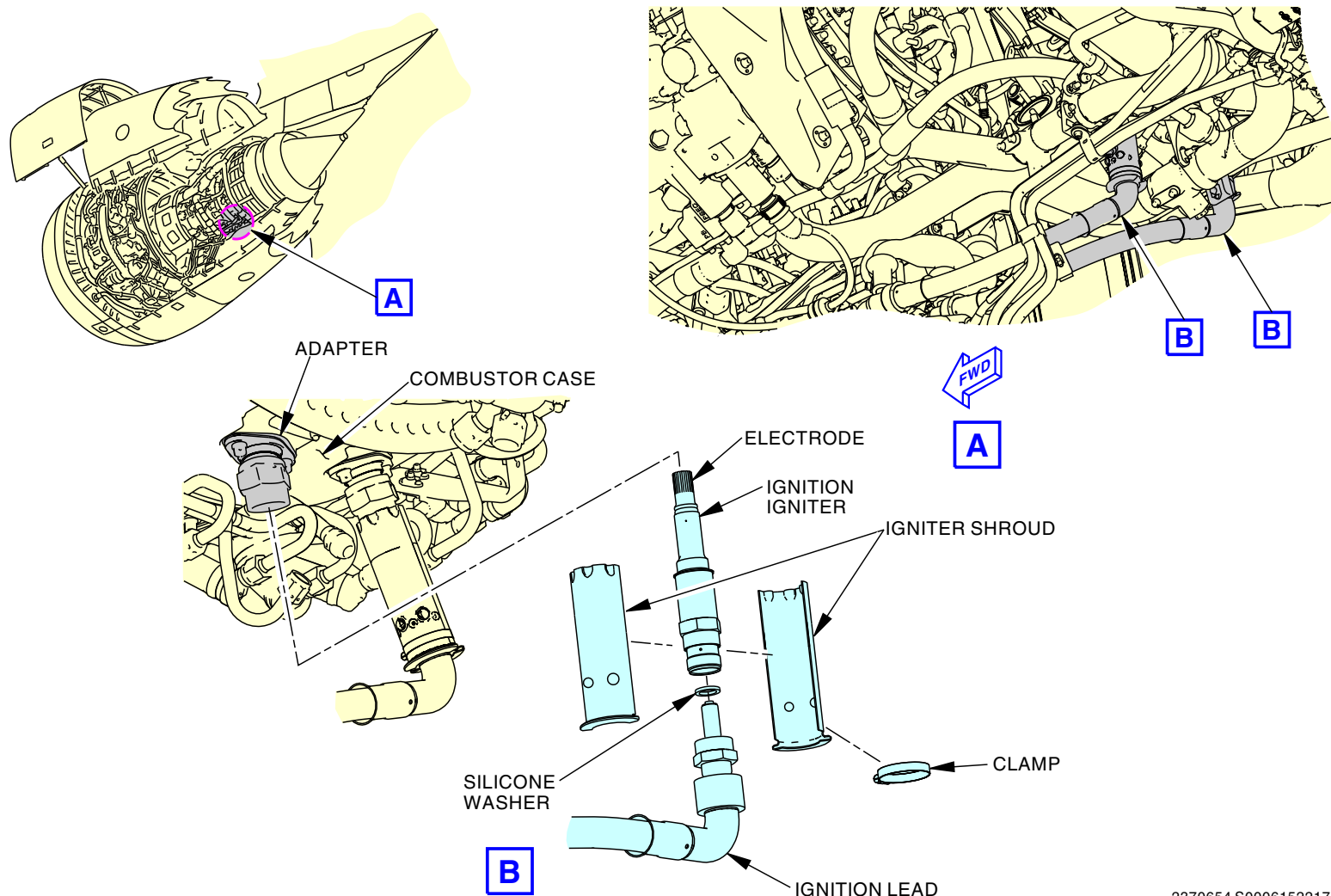
Low pressure compressor discharge air in the core compartment cooling air manifold is used for cooling. The air goes into the ignition lead shroud and then exits at the igniter plug through the igniter plug shroud.

Spark Igniters

Each ignition igniter installs into an adapter at the 5:00 o'clock and 6:00 o'clock positions on the engine. The ignition igniter electrode extends into the combustion chamber.

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IGNITION - DISTRIBUTION - IGNITION LEADS AND SPARK IGNITERS



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IGNITION - DISTRIBUTION - IGNITION LEADS AND SPARK IGNITERS

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IGNITION - FUNCTIONAL DESCRIPTION

General

The electronic engine controls (EECs) turn the two igniters on or off. Input from the flight compartment switches give manual control. The EECs have internal logic for automatic ignition system control.

Ignition Inputs

The EEC and the display processing computers (DPCs) monitor the position of these flight compartment components:

- Ignition selector switch
- Engine start switch
- Start lever.

Each DPC sends digital data signals to the EECs with the start and ignition selector switch position information. When you move a start lever to IDLE, 115v ac ignition power goes to each EEC channel.

The EECs control internal EEC ignition on/off switches. This controls the 115v ac power that goes to the ignition exciters. Each EEC channel controls one ignition exciter. The EEC channel in control can control the igniter in the other channel through the cross channel data bus.

The ignition exciters get 115v ac power and then supply pulses of 15,000 to 20,000v dc electrical power to the ignition igniters. This high voltage causes sparks across the electrodes of the igniter.

GND Position

The EECs make the selected igniter(s) operate when you select the GND position of the start switch and these conditions exist:

- Engine below idle
- Start logic enables ignition operation (bowed rotor start).

Automatic Ignition (Start Switch in the AUTO)

The EECs will operate both igniters if one or more of these conditions exist :

- Rejected takeoff

- Flameout or a rollback
- Quick windmill relight engine start try - (start lever cycled from idle to cutoff and back to idle)
- Rotating stall.

Continuous Ignition

The EECs make the selected igniter(s) operate when you select the CONT position of the start switch and these conditions exist:

- Engine at or above idle
- Ps3 is below the threshold for igniter sparking.

FLT Position

The EECs makes both igniters operate when you select the FLT position of the start switch and these conditions exist:

- Engine below idle
- Airplane in the air.

Damage Protection

The EEC can also stop the operation of the igniters if it senses one or more other these conditions:

- Hot start on the ground
- No-lightoff condition
- Start stall
- Ground start rollback overtemperature.

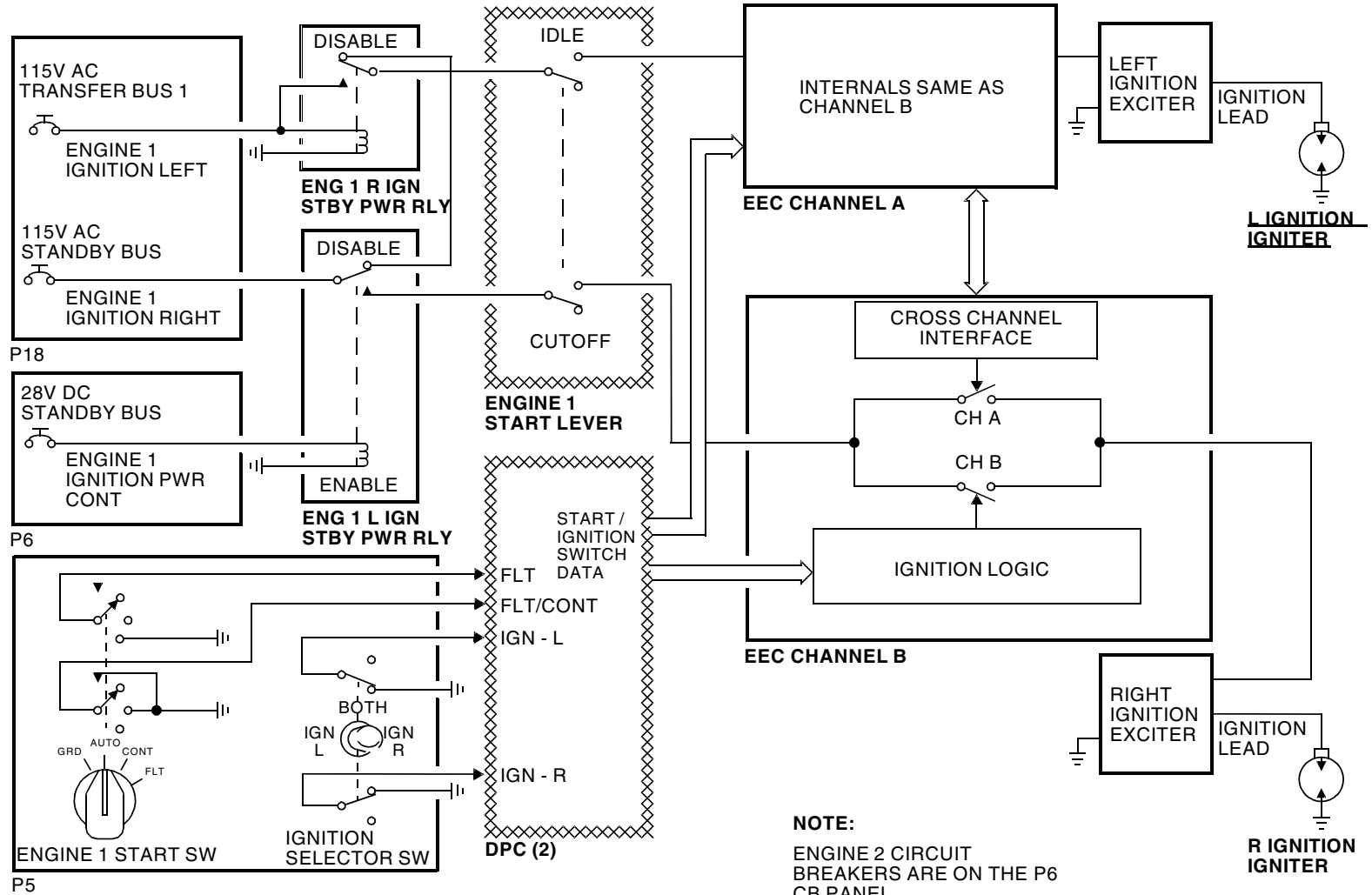
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IGNITION - FUNCTIONAL DESCRIPTION



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IGNITION - FUNCTIONAL DESCRIPTION

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IGNITION - OPERATION

General

These are the flight compartment controls you use to operate the engine ignition:

- Start lever
- Ignition selector switch
- Engine start switch.

Start Lever

The start lever controls ignition electrical power to the EECs. The EECs receives 115v ac power for ignition when the start lever is in the idle position.

Ignition Selector Switch

There are three ignition selector switch positions:

- IGN L (Left spark igniter)
- IGN R (right spark igniter)
- BOTH (both spark igniters).

Engine Start Switch

There are four engine start switch selection positions:

- GRD (ground start)
- OFF or AUTO
- CONT (continuous ignition)
- FLT (flight).

Engine Start Switch Position (GRD)

The engine starter engages and turns the engine when you move the engine start switch to the GRD position. The electronic engine controls (EECs) turn on ignition and fuel to the engine combustor after the appropriate delay time when you then move the start lever to the idle position.

The ignition selector switch tells the EECs which, or both igniters to use for ground start operation. Normal operation is for you to alternate igniters every ground start.

You use the GRD position to start the engine on the ground, or in the air if starter assist is necessary.

See the engine starting chapter for more information. (CHAPTER 80)

Engine Start Switch Position AUTO

Both igniters operate when the start switch is in the AUTO position with these conditions:

- Rejected takeoff
- Flameout or rollback
- Quick windmill relight engine start try (start lever cycled from idle to cutoff and back to idle)
- Rotating stall.

Engine Start Switch Position (CONT)

The flight crew may turn the engine start switch to the CONT position at these times:

- Takeoff
- Approach
- Landing
- Bad Weather.

The ignition igniter(s), as selected by the ignition selector switch, turn on and operate continuously.

Engine Start Switch Position (FLT)

The crew puts the engine start switch to the FLT position for an inflight windmill start. A windmill start does not use the starter.

Both ignition igniters operate continuously when the engine start switch is in the FLT position.

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IGNITION - OPERATION

IGNITION SELECTION	AIRPLANE CONDITION	IGNITER OPERATION
ENGINE START 1 2	ENGINE 1 RIGHT IGNITER SELECTION	LEFT IGNITER RIGHT IGNITER
ENGINE START 1 2	ENGINE 1 & 2 CRUISE, NO IGNITION (UNLESS FLAMEOUT)	LEFT IGNITER RIGHT IGNITER
ENGINE START 1 2	ENGINE 1 & 2 LEFT IGNITER SELECTION	LEFT IGNITER RIGHT IGNITER
ENGINE START 1 2	ENGINE 1 & 2 FLIGHT, BOTH IGNITERS OPERATE	LEFT IGNITER RIGHT IGNITER

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IGNITION - OPERATION

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