

# Challenger Global 300 - Fire Protection

## INTRODUCTION

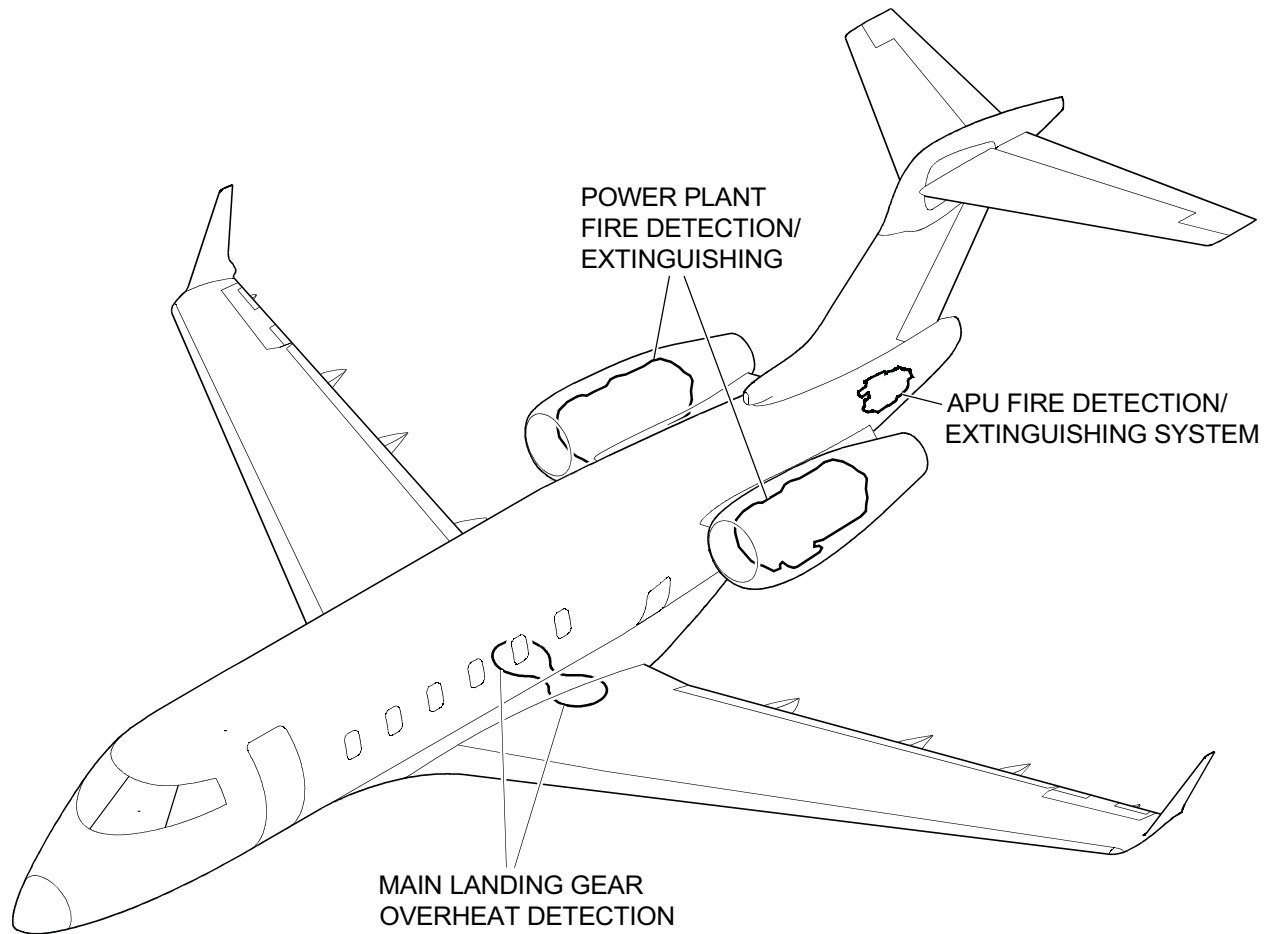
The fire protection system is divided into two subsystems:

- Fire detection
- Fire extinguishing

The fire detection system detects fire in the engines and APU and overheat detection in the main landing gear bays.

The fire extinguishing system provides extinguishing capability for the engines and APU.

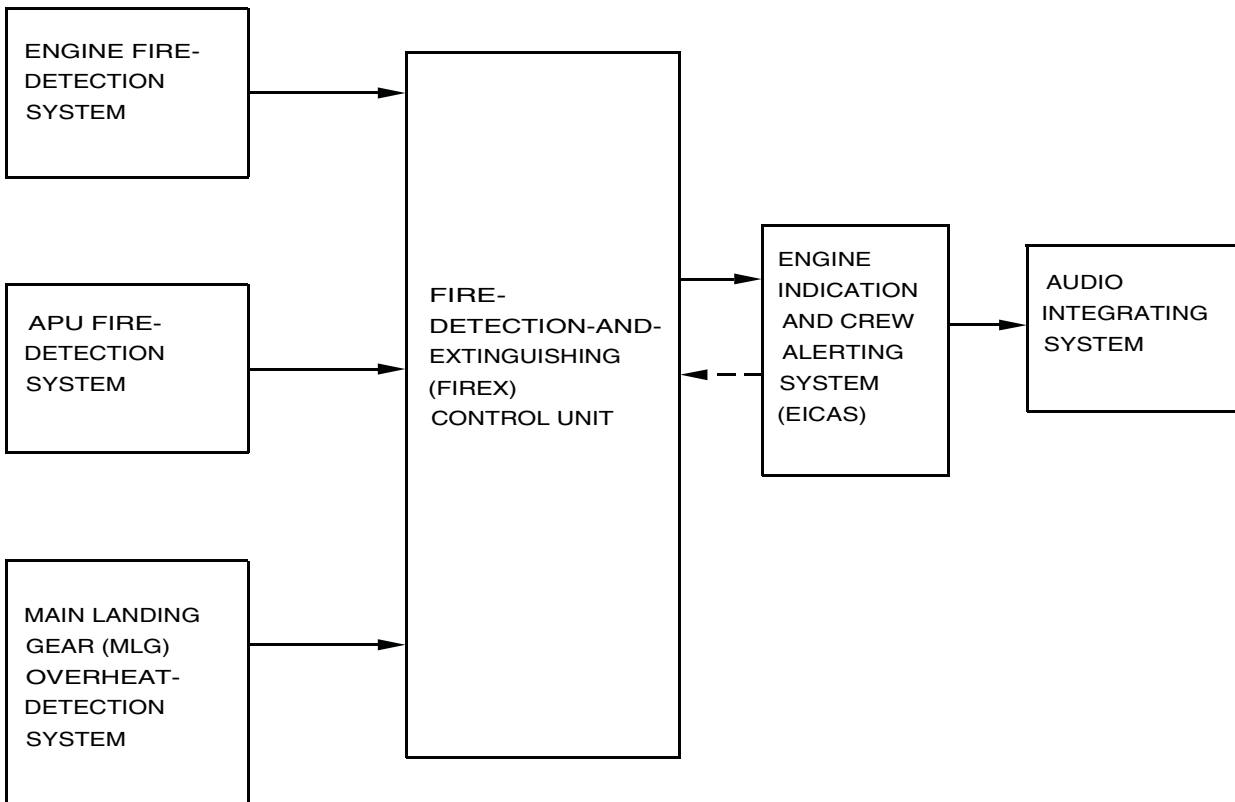
The detection and extinguishing systems are tested and monitored from the flight deck.



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INTRODUCTION (Cont)

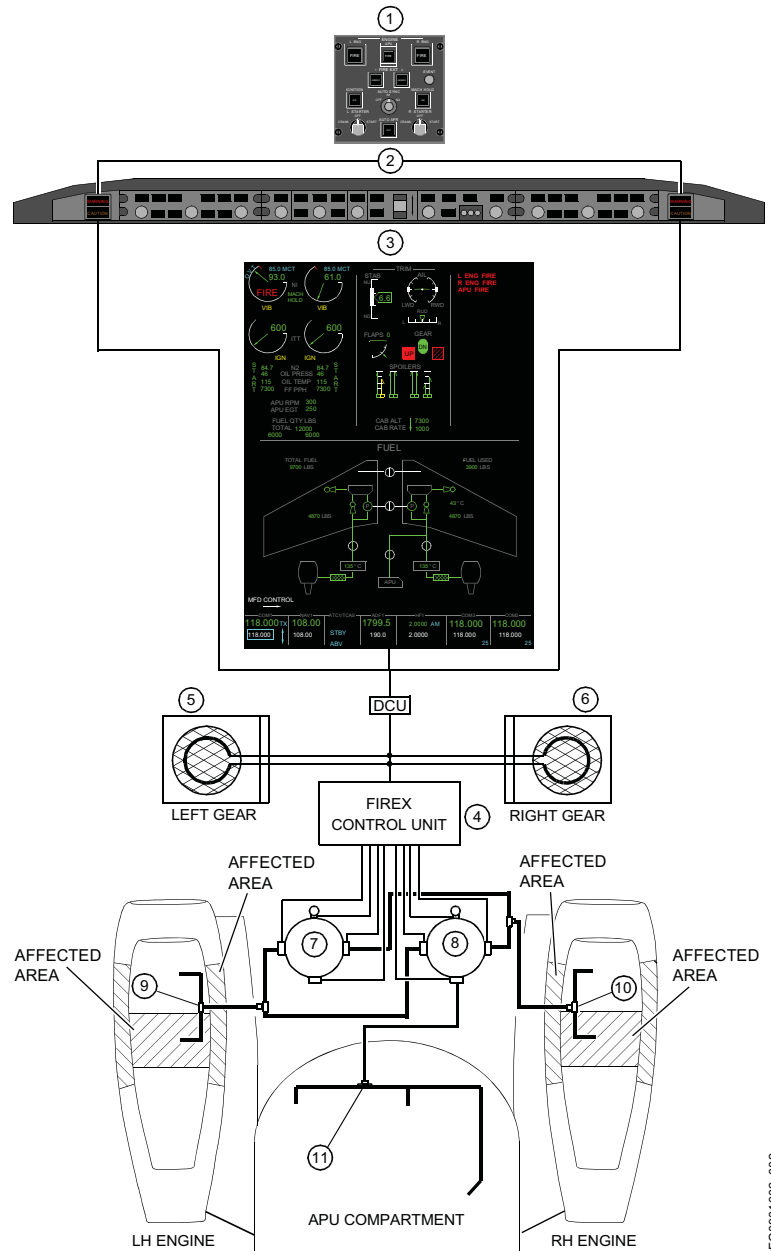
FIRE DETECTION SYSTEM — BLOCK DIAGRAM



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## FIRE PROTECTION SYSTEM OVERVIEW SCHEMATIC

1. ENGINE Panel.
2. Master WARNING/CAUTION LIGHTS.
3. Left MFD EICAS display.
4. FIREX Control Unit.
5. Left Main Wheel Well Overheat Detection.
6. Right Main Wheel Well Overheat Detection.
7. Fire Extinguisher Bottle No. 1.
8. Fire Extinguisher Bottle No. 2.
9. Left Engine Compartment Discharge Lines.
10. Right Engine Compartment Discharge Lines.
11. APU Compartment Discharge Lines.



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# Challenger Global 300 - Fire Protection

## ENGINE FIRE DETECTION

### DESCRIPTION

The engine fire detection system functions by detecting an overheat condition on the exterior of the engine.

If a fire is detected in the engine, the affected L or R ENG FIRE switch illuminates along with the master warning light, the master warning chimes, a L or R ENGINE FIRE (W) CAS message, a FIRE EI red in the N1 indicator, and the aural LEFT or RIGHT ENGINE FIRE.

The engine fire extinguishing system includes two bottles. If required, both bottles can be discharged into either engine.

### COMPONENTS AND OPERATION

#### DETECTION LOOPS

Each engine is installed with dual fire detection loops. The loops provide fire detection around the core engine area, engine accessory area, forward nacelle and pylon areas. The loops are connected to the fire detection and extinguishing control unit (FIREX-CU). The loops are constructed of an outer metal sheathing and two internal wires that are separated by an insulating material (thermistor). One of the wires carries electrical current; the other is grounded to the outer sheathing at the control unit. The resistance of the thermistor decreases with an increase in temperature.

When the electrical resistance decreases to a trip point, electrical current from the live internal wire conducts to the second internal wire and a fire indication is generated.

This loop system minimizes the possibility of false fire warnings. Both loops must sense the fire or overheat condition under similar parameters before flight deck fire indications are generated.

#### FIRE DETECTION AND EXTINGUISHING CONTROL UNIT

The fire detection and extinguishing control unit is the aircraft fire protection system electronic control unit that monitors the electrical resistance of the loops. The control unit is located in the aft equipment bay. When both loops experience the same decrease in resistance within a preset time, the control unit sends a fire signal to the EICAS. Each individual control circuit and its related sensing loop is monitored. If one loop malfunctions, the second loop can still detect a fire.

#### FIRE EXTINGUISHER BOTTLES

Two fire extinguisher bottles are installed in the aft equipment bay. Each are equipped with a pressure switch, pressure gauge, two discharge heads on the number 1 bottle, and three discharge heads on the number 2 bottle. Each squib has two firing bridgewires fed by separate electrical circuits and are installed on each fire bottle. The bottles are filled with Halon 1301.

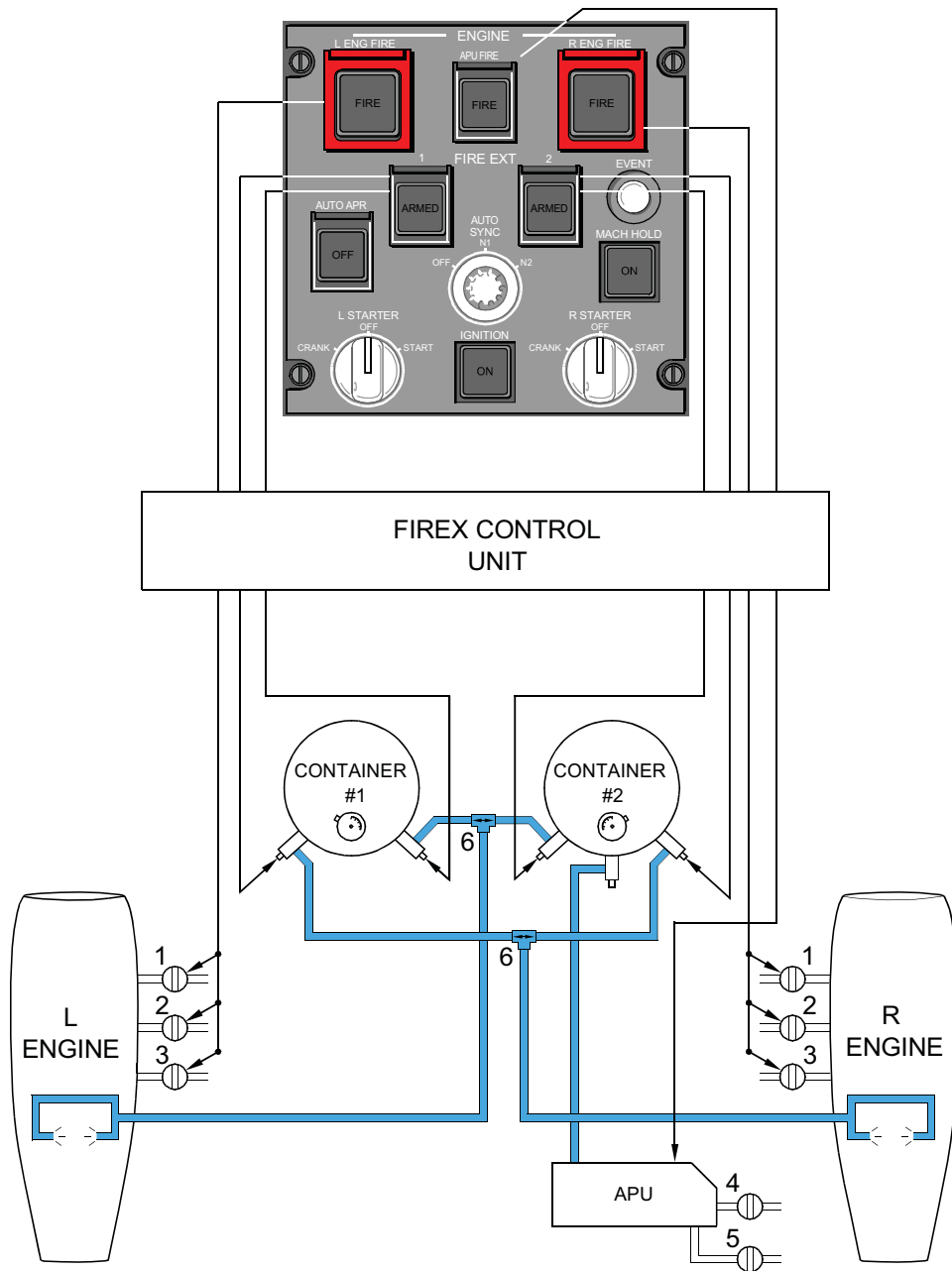
If required, both bottles can be discharged into one engine. The selection of the L or R ENG FIRE switch determines which squib is fired. Only bottle No. 2 can be discharged into the APU compartment.

Both fire extinguishers are installed outside the aircraft's pressure bulkhead in the aft equipment bay. For the left and right engines, a check tee is placed at the intersection between the plumbing from the two bottles and the common plumbing going to the fire zone. The check tee prevents extinguishing agent from the second discharged bottle from back filling into the bottle that was discharged first.

# Challenger Global 300 - Fire Protection

## ENGINE FIRE DETECTION (Cont)

### FIREX CONTROL UNIT SCHEMATIC



- 1- BLEED AIR VALVE
- 2- FUEL SHUTOFF VALVE
- 3- HYDRAULIC SHUTOFF VALVE
- 4- APU BLEED SHUTOFF VALVE
- 5- APU FUEL SHUTOFF VALVE
- 6- TWO WAY CHECK VALVE

**LEGEND**  
█ ENGINE DISCHARGE

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## ENGINE FIRE PROTECTION

### L (R) ENG FIRE SWITCHES

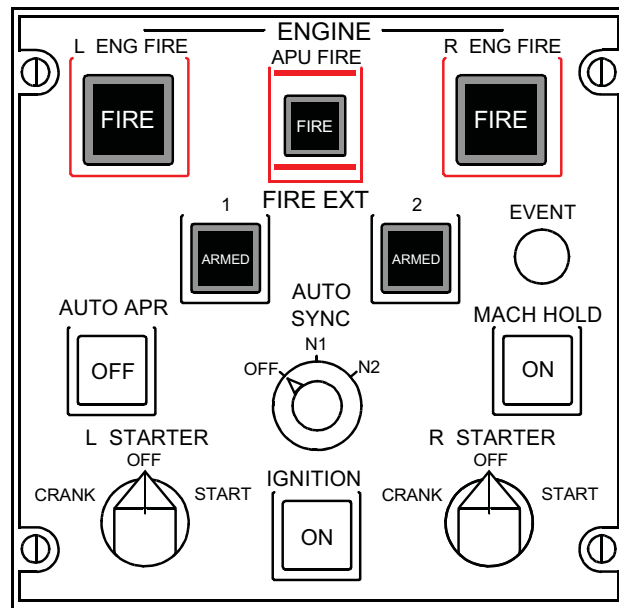
When the ENG FIRE switch is pressed:

- Applicable (left or right) squib on both bottles are armed and both EXT 1 and EXT 2 switches illuminate ARMED
- Fuel shutoff valve closes
- Bleed-air shutoff valves closes
- Hydraulic shutoff valve closes
- Generator is selected offline
- FADEC commands engine shutdown

### FIRE EXT 1 (2) SWITCHES

When the FIRE EXT 1 or FIRE EXT 2 switch is pressed, electrical current fires the squib in the associated bottle and pressurized Halon is directed into the engine fire zones. The selection of the L or R ENG FIRE switch determines which engine the bottles are discharged into the engine nacelle. During an engine fire, FIRE EXT 1 should always be depressed first, regardless of which engine has the fire. The APU compartment can only be extinguished by bottle No. 2. Therefore, if the fire is extinguished with the bottle No. 1, then bottle No. 2 remains for use on the other engine or the APU if needed.

After an extinguisher bottle is discharged, the ARMED light on the FIRE EXT switch extinguishes and the FIREX BTL 1 (2) LOW (A) CAS illuminates.



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### ENGINE FIRE PROTECTION (Cont)

#### FIREX BOTTLE PRESSURES

During checks on the FIREX bottles, the following pressure/temperature chart can be used to determine if bottle pressure is within acceptable limits for bottle temperature. The table provided applies to bottles with 4.3 lb agent.

<b>Minimum/Maximum FIREX Bottle Pressure (4.3 lb nominal weight)</b>		
	<b>Gage reading (psig)</b>	
<b>Temp °C</b>	<b>Minimum</b>	<b>Maximum</b>
-55	251	343
-50	277	354
-45	288	367
-40	302	380
-35	315	394
-30	330	410
-25	347	427
-20	365	445
-15	384	465
-10	404	486
-5	427	508
0	450	533
5	476	559
10	503	587
15	532	616
20	578	648
25	596	681
30	631	717
35	668	755
40	708	795
45	750	838
50	796	886
55	849	941
60	895	982
65	964	1096
70	1032	1165
75	1100	1235
80	1168	1305
85	1235	1375
90	1303	1445
95	1371	1515
100	1439	1585

## AUXILIARY POWER UNIT FIRE PROTECTION

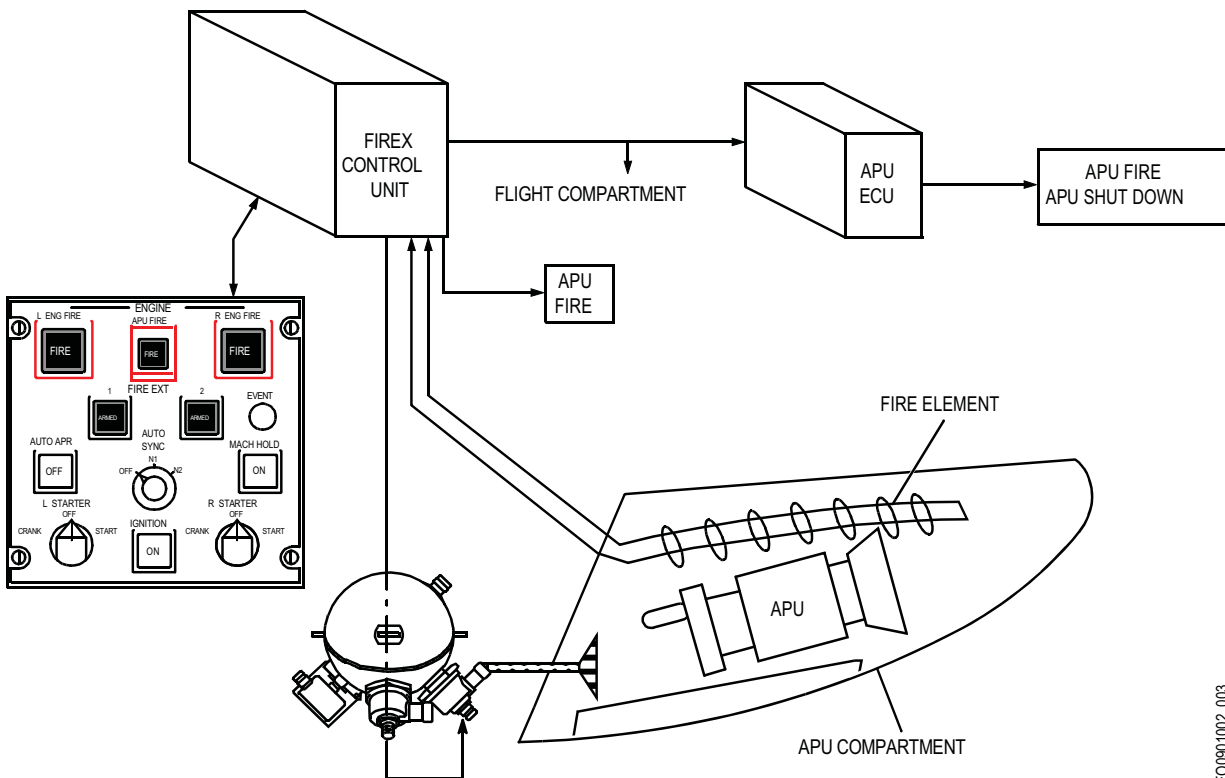
### DESCRIPTION

The auxiliary power unit (APU) fire detection system functions by detecting an overheat condition within the APU enclosure. An APU fire can only be extinguished from bottle No. 2.

The APU fire protection has a ground mode for unattended operation and a flight mode.

On the ground, when a condition is detected, the APU shuts down automatically. Five seconds later, the APU fire bottle automatically discharges Halon into the APU enclosure.

In flight, when a fire condition is detected and the APU FIRE switch is pushed, the APU shuts down and arms the discharge cartridge on the number 2 container. The flight crew must discharge the bottle by pushing the FIRE EXT 2 switch.



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### COMPONENTS AND OPERATION

#### DETECTION LOOPS

The APU enclosure is fitted with dual fire detection loops. The loops are connected to the fire detection and extinguishing control unit. The loops are constructed of an outer metal sheathing and two internal wires that are separated by an insulating material (thermistor). One of the wires carries electrical current, the other is grounded to the outer sheathing at the control unit. The resistance of the thermistor decreases with an increase in temperature.

When the electrical resistance decreases to a trip point, electrical current from the live internal wire conducts to the second internal wire and a fire indication is generated.

This dual loop system minimizes the possibility of false fire warnings. Both loops must sense the fire or overheat condition under exacting parameters before flight deck fire indications are generated.



## AUXILIARY POWER UNIT FIRE PROTECTION (Cont)

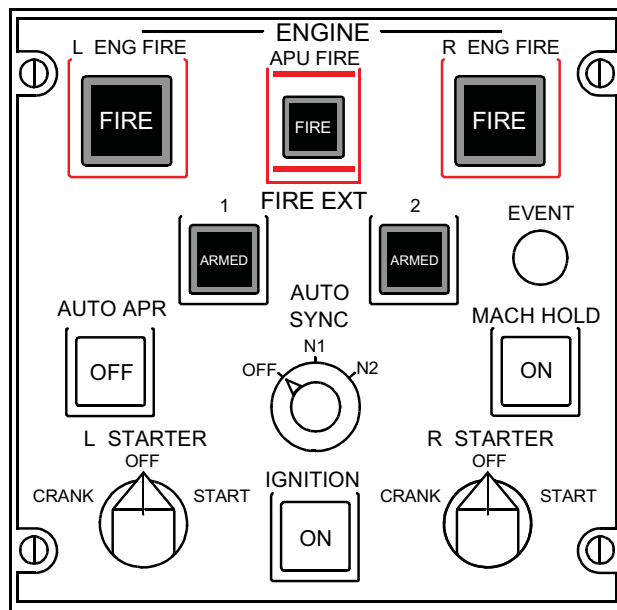
### FIRE EXTINGUISHER BOTTLE

Discharge of bottle 2 to the APU compartment is controlled exclusively by the cockpit APU FIRE switch during flight. Discharge to the APU on the ground can be commanded by either the cockpit switch or automatically by the FIREX-CU during APU unattended mode operation. For both the main powerplants and APU, two switches are required to discharge the extinguisher. The first switch is a guarded latching switch that shuts down and isolates the engine/APU and arms the corresponding discharge cartridges on the bottle(s). The second switch is a momentary switch that applies discharge current to the selected cartridge. A pressure switch, a pressure gauge and one explosive squib for the APU, is installed on the fire bottle. The bottle is filled with Halon 1301.

### APU FIRE SWITCH

If a fire is detected in the APU enclosure, the APU FIRE switch illuminates (along with the master warning light, the master warning chimes, an APU FIRE (W) CAS message, and the aural APU FIRE). When the APU FIRE switch is depressed:

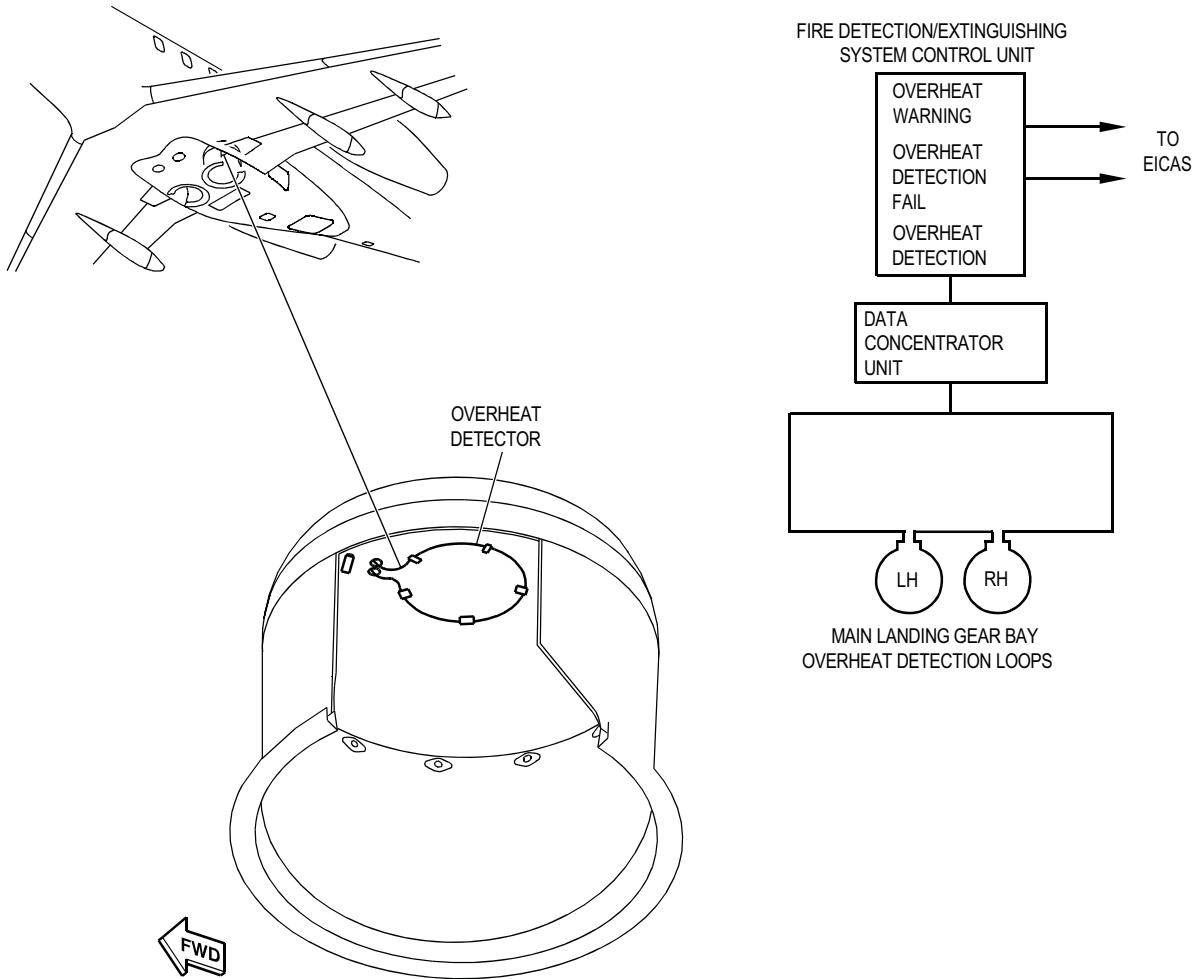
- Bottle 2 squib is armed and EXT 2 switch illuminates ARMED
- APU fuel shutoff valve closes
- APU electronic control unit closes the APU fuel metering valve
- APU bleed-air shutoff valves closes
- APU generator is selected offline



## MAIN LANDING GEAR OVERHEAT DETECTION

### DESCRIPTION

The Challenger 300 includes two main landing gear bays (MLG), also referred to as main wheel wells. due to the possibility of brake or tire overheating during takeoff and the fact that the MLG bays are constructed from composite material, an overheat detection system has been installed as part of the aircraft's FIREX system.



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## MAIN LANDING GEAR OVERHEAT DETECTION (Cont)

### COMPONENTS AND OPERATION

#### DETECTION LOOPS

The main landing gear bay is protected by a single overheat detection loop for each main landing gear bay and a dual channel overheat detection unit. Each overheat sensing loop is installed around the top of the inner surface of each main wheel bin.

The overheat detection loops are connected to the Fire Detection and Extinguishing control unit (FIREX-CU). The loops are constructed of an outer metal sheathing and two internal wires that are separated by an insulating material (thermistor). One of the wires carries electrical current, the other is grounded to the outer sheathing at the control unit. The resistance of the thermistor decreases with an increase in temperature.

When the electrical resistance decreases to a trip point, electrical current from the live internal wire conducts to the second internal wire and a fire indication is generated.

#### FIRE DETECTION AND EXTINGUISHING CONTROL UNIT

The control unit monitors the electrical resistance of each single loop system. When the loop experiences a decrease in resistance over a preset time, the control unit sends an overheat signal to the Data Concentrator Unit (DCU), which routes them to the EICAS. When this occurs, the master warning lights illuminate, a triple chime sounds, and a GEAR BAY OVHT (W) CAS illuminates.

## CARGO BAY FIRE PROTECTION

### DESCRIPTION

A smoke detector is installed in the cargo bay. A fire in this area must be extinguished with a portable fire extinguisher. Refer to Chapter 8, *OXYGEN AND EMERGENCY EQUIPMENT* for information regarding portable fire extinguishers.

### COMPONENTS AND OPERATION

#### SMOKE DETECTORS

A single smoke detector is mounted on the ceiling of the cargo bay. If smoke is detected, the master warning lights illuminate, the master warning chime sounds, and a CARGO SMOKE (W) CAS message illuminates.

**NOTE:** Operation of mobile transceivers in close proximity to the smoke detectors or exhaust fumes from ground handling equipment may cause a false alarm.

## CONTROLS AND INDICATIONS

### SYSTEMS TEST

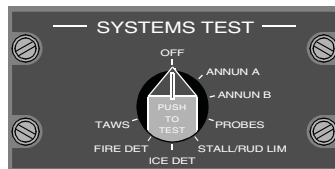
#### DESCRIPTION

FIRE DET test functions are available on the SYSTEMS TEST rotary switch located on the pedestal near the PARK/EMER brake handle.

The engine, APU and main landing gear bay, fire protection systems are continuously monitored by the fire detection and extinguishing system (FIREX) and no preflight test is required. However, these systems can be tested when desired or when directed by a flight manual procedure. When the SYSTEMS TEST switch is rotated to the FIRE DET position and then pressed, the following will occur:

- Warning (W) CAS messages illuminate:
  - L ENGINE FIRE
  - R ENGINE FIRE
  - APU FIRE
  - MLG BAY OVHT
- Control unit tests all detection and extinguishing components
- FIRE SYS IN TEST (S) CAS illuminates
- Both master warning lights flash
- Master warning chime sounds
- LEFT ENGINE FIRE, RIGHT ENGINE FIRE, or APU FIRE voice aural sounds repeatedly
- L ENG FIRE, R ENG FIRE, and APU FIRE switches illuminate
- FIRE EXT 1 and FIRE EXT 2 switches illuminate
- Upon satisfactory completion, a FIRE SYS TEST OK (S) CAS illuminates

If any component does not pass the test, the FIRE SYS TEST OK (S) CAS will not illuminate. A CAS message illuminates indicating which component failed. The test takes approximately 10 seconds to complete.



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## Challenger Global 300 - Fire Protection

### EICAS MESSAGES

The fire protection system CAS messages and voice aural are listed in the table below. A brief explanation of each message is provided.

MESSAGE	INHIBITS	MEANING	AURAL WARNING
<b>APU FIRE</b>		Fire has been detected in the APU compartment	
<b>L (R) ENGINE FIRE</b>		The L (R) ENGINE FIRE CAS, FIRE EI in the N1 indicator, FIRE indication in the L(R) ENG FIRE switch, or "LEFT (RIGHT) ENGINE FIRE" voice message indicates that the engine fire detection loop has activated. An engine fire is usually accompanied by other indications, such as: excessive ITT, erratic or rough engine operation, fluctuating engine indications, or smoke in the cabin.	"Left (Right) Engine Fire"
<b>CARGO SMOKE</b>		Smoke has been detected in the cargo (baggage) area	
<b>GEAR BAY OVHT</b>	TO/LAND	An overheat condition has been detected in the main landing gear bays	
<b>APU FIRE DET FAIL</b>	TO/LAND	An APU fire detection system has detected a failure that will not allow the detection system to indicate a fire	
<b>CARGO SMOKE DET FAIL</b>	TO/LAND	The cargo smoke detection system has failed	
<b>L (R) FIRE DET FAIL</b>	TO/LAND	The engine fire detection system has failed	
<b>FIRE SYS FAULT</b>	TO/LAND	The fire detection and extinguishing system has detected a fault	
<b>FIREX APU SQUIB FAIL</b>	TO/LAND	APU fire extinguisher squib on bottle #2 has failed (NO low pressure indication)	
<b>GEAR BAY DET FAIL</b>	TO/LAND	The gear bay overheat detection has failed	
<b>FIRE SYS FAULT</b>	TO/LAND	The FIREX control unit has detected a fault	
<b>FIREX BTL 1 (2) FAULT</b>	TO/LAND	The respective bottle squib for the left or right engine has failed	
<b>FIREX BTL 1 (2) LOW</b>	TO/LAND	The respective bottle pressure is low	
<b>FIRE SYS IN TEST</b>		The fire detect test system is conducting the manually activated system test	
<b>FIRE SYS TEST OK</b>		The fire detect test system has passed the system test	