



CHAPTER 10 – FIRE PROTECTION

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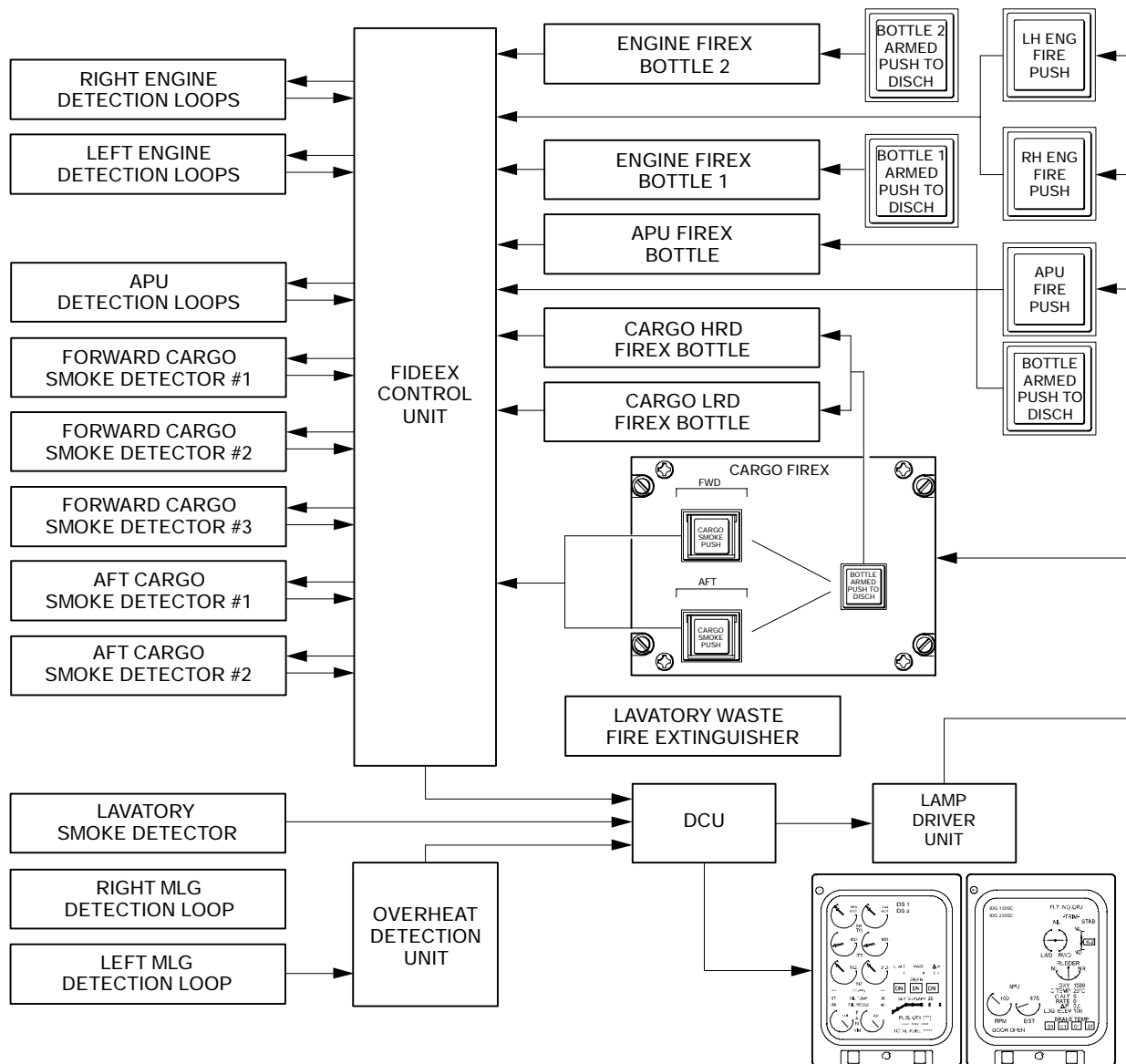
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1. INTRODUCTION

Fire protection consists of a fire detection and extinguishing (FIDEEX) system for detecting and extinguish a fire in the engine nacelles, the auxiliary power unit (APU) compartment and the forward and aft cargo compartments. An independent system is provided for fire detection and protection in the lavatories. A detection system is also provided for the main landing gear wheel wells.

Indications to alert the crew to fire, smoke and overheat conditions as well as fire protection system health are provided by the EICAS displays and panel lights.



FIDEEX System Block Diagram
Figure 10-10-1

	FIRE PROTECTION Fire Detection and Extinguishing (FIDEEX)		Vol. 1	10-20-1
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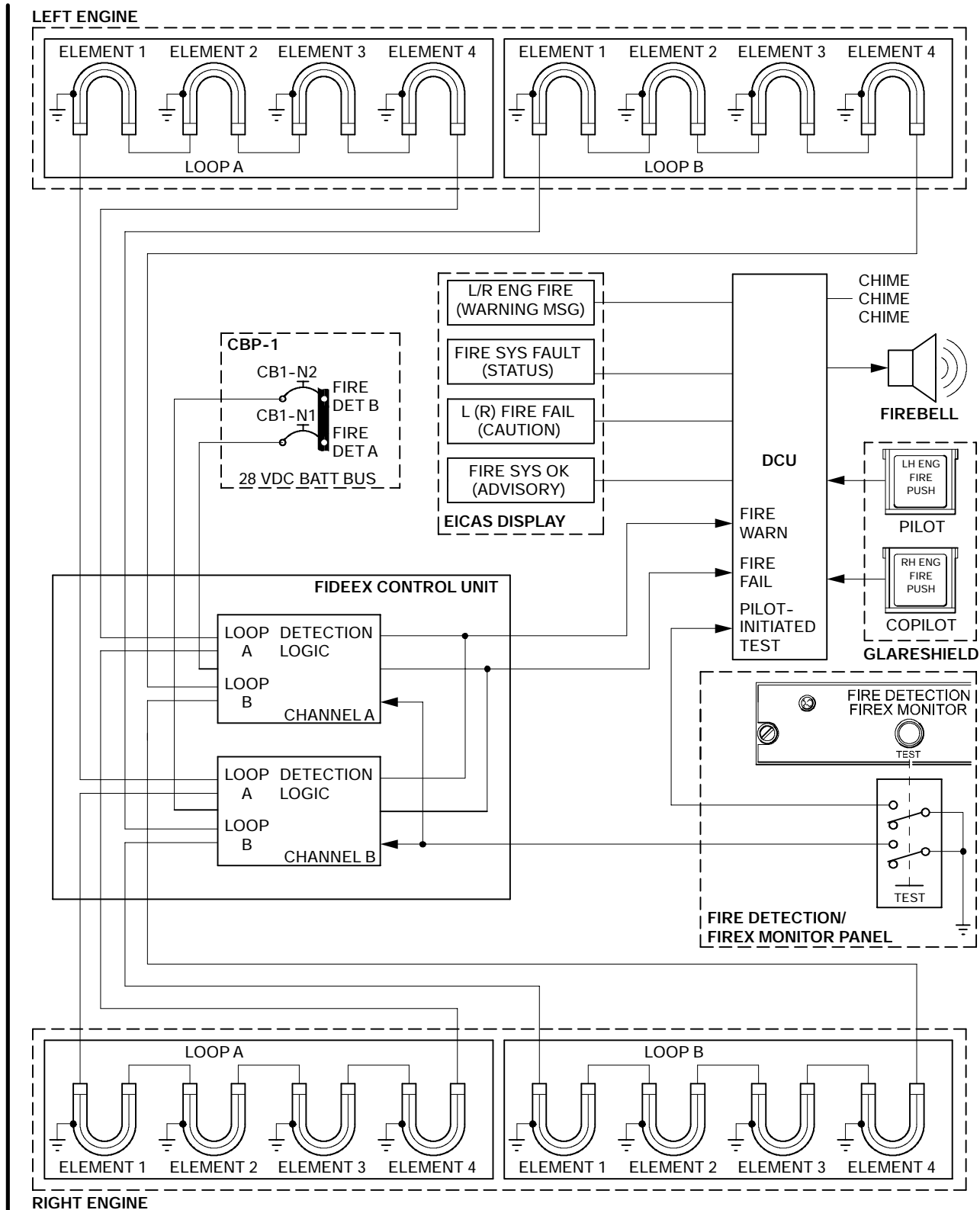
1. FIRE DETECTION AND EXTINGUISHING (FIDEEX)

The fire detection and extinguishing system (FIDEEX) interfaces with the engines, APU and cargo compartment fire protection systems. The FIDEEX uses the interfacing to provide fire detection, smoke detection, fire extinguishing and system indication. The L/R ENG FIRE PUSH and the 1/2 BOTTLE ARMED PUSH TO DISCH switchlights on the glareshield are used by the crew to supply control inputs to the FIDEEX system.

A. Engine

Detection

Engine fire detection is provided by dual heat sensitive detection loops arranged in parallel around the engine combustion section and exhaust pipe. Each loop is connected to the FIDEEX and is monitored continuously for fire or overheat conditions. In normal operation, both detection loops must detect a fire or overheat condition before a fire warning alarm is issued. If a short or open circuit fault is detected in one loop, the FIDEEX control unit will automatically switch to single loop detection and signal the EICAS to display a L/R FIRE FAIL caution message on the EICAS primary page.



Engine Fire Detection – Block Schematic
Figure 10-20-1

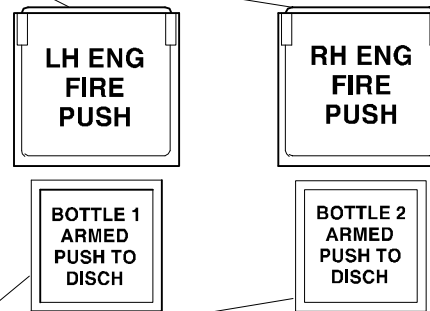
Extinguishing

The engine fire extinguishing system provides a means to extinguish fires in the left and right engines. The system consists of two FIREX bottles, located in the aft equipment compartment, a low pressure switch, a bottle pressure gauge and discharge lines. The bottles contain Halon and are pressurized to 600 psi. Each bottle has two firing cartridges (squibs) to permit discharge of the fire extinguishing agent into either engine nacelle. The pressure switches are connected to the FIDEEX, and if the bottle pressure decrease to a preset point, an ENG BTL 1 (2) LO caution message will be displayed on the EICAS primary page.

LH and RH ENG FIRE PUSH

Used to arm left or right squibs of both bottles. Closes engine fuel, bleed air and hydraulic shut-off valves.

- LH and RH ENG FIRE PUSH (red) light indicates that a fire is detected in respective engine.



BOTTLE 1 and 2 ARMED PUSH TO DISCH

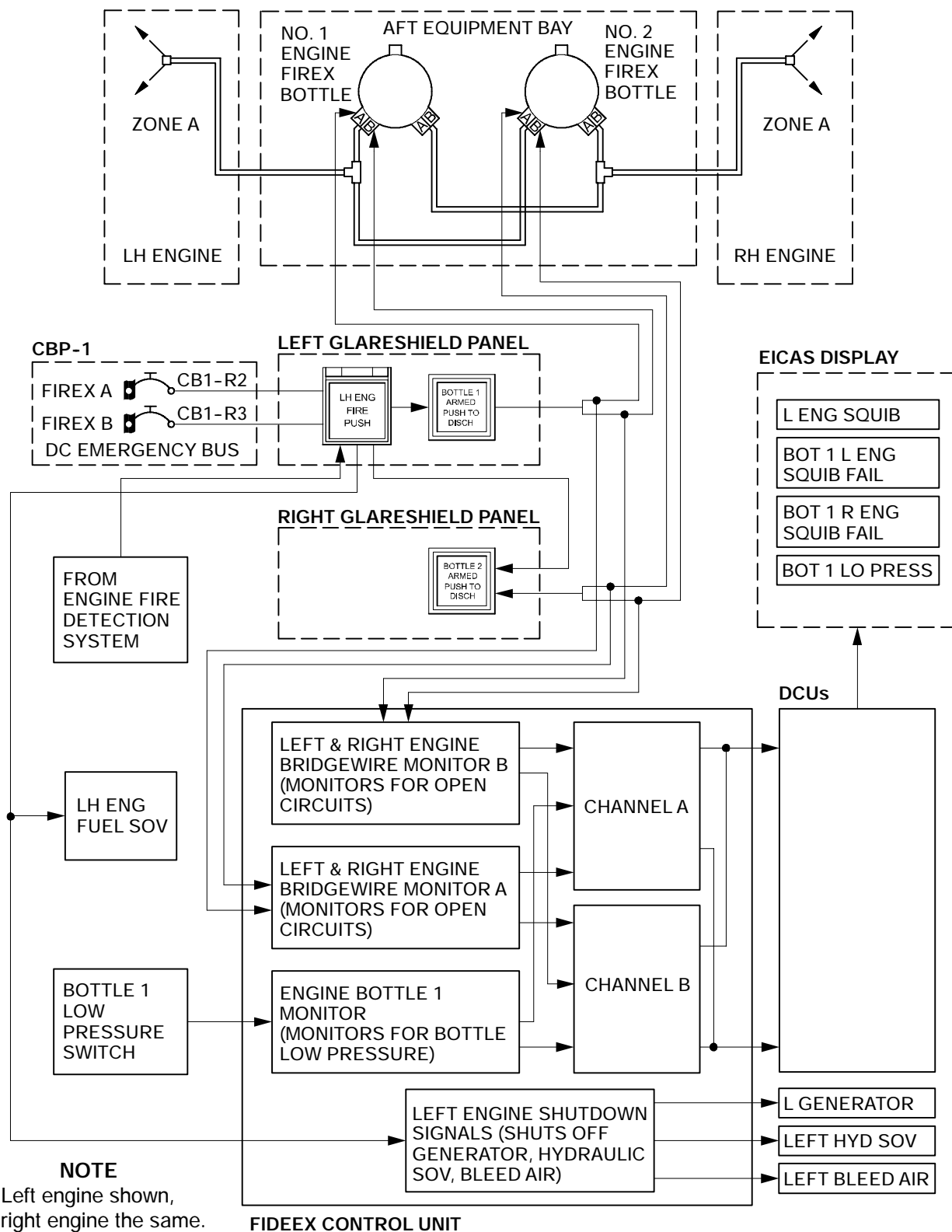
Used to discharge one bottle.

- BOTTLE 1 or 2 ARMED PUSH TO DISCH (green) light indicates respective squib is armed and bottle is charged.

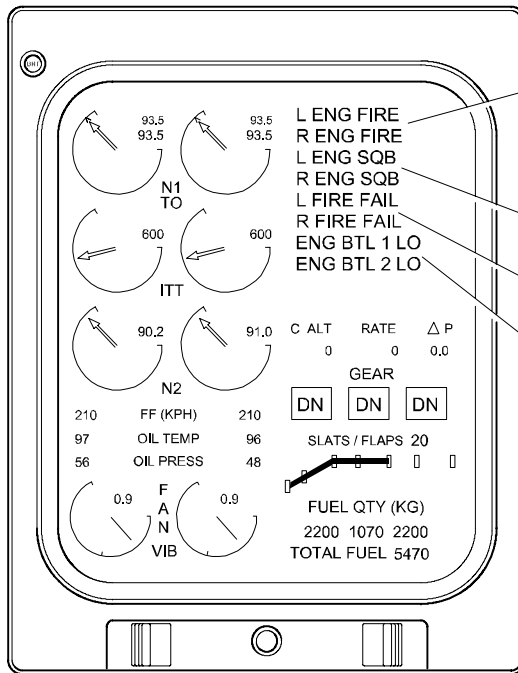
Left Glareshield

Right Glareshield

Fire Detection and Extinguishing (FIDEEX) – Engine Push Buttons
 Figure 10-20-2



Engine Fire Extinguishing – Schematic
Figure 10-20-3



Primary Page

L or R ENG FIRE warning (red)
Indicates that a fire exists in the left or right engine.



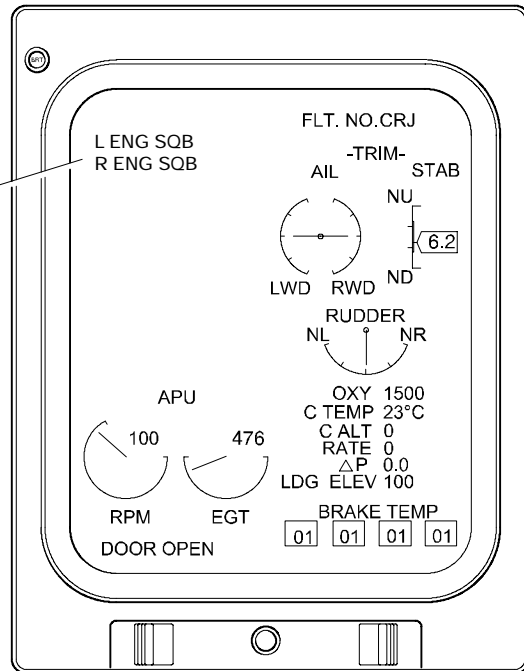
FIREBELL

L or R ENG SQB caution (amber)
Indicates that left or right squibs of both bottles have failed or have fired.

L or R FIRE FAIL caution (amber)
Indicates a failure of the respective engine detection system.

ENG BTL 1 or 2 LO caution (amber)
Indicates that respective bottle has discharged.

L or R ENG SQB status (white)
Indicates that one left or right squib has failed or has fired.



Status Page

Fire Detection and Extinguishing (FIDEEX) – EICAS Indications <1001>
Figure 10-20-4



FIRE PROTECTION
Fire Detection and Extinguishing (FIDEEX)

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ENGINE FIRE EXTINGUISHING

EVENT (Left engine fire procedure is described, the right engine fire procedure is similar)	RESULT	GLARESHIELD INDICATIONS			
		LH ENG FIRE PUSH	BOTTLE 1 ARMED PUSH TO DISCH	BOTTLE 2 ARMED PUSH TO DISCH	MASTER WARNING
1 Fire condition occurs in the left engine fire zone.	- Firebell sounds. - MASTER WARNING and LH FIRE PUSH switchlights come on.	ON	OUT	OUT	ON
2 MASTER WARNING switchlight is pressed in.	- Firebell is silenced. - MASTER WARNING switchlight goes out and the system is reset.	ON	OUT	OUT	OUT
3 Left thrust lever is set to the SHUTOFF position.	- LH ENG FIRE PUSH switchlight remains on.	ON	OUT	OUT	OUT
4 LH ENG FIRE PUSH switchlight is pressed in.	- BOTTLE 1 ARMED PUSH TO DISCH switchlight comes on. - BOTTLE 2 ARMED PUSH TO DISCH switchlight comes on. - Left squibs of bottles 1 and 2 are armed. - Left engine fuel SOV closes. - Left bleed air SOV closes. - Left hydraulic SOV closes.	ON	ON	ON	OUT
5 BOTTLE 1 ARMED PUSH TO DISCH switchlight is pressed in.	- Left squib on bottle 1 fires. - FIREX agent from bottle 1 discharges into left power plant nacelle.	ON	ON	ON	OUT
6 Bottle 1 fully discharges.	- The pressure switch on bottle 1 opens as pressure drops below the set point. - ENG BTL 1 LO is displayed on the EICAS.	ON	OUT	ON	OUT
7 Fire condition in left engine persists.	- LH ENG FIRE PUSH switchlight remains on.	ON	OUT	ON	OUT



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Fire Detection and Extinguishing (FIDEEX)

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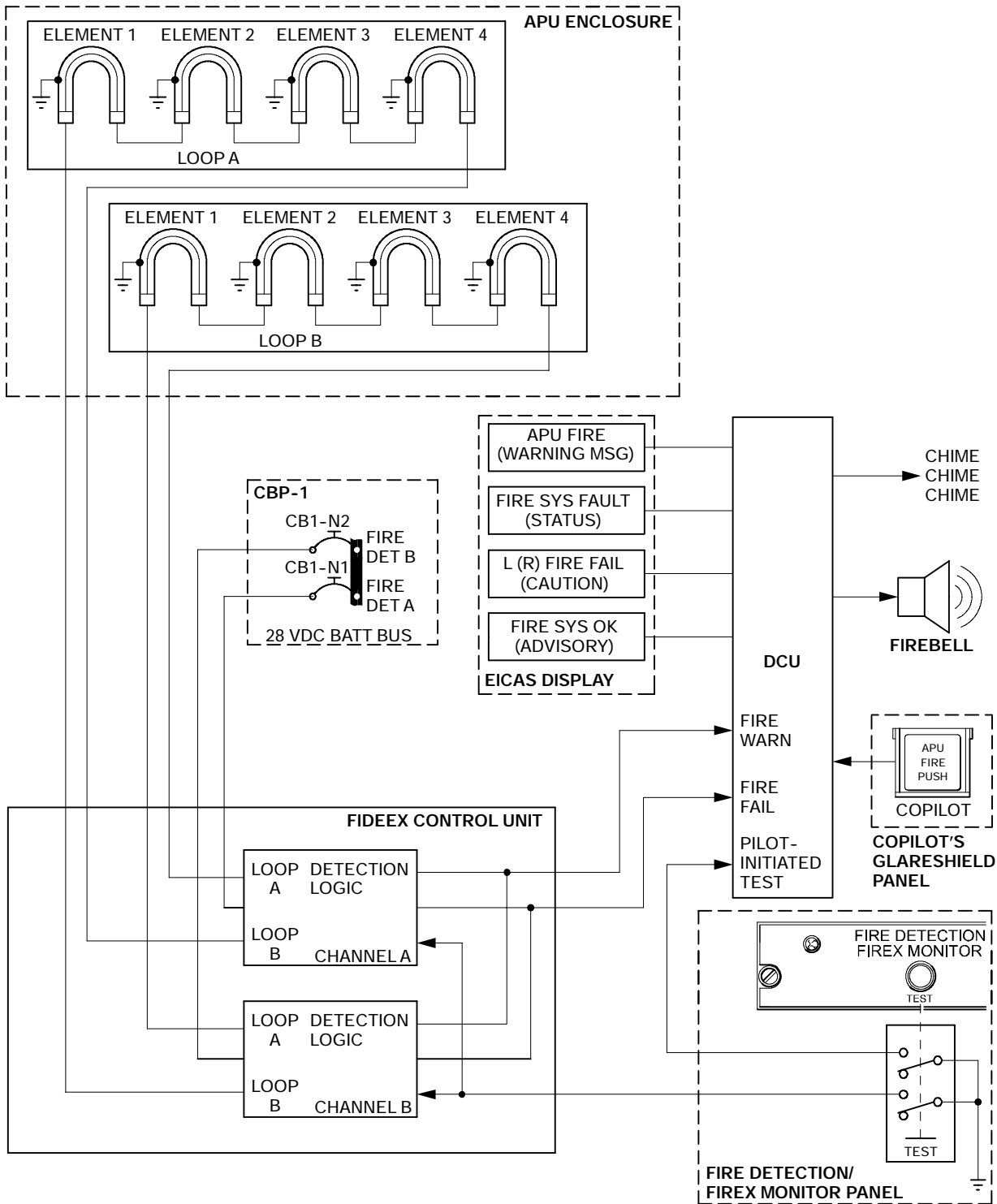
ENGINE FIRE EXTINGUISHING

8	BOTTLE 2 ARMED PUSH TO DISCH switchlight is pressed in.	<ul style="list-style-type: none"> - Left squib on bottle 2 fires. - FIREX agent from bottle 2 discharges into left engine nacelle. 	ON	OUT	ON	OUT
9	Bottle 2 fully discharges.	<ul style="list-style-type: none"> - The pressure switch on bottle 2 opens as pressure drops below the set point. - ENG BTL 2 LO is displayed on EICAS. 	OUT	OUT	OUT	OUT

B. APU

Detection

The APU fire detection system is used to detect a fire or overheat condition in the APU enclosure. The detection system consists of dual heat sensitive detection loops arranged in parallel around the APU and the forward APU firewall and above the two APU compartment doors. Each loop is connected to the FIDEEX and is monitored continuously for fire or overheat conditions. In normal operation, both detection loops must detect a fire or overheat condition before a fire warning alarm is issued. If a short or open circuit fault is detected in one loop, the FIDEEX control unit will automatically switch to single loop detection and signal the EICAS to display a APU FIRE FAIL caution message on the EICAS primary page.



APU Fire Detection – Block Schematic
Figure 10-20-5

Extinguishing

The APU fire extinguishing system provides a means to extinguish fires in the APU enclosure. The system consists of a single FIREX bottle, located in the aft equipment compartment, a low pressure switch, a bottle pressure gauge and discharge lines. The bottle contain Halon and is pressurized to 600 psi. The bottle has a single firing cartridge (squib) to permit discharge of the fire extinguishing agent into APU enclosure. The pressure switch is connected to the FIDEEX, and if the bottle pressure decreases to a preset point, an APU BTL LO caution message will be displayed on the EICAS primary page.

APU FIRE PUSH

Used to arm APU bottle squib.
 Closes APU bleed air load control valve and turns off the APU fuel pump.

- APU FIRE PUSH (red) light indicates that a fire is detected in the APU compartment.

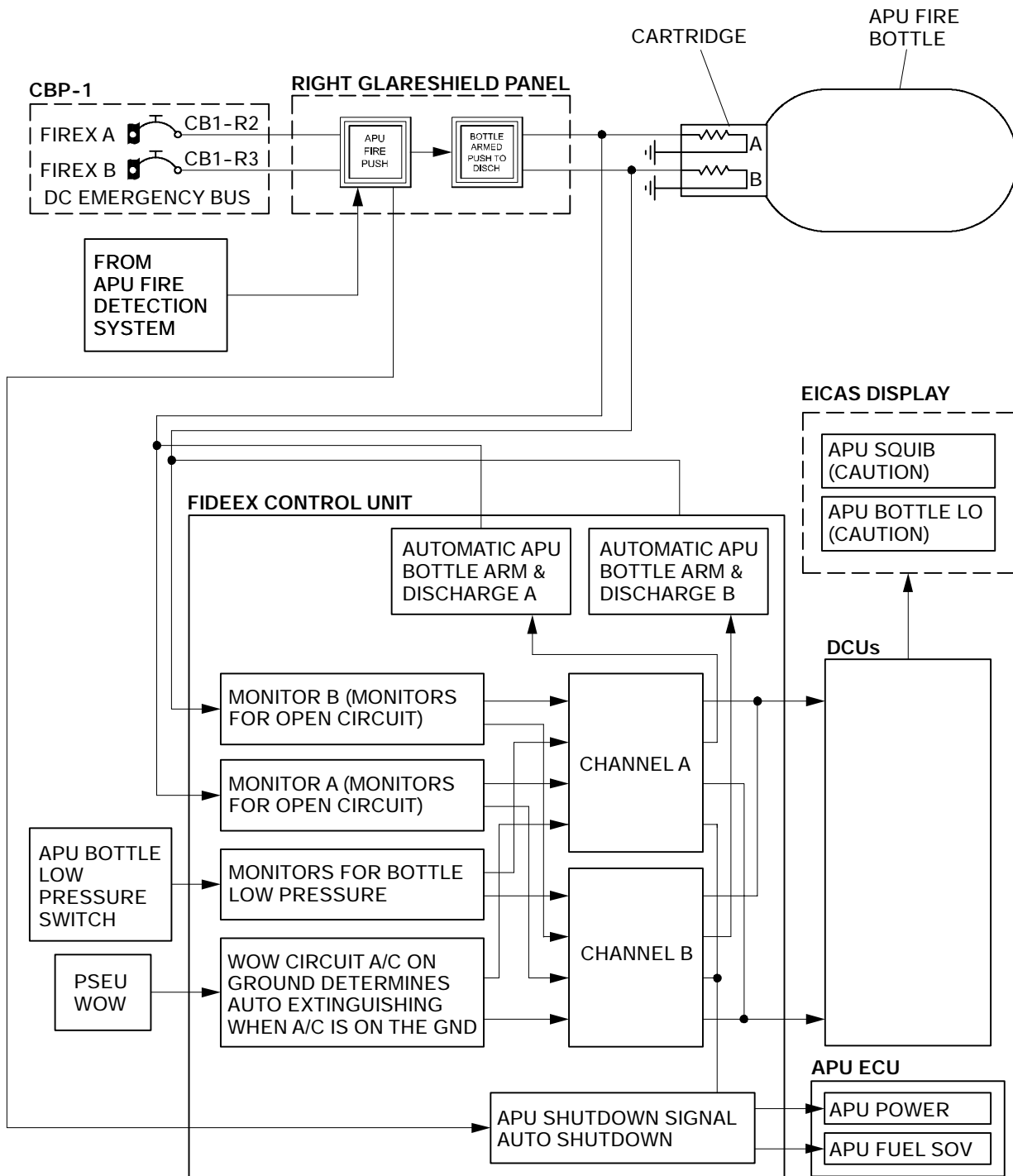


Right Glareshield

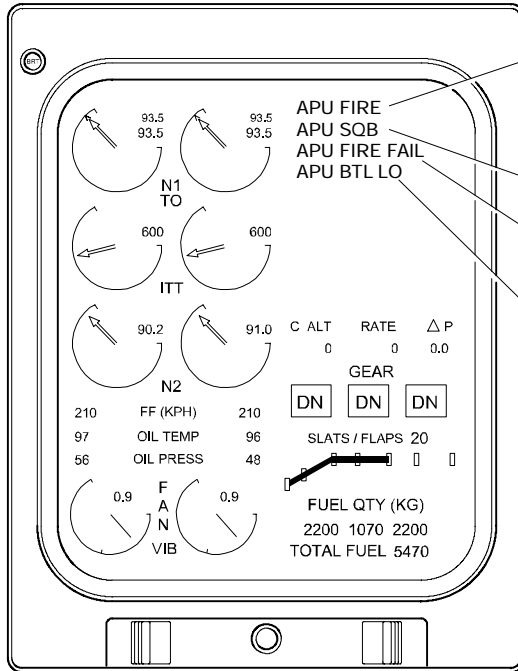
BOTTLE ARMED PUSH TO DISCH

Used to discharge APU bottle.
 • BOTTLE ARMED PUSH TO DISCH (green) light indicates the squib is armed and the bottle is charged.

Fire Detection and Extinguishing (FIDEEX) – APU Pushbuttons
 Figure 10-20-6



APU Fire Extinguishing – Schematic
Figure 10-20-7



Primary Page

APU FIRE warning (red)
Indicates that a fire exists in the APU compartment.



APU SQB caution (amber)
Indicates that the APU bottle squib has failed or has fired.

APU FIRE FAIL caution (amber)
Indicates a failure of the APU detection system.

APU BTL LO caution (amber)
Indicates that APU bottle has discharged.

Fire Detection and Extinguishing (FIDEEX) – APU EICAS Indications <1001>
Figure 10-20-8



APU FIRE EXTINGUISHING

EVENT	RESULT	GLARESHIELD INDICATIONS		
		APU FIRE PUSH	BOTTLE ARMED PUSH TO DISCH	MASTER WARNING
1 Fire condition occurs in APU fire zone.	<ul style="list-style-type: none"> - Firebell sounds. - MASTER WARNING and APU FIRE PUSH lights come on. - Emergency shut down is automatically initiated. If airplane is on the ground: <ul style="list-style-type: none"> - APU bottle automatically discharges after 5 seconds. 	ON	OUT	ON
2 MASTER WARNING is pressed in.	<ul style="list-style-type: none"> - Firebell is silenced. - MASTER WARNING light goes out and system is reset. 	ON	OUT	OUT
3 APU FIRE PUSH is pressed in.	<ul style="list-style-type: none"> - BOTTLE ARMED PUSH TO DISCH light comes on. - APU squibs are armed. - APU fuel SOV closes. - APU bleed air LCV closes. 	ON	ON	OUT
4 BOTTLE ARMED PUSH TO DISCH is pressed in.	<ul style="list-style-type: none"> - APU squib fires. - FIREX agent discharges into APU compartment. 	ON	ON	OUT
5 APU bottle fully discharges.	<ul style="list-style-type: none"> - Pressure switch on bottle opens as pressure drops below set level. - APU BTL LO is displayed on EICAS. 	OUT	OUT	OUT

C. Cargo Compartment

The cargo smoke detection system provides smoke detection in the forward and aft cargo compartments using optical type smoke detectors. Three detectors are located in the ceiling of the forward cargo compartment and two in the ceiling of the aft cargo compartment. All the smoke detector are protected from damage by a steel cage. Each detector is capable of producing an alarm within an established time frame and smoke concentration level. The detectors are positioned to avoid false alarms with overlapping coverage to guard against the failure of one detector.

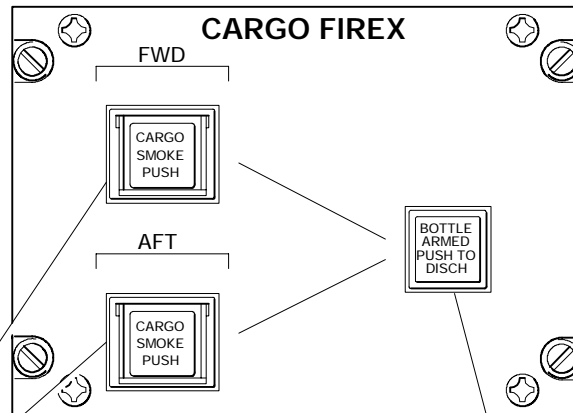
The FIDEEX control unit monitors the cargo bay smoke detectors. Normally, two detectors must detect smoke to issue a cargo compartment smoke warning. If there is only one serviceable detector within a compartment, the FIDEEX will automatically switch to single smoke detector operation. In the event of a detector fault, a signal will be sent by the FIDEEX control unit to the to the EICAS to display a FIRE SYS FAULT caution message on the EICAS primary page.

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NOTE

Operation of mobile transceivers in close proximity to the smoke detectors may cause a false alarm.

Fire suppression for the forward and aft cargo compartments is provided by a high rate discharge FIREX bottle and a low rate discharge FIREX bottle. Both bottles are located inside the right belly fairing, aft of the main landing gear, and are pressurized to 360 psi with Halon. Each bottle has a forward and aft compartment firing cartridge (squib), used to discharge the extinguishing agent into either compartment. Each bottle has a low pressure switch and a pressure gauge. Both bottles discharge simultaneously. The high rate discharge bottle is designed to quickly deliver extinguishing agent into the cargo compartment for initial fire suppression. The low rate discharge bottle discharges slowly, maintaining a flow of extinguishing agent into the cargo compartment (over a 60 minute period) to prevent reignition and allow for aircraft diversion. The pressure switches are connected to the FIDEEX, and if either bottle pressure decrease to a preset point, an CARGO BTL LO caution message will be displayed on the EICAS primary page.



Cargo Firex Panel Center Pedestal

FWD and AFT CARGO SMOKE PUSH

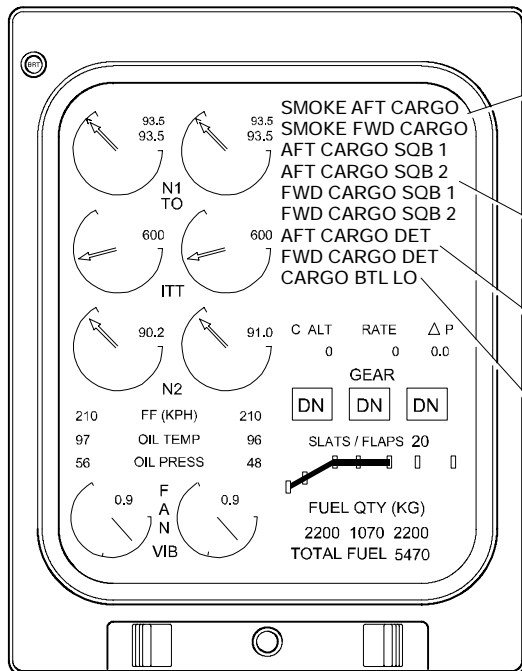
Used to arm the forward or aft squibs of both cargo bottles. AFT CARGO SMOKE PUSH closes the air-conditioning shut-off valve and turns the heater off.

- CARGO SMOKE PUSH (red) light indicates that a smoke condition is detected in respective cargo compartment.

BOTTLE ARMED PUSH TO DISCH

Used to discharge both cargo bottles.

- BOTTLE ARMED PUSH TO DISCH (green) light indicates respective squibs are armed and bottles are charged.



Primary Page

SMOKE AFT or FWD CARGO warning (red)

Indicates that a smoke condition exists in the forward or aft cargo compartment.



AFT or FWD CARGO SQB 1 or 2 caution (amber)

Indicates that the forward or aft cargo bottle squib 1 or 2 has failed or has fired.

AFT or FWD CARGO DET caution (amber)

Indicates a failure of the forward or aft cargo detection system.

CARGO BTL LO caution (amber)

Indicates that one or both cargo bottle(s) have discharged.

Fire Detection and Extinguishing (FIDEEX) – Cargo Firex <1001>
Figure 10-20-9



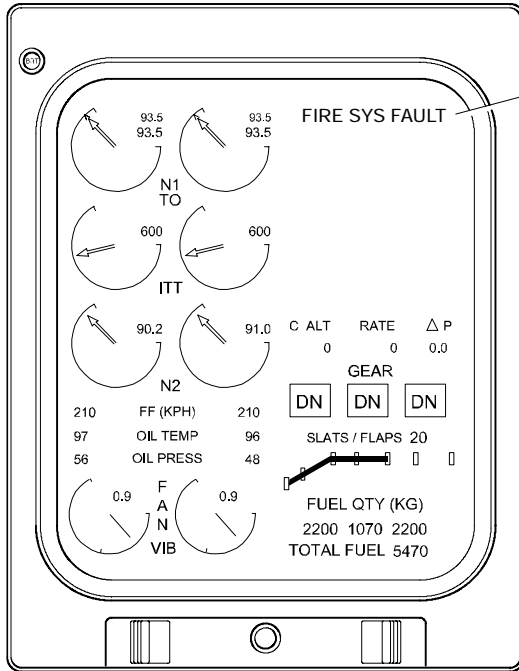
CARGO COMPARTMENT FIRE EXTINGUISHING					
EVENT (Aft described; forward similar)	RESULT	INDICATIONS			
		CARGO SMOKE PUSH	BOTTLE ARMED PUSH TO DISCH	MASTER WARN- ING	
1	Fire condition occurs in aft cargo compartment.	<ul style="list-style-type: none"> - "Smoke" aural is annunciated. - MASTER WARNING and AFT CARGO SMOKE PUSH lights come on. 	ON	OUT	ON
2	MASTER WARNING is pressed in.	<ul style="list-style-type: none"> - MASTER WARNING light goes out and system is reset. 	ON	OUT	OUT
3	AFT SMOKE CARGO PUSH is pressed in.	<ul style="list-style-type: none"> - BOTTLE ARMED PUSH TO DISCH light comes on. - Aft squibs of both bottles are armed. For aft cargo compartment: <ul style="list-style-type: none"> - Cargo bay heater shuts off. - Cargo air-conditioning shut-off valve closes. 	ON	ON	OUT
4	BOTTLE ARMED PUSH TO DISCH is pressed in.	<ul style="list-style-type: none"> - Aft squibs of both bottles fire. - FIREX agent discharges into aft cargo compartment. 	ON	ON	OUT
5	One bottle fully discharges.	<ul style="list-style-type: none"> - Pressure switch on one bottle opens as pressure drops below set level. - CARGO BTL LO is displayed on EICAS. - Remaining bottle continues to discharge for a minimum of 60 minutes. 	OUT	OUT	OUT

D. Testing

Testing is initiated using the TEST switch located on the Fire Detection / FIREX Monitor Panel, on the overhead panel. Test results are provided on the EICAS displays. The FIDEEX control unit monitors the fire protection systems by automatically performing periodic checks.



**Fire Detection/FIREX Monitor Panel
Overhead Panel**

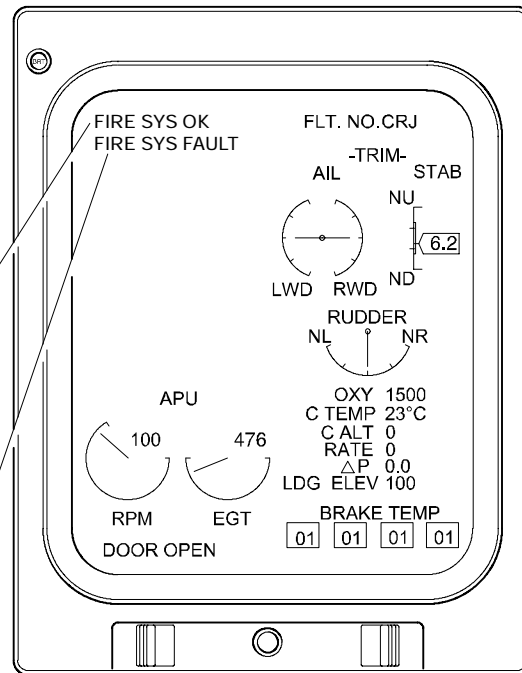


Primary Page

FIRE SYS OK advisory (green)
Indicates that FIDEEX system has been tested and is operational.

FIRE SYS FAULT status (white)
Indicates a loss of redundancy in the FIDEEX system.

FIRE SYS FAULT caution (amber)
Indicates loss of all ARINC communication to the FIDEEX system.



Status Page



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Fire Detection and Extinguishing (FIDEEX)

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E. System Circuit Breakers

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
FIDEEX	Cargo Smoke Detection	CARGO SMOKE DET A	BATTERY BUS	1	M8	
		CARGO SMOKE DET B			M9	
	Fire Detection	FIRE DET A			N1	
		FIRE DET B			N2	
	Fire Extinguishing	FIREX A	DC EMERGENCY		R2	
		FIREX B			R3	



FIRE PROTECTION
Fire Detection and Extinguishing (FIDEEX)

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1. LAVATORY FIRE PROTECTION

Lavatory fire detection and protection for each lavatory consists of a ceiling mounted smoke detector and a waste compartment fire extinguisher. <2202>

A. Detection

A smoke detector, in each lavatory, monitors for the presence of smoke. When the smoke density exceeds a preset level, the detector sounds an aural alarm and a SMOKE FWD (AFT) LAV warning message is displayed on the EICAS primary page. The lavatory smoke detector is not connected to or monitored by the FIDEEX control unit. <2202>

The smoke detectors can be tested by pressing the test button on the detector. During the test, an aural alarm sounds in the lavatory, the red alarm light on the detector comes on and a SMOKE FWD (AFT) LAV warning message is displayed on EICAS primary page. The system is reset by pressing the interrupt button on the detector. <2202>

NOTE

Operation of mobile transceivers in close proximity to the smoke detectors may cause a false alarm.

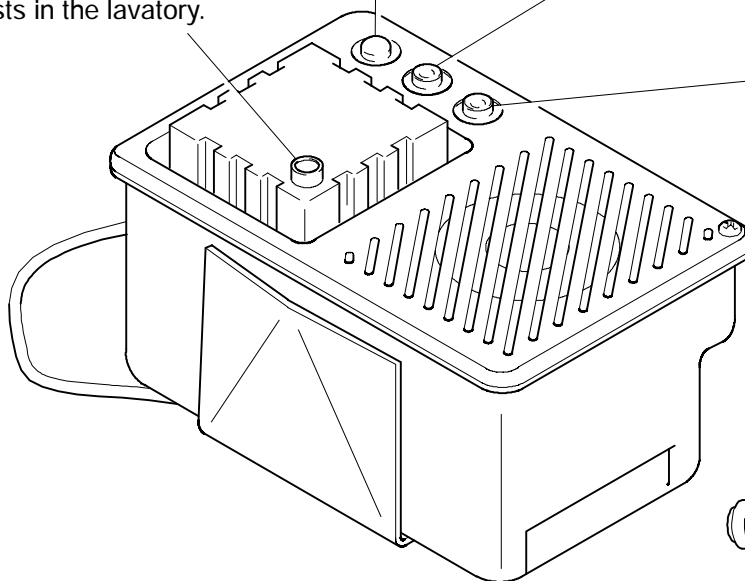
Alarm Light (red)
Comes on with the aural alarm to indicate that a smoke condition exists in the lavatory.

Power Light (green)
Comes on to indicate that the unit is powered.

Interrupt Pushbutton
Used to reset smoke detector.

Test Pushbutton
Used to test smoke detector. When pressed in:

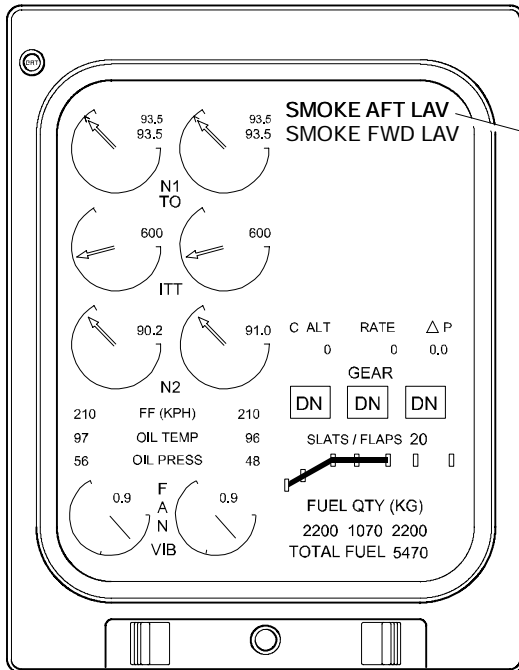
- Aural alarm comes on.
- Alarm light comes on.
- EICAS warning message is displayed.



700 and 2000 Hz tone

**Smoke Detector
Lavatory Ceiling**

Smoke Detector
Figure 10-30-1



SMOKE AFT or FWD LAV warning (red)
Indicates that a smoke condition exists in the lavatory.

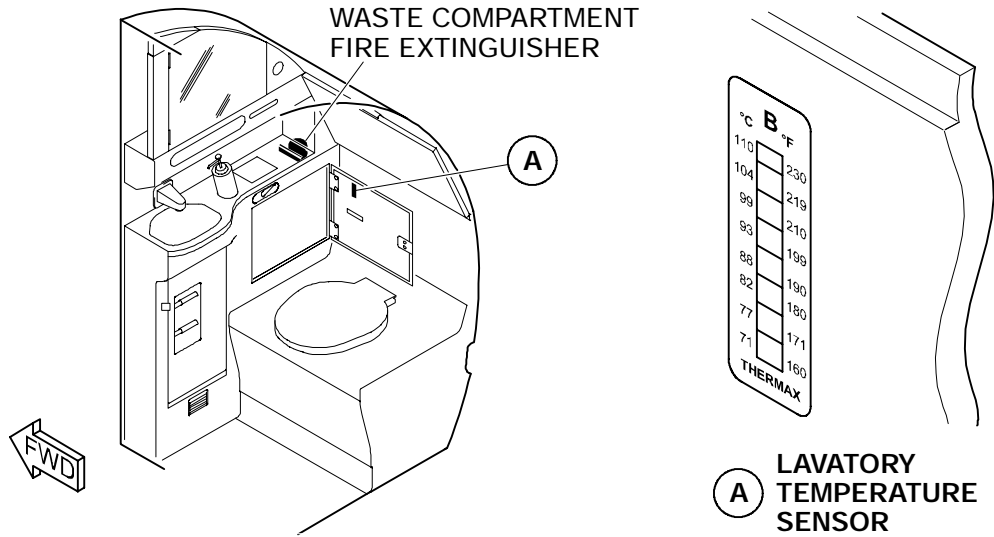
Primary Page

Smoke Detector EICAS Indications <1001,2202>
Figure 10-30-2

B. Extinguishing

Fire extinguishing in the lavatory waste paper towel container is done automatically. The system consists of a disposable extinguisher bottle and a dual discharge nozzle. The bottle is mounted near the waste container with the nozzles extending into the waste container. The end of each discharge nozzle is sealed with a heat sensitive capsule which, when subjected to heat, melts to release the extinguishing agent into the waste container.

A temperature sensor installed on the inside of the waste compartment door is used to provide evidence that high temperature has occurred in the waste compartment and that the extinguisher bottle may have discharged. The sensor is a heat sensitive strip with a temperature scale that turns black when the temperature in the compartment exceeds 160°F (71°C).



Lavatory Waste Compartment Extinguisher
Figure 10-30-3

C. System Circuit Breakers

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Lavatory	Smoke Detection	LAV SMOKE DET	DC BUS 1	1	D9	



**FIRE PROTECTION
Lavatory**

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1. MAIN LANDING GEAR OVERHEAT DETECTION

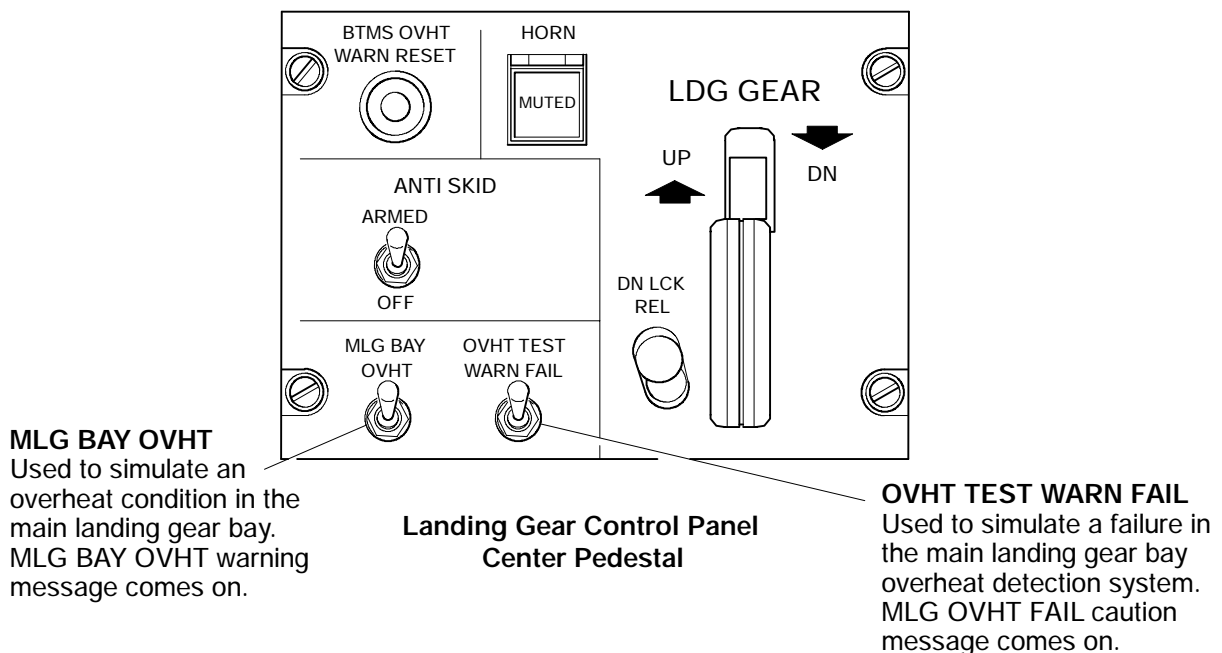
The main landing gear overheat detection system provides indication of overheat conditions in the main landing gear wheel wells that can be caused by overheated brakes or brake fires. The system consists of two overheat detection loops and an overheat detection unit.

The detection loops are installed around the top inner surface of each main wheel bin and are connected in series to the detection unit.

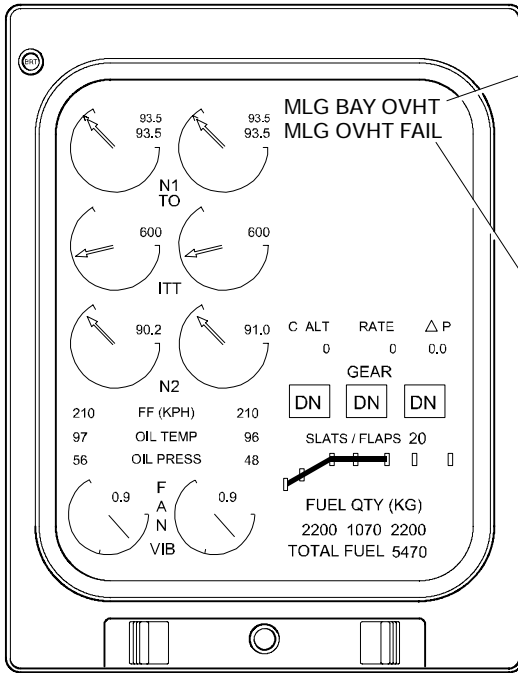
The overheat detection unit is located under the copilots side console. The unit continuously monitors the loops for overtemperature conditions and system faults. If an overheat condition is detected by the unit, in either wheel bin, a signal is sent to display a MLG BAY OVHT warning message on the EICAS primary page. If a system fault is detected by the unit, a signal is sent to display a MLG OVHT FAIL caution message on the EICAS primary page.

The warning of an overheat condition, alerts the pilot to immediately lower the landing gear to reduce the landing gear temperature. The warning message will persist until the temperature in the wheel bin returns to normal limits.

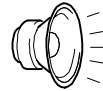
The main landing gear overheat detection system may be tested, from the landing gear control panel, by simulating an overheat condition or a system fault condition. The EICAS will display the applicable warning or caution message during the test.



Landing Gear Control Panel
Figure 10-40-1



MLG BAY OVHT warning (red)
Indicates that an overheat condition exists in one or both of the main landing gear bays.

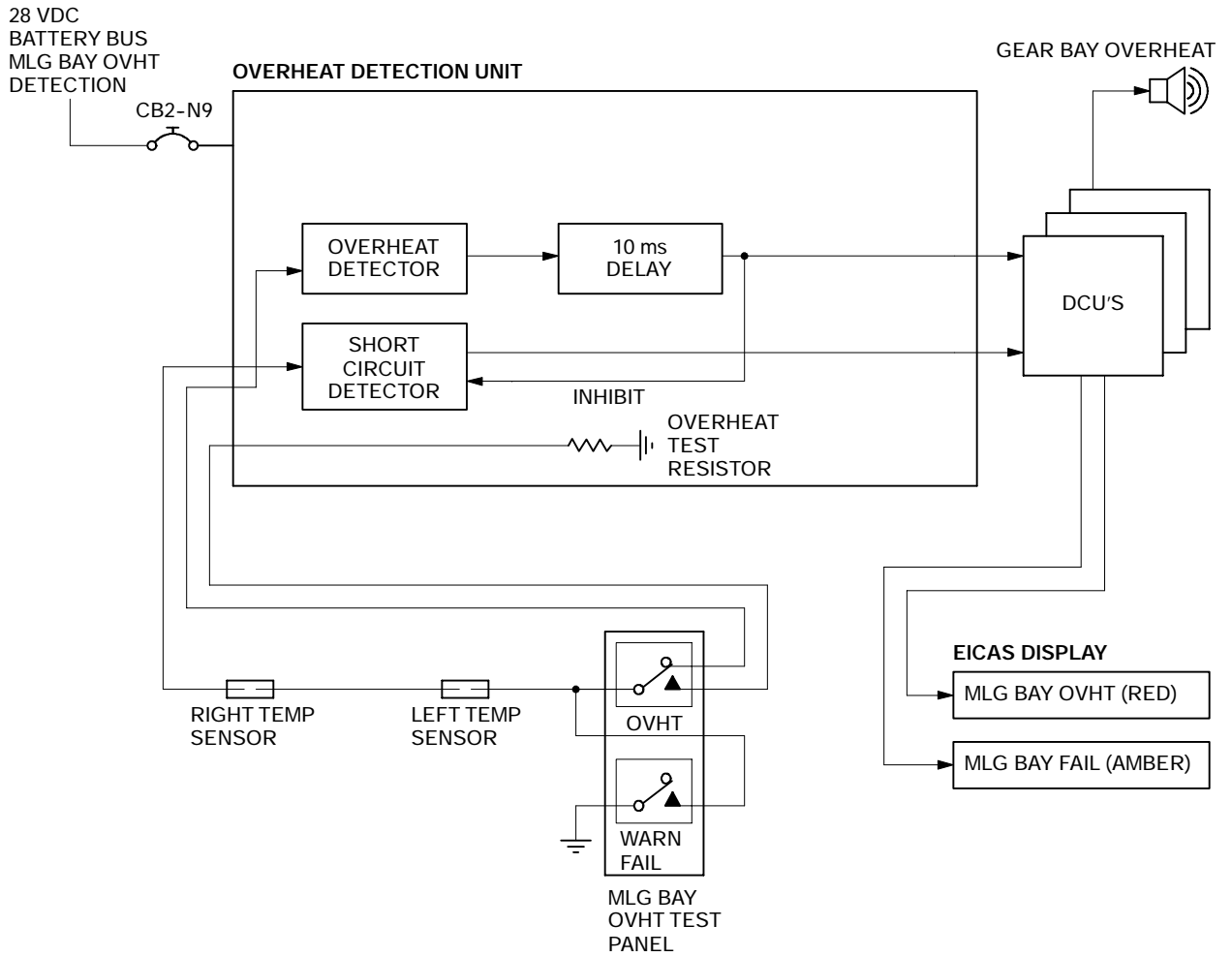


GEAR BAY OVERHEAT

MLG OVHT FAIL caution (amber)
Indicates that a fault exists in the main landing gear bay overheat detection system.

Primary Page

Landing Gear EICAS Messages <1001>
Figure 10-40-2



MLG Overheat Indication and Test
Figure 10-40-3



FIRE PROTECTION
Main Landing Gear Overheat Detection

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A. System Circuit Breakers

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Main Landing Gear	Overheat Detection	MLG BAY OVHT DET	BATTERY BUS	2	N9	