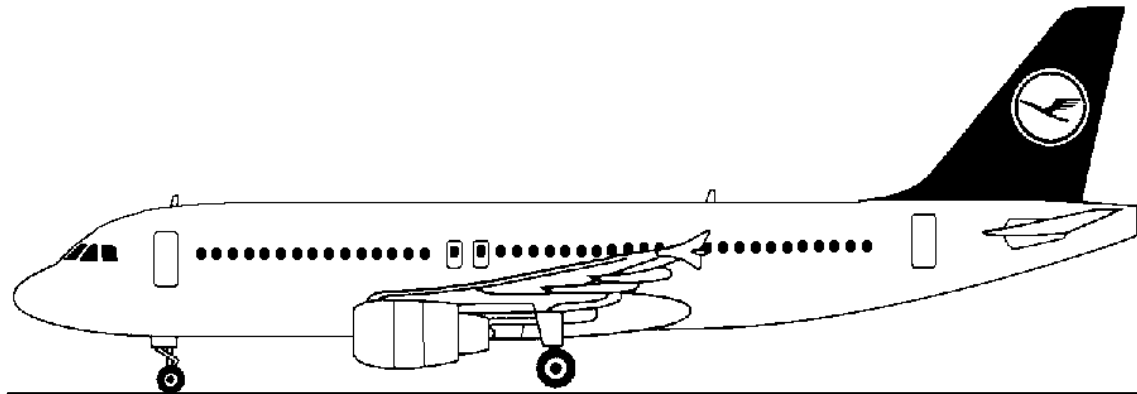




Lufthansa Technical Training

Training Manual A 319/320/321



ATA 26

Fire Protection

Line & Base Maintenance

ATA Spec. 104 Level 3



Lufthansa Technical Training

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Lufthansa

TECHNISCHE SCHULUNG

Training Manual

A320/321



ATA 26 FIRE PROTECTION

26-00 GENERAL

FIRE DETECTION

Definition

The design of the fire detection system is different according to the area which is monitored.

Overheat and Fire Detection

The fire and overheat detection elements are installed in each engine nacelle and in the APU compartment.

Smoke detection

The function of the smoke detection system is to monitor each lavatory, the avionics compartment and cargo compartments.

System Description

- Fire and Overheat Detection
Thermo sensitive loops detect fire or overheat conditions. They trigger the warning by means of the Fire Detection Unit (FDU) when the temperature reaches the threshold of the monitored area.
- Engine
Two independent loops are installed in each engine nacelle. They are connected in parallel and according to an AND logic.
The purpose of this logic is to prevent spurious FIRE warnings.
The engine overheat and fire detection system is detailed in ATA chapter 26-10-00.
- APU
The detection system monitors the APU compartment where fuel and bleed air systems are possible fire sources.
The detection system comprises two independent loops. They are connected in parallel and according to an AND logic.
The purpose of this logic is to prevent spurious FIRE warnings.
The APU fire and overheat detection system is detailed in ATA chapter 26-10-00.
- Smoke Detection
Smoke detectors are used to detect the visible and invisible combustion

particles.

When the preset threshold is reached, the smoke detector triggers a warning via the Smoke Detection Control Unit (SDCU).

- Avionics compartment
In the avionics compartment, smoke detection system sensing is provided with one smoke detector.
The smoke detector is installed on the ventilation air extraction duct.
When the warning is triggered, the crew members must initiate the smoke procedure.
The avionics compartment smoke detection is detailed in ATA chapter 26-10-00.
- Lower deck cargo compartment
In the lower deck cargo compartment there are ambient smoke detectors. They function by pair to prevent spurious smoke warnings.
The ambient smoke detectors are installed in the forward, aft and bulk cargo compartment.
When a warning is triggered, the corresponding ventilation and heating system closes automatically.
The lower deck cargo compartment smoke detection is detailed in ATA chapter 26-10-00.
- Lavatories
Each lavatory is equipped with one ambient smoke detector.
The lavatory smoke detection system is detailed in ATA chapter 26-10-00.

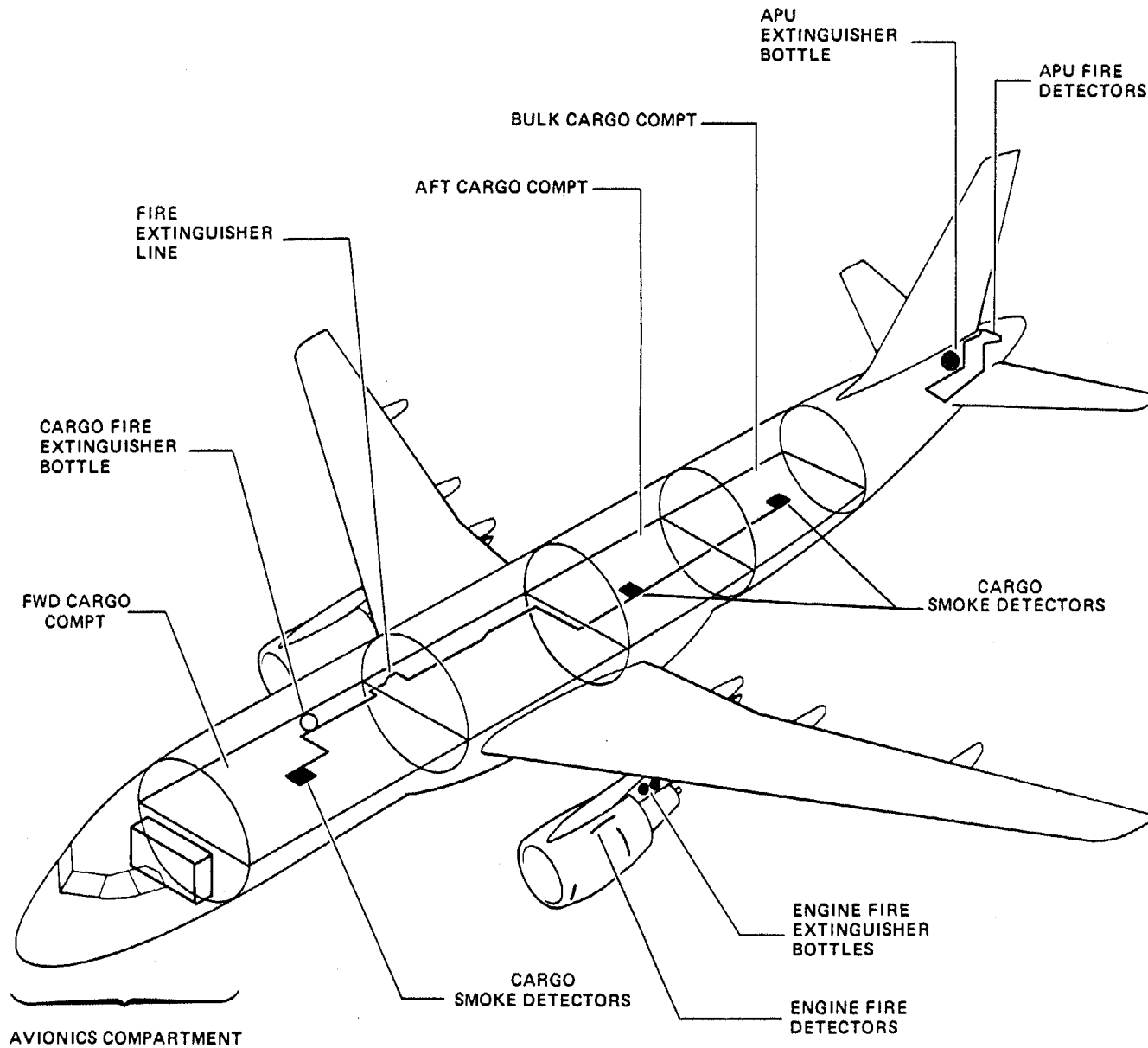


Figure 1

EXTINGUISHING

Definition

There are several different fire extinguishing methods.

The methods depend on:

the area in which the fire occurs

the fact that the aircraft is in flight or on the ground.

For each method one or two fixed fire extinguisher bottle(s) or portable fire extinguisher(s) are used. They are operated either automatically and manually or manually only.

System Description

Fixed Equipment

The function of the fixed equipment installed on board is to extinguish fire occurring in the following areas:

Engine

There is a fire extinguishing system in each nacelle. The system is supplied by two bottles. The percussion of the bottles is controlled from the cockpit.

The engine nacelle fire extinguishing system is detailed in ATA chapter 26-20-00.

APU

The APU fire extinguishing system is supplied by one bottle.

The percussion of the bottle on the ground can be controlled manually or automatically. In flight, the percussion is manually activated from the cockpit.

The APU fire extinguishing system is detailed in ATA chapter 26-20-00.

Cargo

The cargo fire extinguishing system is supplied by one bottle. The extinguishing agent can be sprayed in the forward cargo compartment or in the aft cargo compartment.

The percussion of the bottle is controlled from the cockpit.

The cargo compartment fire extinguishing system is detailed in ATA chapter 26-20-00.

Lavatories

bottle located above the waste bin can extinguish a fire in the lavatory waste bin.

The fire extinguisher bottle is squibbed automatically by a thermal fuse and sprays the extinguishing agent directly into the waste bin.

The lavatory fire extinguishing system is detailed in ATA chapter 26-20-00.

Portable Equipment

The portable extinguishers are operated manually and are used if there is a fire in the cockpit or the cabin.

The portable extinguishers are detailed in ATA chapter 26-24-00.

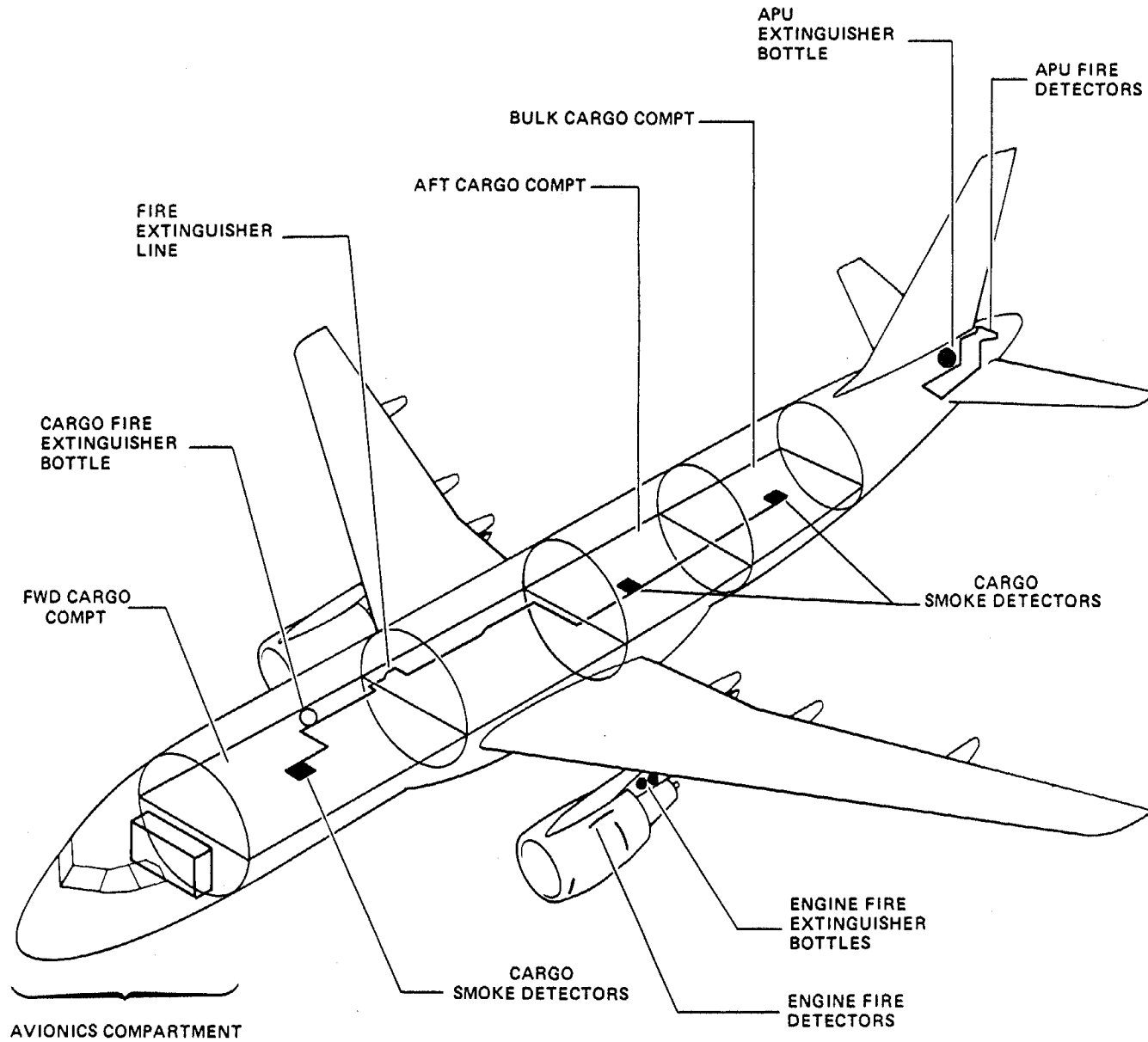
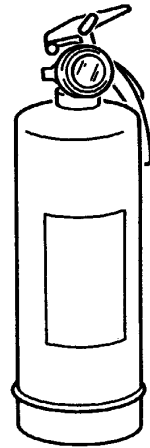


Figure 2 Fire Detection/Extinguishing System



Student Note



TYPICAL PORTABLE
EXTINGUISHER
(CABIN AND COCKPIT)

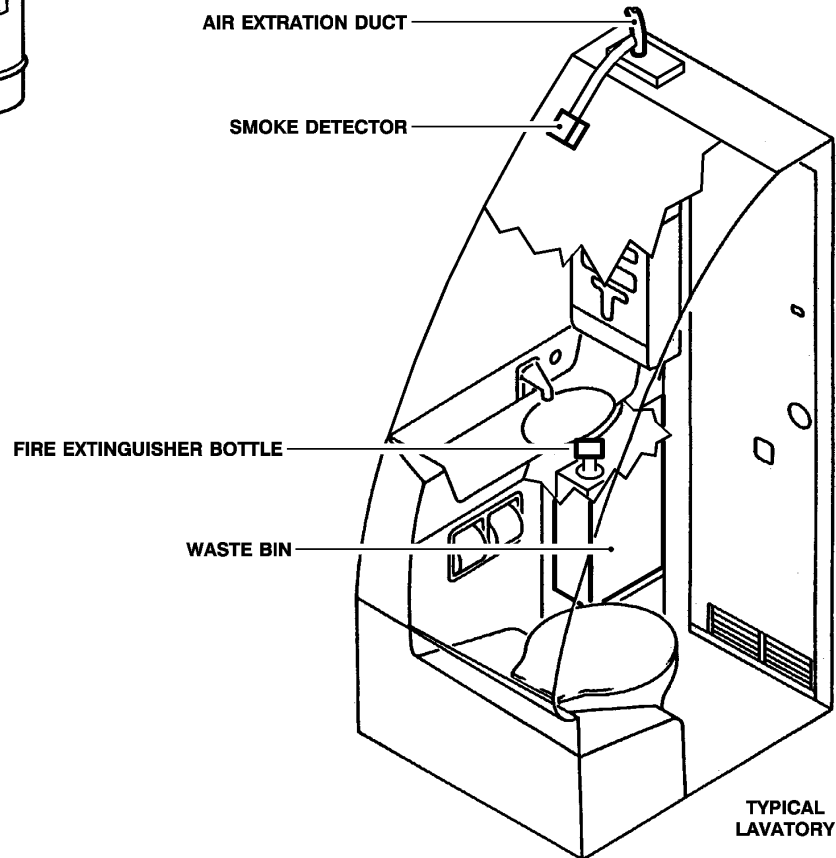


Figure 3 Lavatory Detection/Extinguishing



Student Note

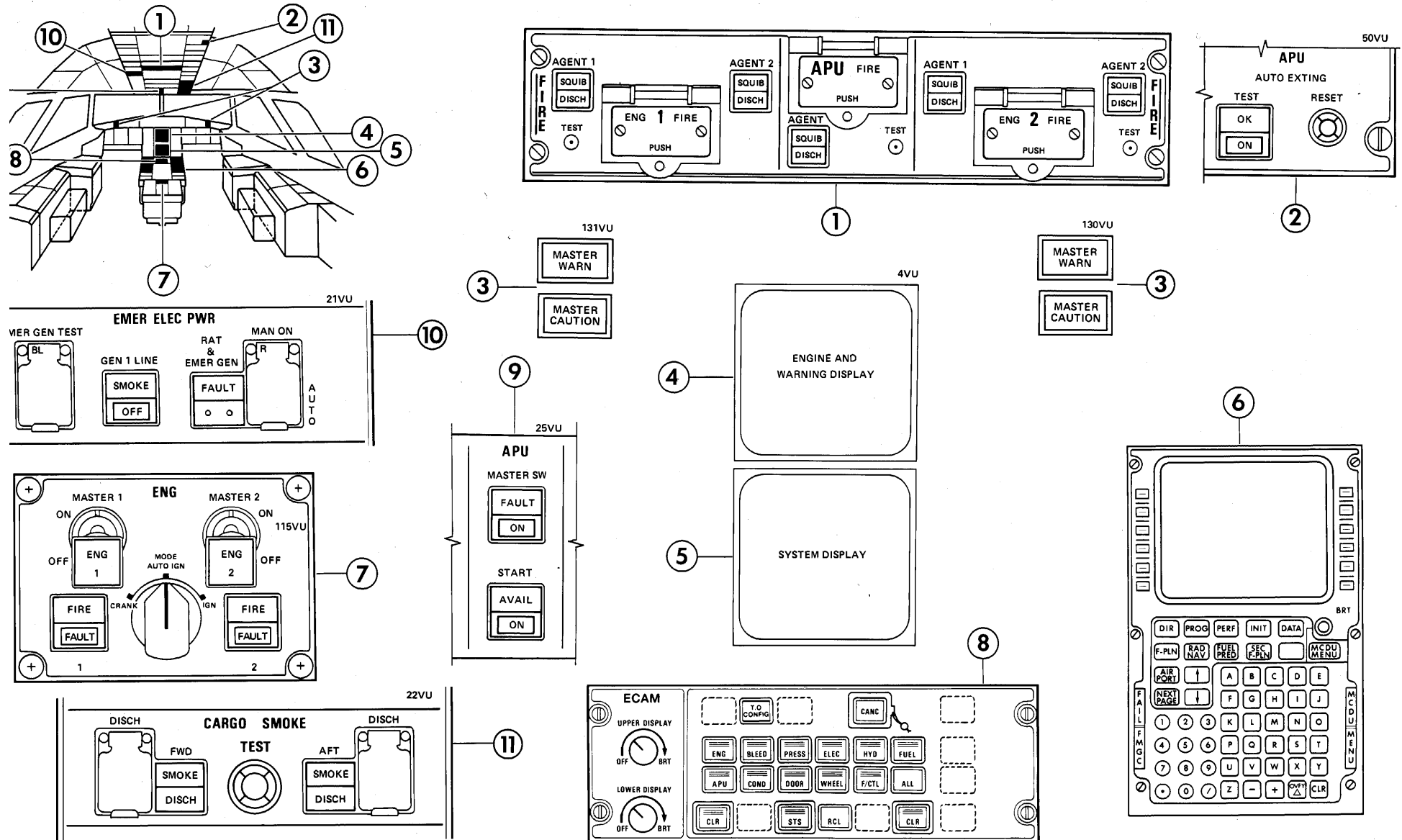


Figure 4 Component Location Indicators and Controls



ENGINE/APU FIRE DETECTION MODULE

Panel Description

①. **ENG 1(2) FIRE** pushbutton switch

- In and guarded:
 - Normal position.
- Release out:
 - An electrical signal causes for the respective engine:
 - Aural warning cancellation.
 - SQUIB arming
 - Fuel LP valve closure
 - ENG fuel return valve closure.
 - Hydraulic fire valve closure.
 - ENG bleed valve closure.
 - Pack flow control valve closure.
 - Elec generator deactivation.

② **Agent 1 (2) Pushbutton**

- Active when the corresponding ENG FIRE or APU pushbutton is pushed.
- Momentarily pressed:
 - The Bottle is discharged.

③ **SQUIB Lights:**

- Illuminate white when the corresponding ENG FIRE pushbutton is pushed to facilitate identification of the AGENT pushbutton to be activated, or illuminate during the Test.

④ **DISCH lights:**

- Illuminate amber when the related fire extinguisher bottle is depressurized, or illuminate during the Test.

⑤ **TEST Pushbutton**

- Enables fire detection and extinguishing system operation to be tested for the respective engine or the APU.
- When pressed:
 - Continuous repetitive chime sounds.
 - MASTER WARNING Lights flash.

- ECAM engine or apu fire warnings are activated.
- On the Fire Panel:
 - ENG.FIRE or APU FIRE pushbutton illuminates red.
 - The SQUIB lights illuminate white provided discharge supplies are available.
 - The DISH lights illuminate amber.
- On the ENG panel (pedestal)
 - The fire light under the Master Switch illuminates red.

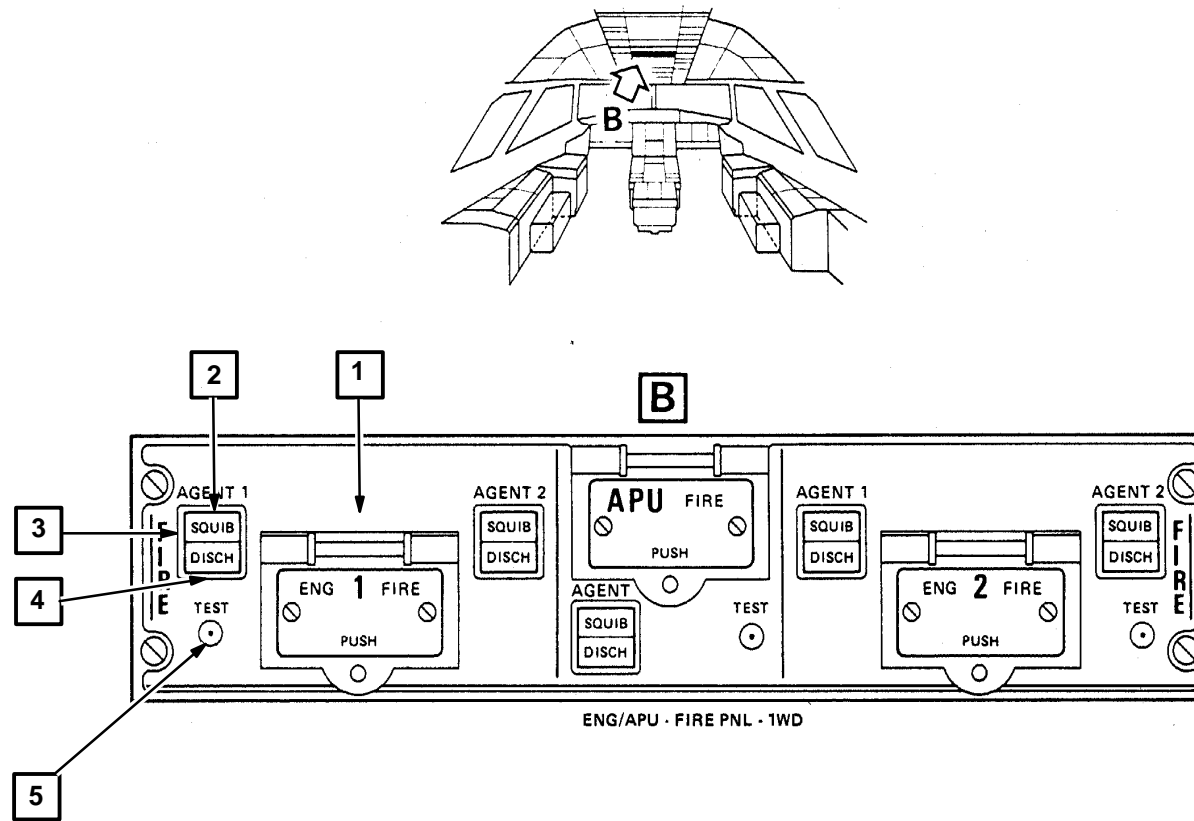


Figure 5 Engine/APU Fire Detection Module

ENGINE FIRE PEDESTAL PANEL**Panel Description****1 Fire Light**

- Identifies the engine to be shutdown.
- Illuminates red as long as a fire is detected on the respective engine.

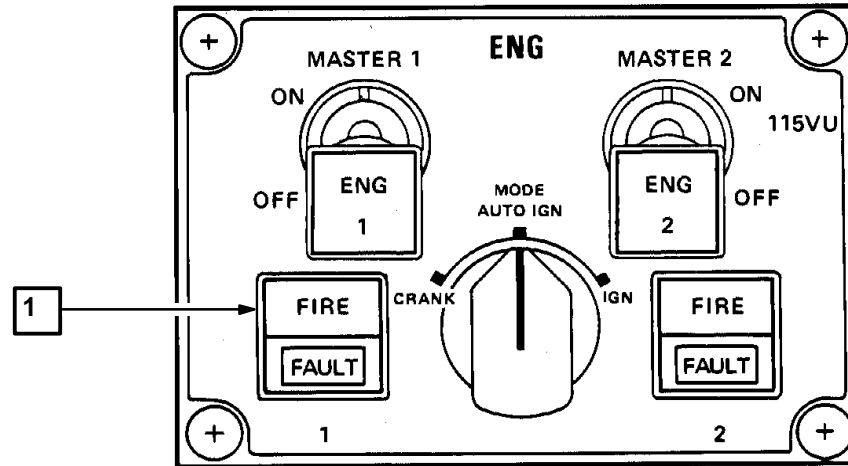


Figure 6 Engine Fire Light Center Pedestal

ENGINE/APU FIRE DETECTION MODULE

Panel Description

1 APU FIRE pushbutton switch

- In and guarded
 - Normal position
- Released out: An electrical signal causes
 - APU shut down
 - Aural warning cancellation
 - Squib arming
 - Fuel LP valve closure
 - APU fuel pumps off (AFT and FWD)
 - APU bleed and X bleed valves closure
 - APU GEN deactivation
- APU FIRE light : Illuminates red independently of the pushbutton position as long as the APU fire warning is activated.

2 AGENT pushbutton

- Active when the corresponding APU FIRE pushbutton is pushed.
- Momentarily pressed:
 - the bottle is discharged.

3 SQUIB light:

- Illuminates white when the APU FIRE pushbutton is pushed to facilitate identification of the agent pushbutton to be activated, or illuminates during the Test.

4 DISCH light:

- Illuminates amber when the fire extinguisher bottle is depressurized, or during the Test.

5 TEST Pushbutton

- Enables fire detection and extinguishing system operation to be tested.
- When pressed:
 - Continuous repetitive chime sounds.
 - Master Warning lights flash.
 - ECAM APU fire warning is activated.

- On the APU FIRE panel:
 - APU FIRE pushbutton illuminates red
 - SQUIB light illuminates white
 - DISCH light illuminates amber

NOTE: Automatic shutdown on ground does not occur during test.

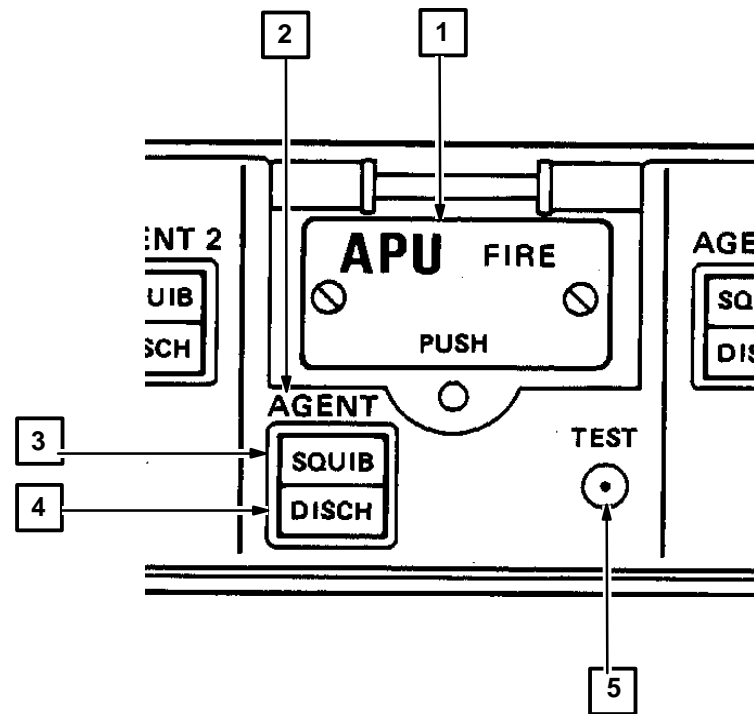


Figure 7 APU Fire Detection/Extinguishing Control and Indication

APU MAINTENANCE PANEL**1 APU AUTO EXTING Test PB:**

- The Push Button must be pressed momentarily.
- The Test ON light illuminate,
- The APU FIRE warning illuminate,
- The APU Fire Horn sounds after 3 seconds.
- The AUTO EXTING OK Light illuminate after 3 seconds to indicate a successful test.

Note:

If in operation, the APU shuts down.

2 RESET Pb:

Press the pushbutton to switch off the Auto Exting. Test circuit and enable the start of the APU.

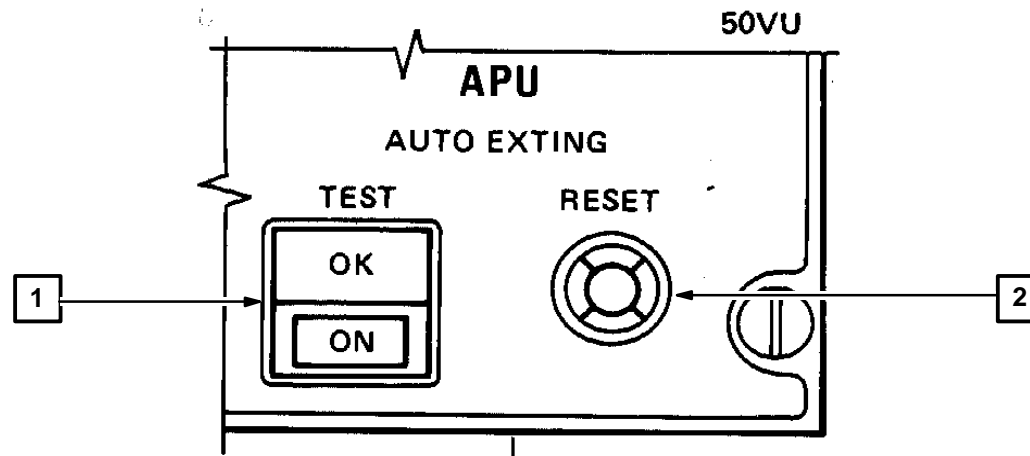


Figure 8 APU Auto Extinguishing Test Panel

APU FIRE EXTERNAL CONTROL**Panel Description****① APU Fire light**

- The APU FIRE light illuminates red on Ground, accompanied by an external warning horn when an APU fire is detected.
- The APU fire extinguisher will automatically discharge 3 seconds after the fire warning appearance.
- The light will go off after extinction of the fire.

② APU SHUT OFF pushbutton

- The pushbutton is guarded by a flap. When it is pressed in the event of an APU fire, automatic shutdown is confirmed and external horn is silenced.

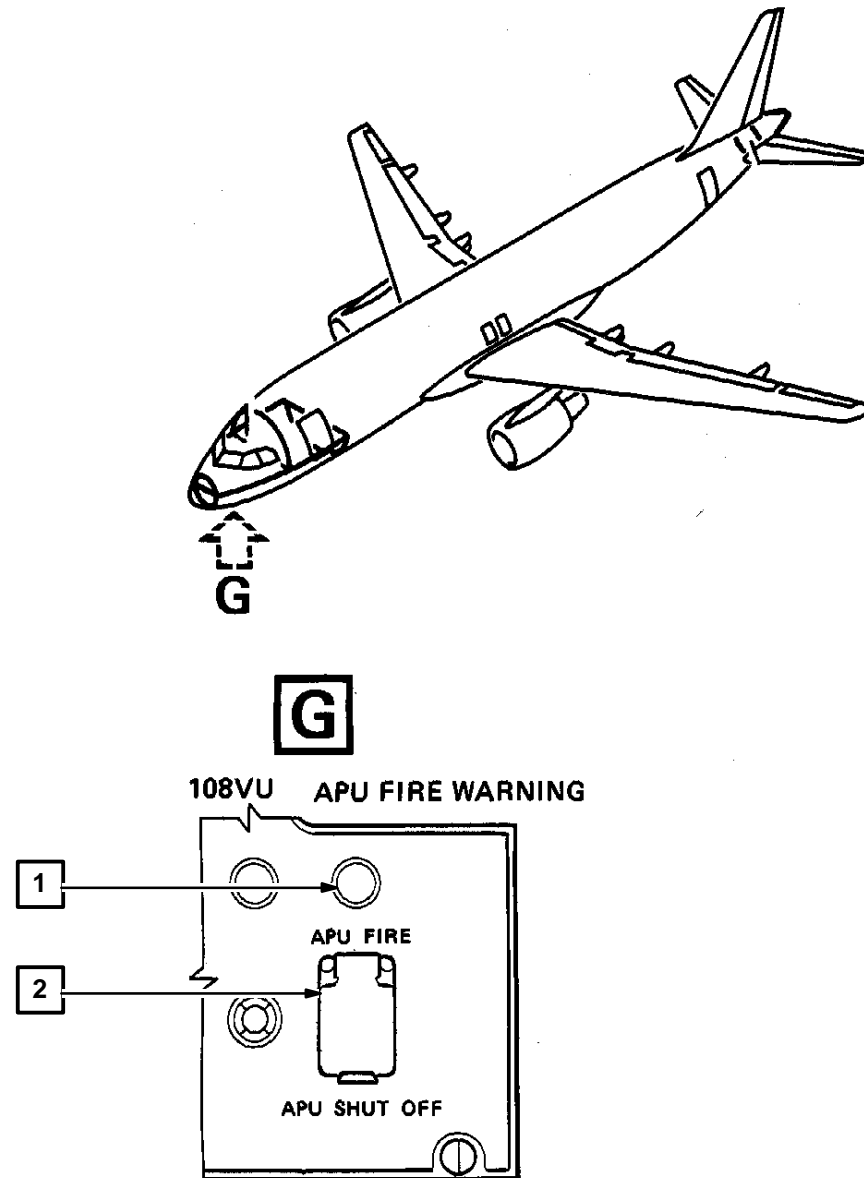


Figure 9 APU Fire Indication and Shut Off on Ext.Pwr.Rec.



AVIONIC SMOKE**Avionics Compartment**

When a smoke detection is confirmed by the Smoke Detector, the following smoke warnings are triggered on:

- the VENTILATION control panel (22VU)
- the EMER ELEC POWER control panel (21VU)
- the MASTER CAUTION lights
- the ECAM warning display
- the aural warning sounds

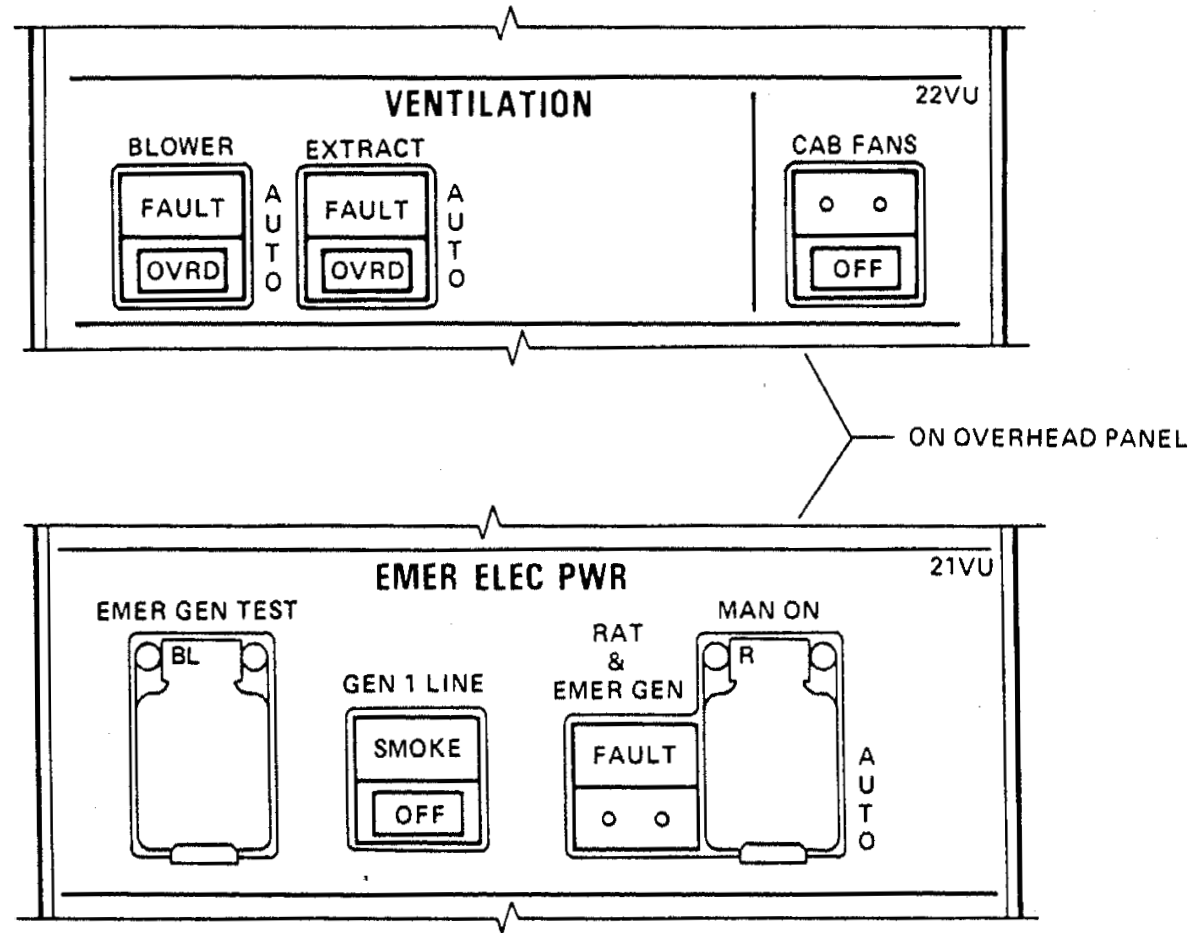


Figure 10 Avionic Smoke Det. Control and Indication

CARGO SMOKE OVERHEAD PANEL**Panel Description****① SMOKE Light:**

- Illuminates red associated with ECAM warning when smoke is detected in the associated compartment.

② DISCH pushbutton:

- When pressed the associated squib is ignited for discharge of the extinguishing agent in the associated cargo compartment. (FWD or AFT/BULK).

③ DISCH lights:

- Illuminate amber when associated bottle is depressurized.

④ TEST pushbutton:

- When pressed:
 - the smoke detectors are tested by the SDCU in sequence.
 - SMOKE lights illuminate red on the overhead panel associated with ECAM warnings and continuous repetitive chime.
 - the isolation valves of the ventilation system close.
 - DISCH lights illuminate amber.

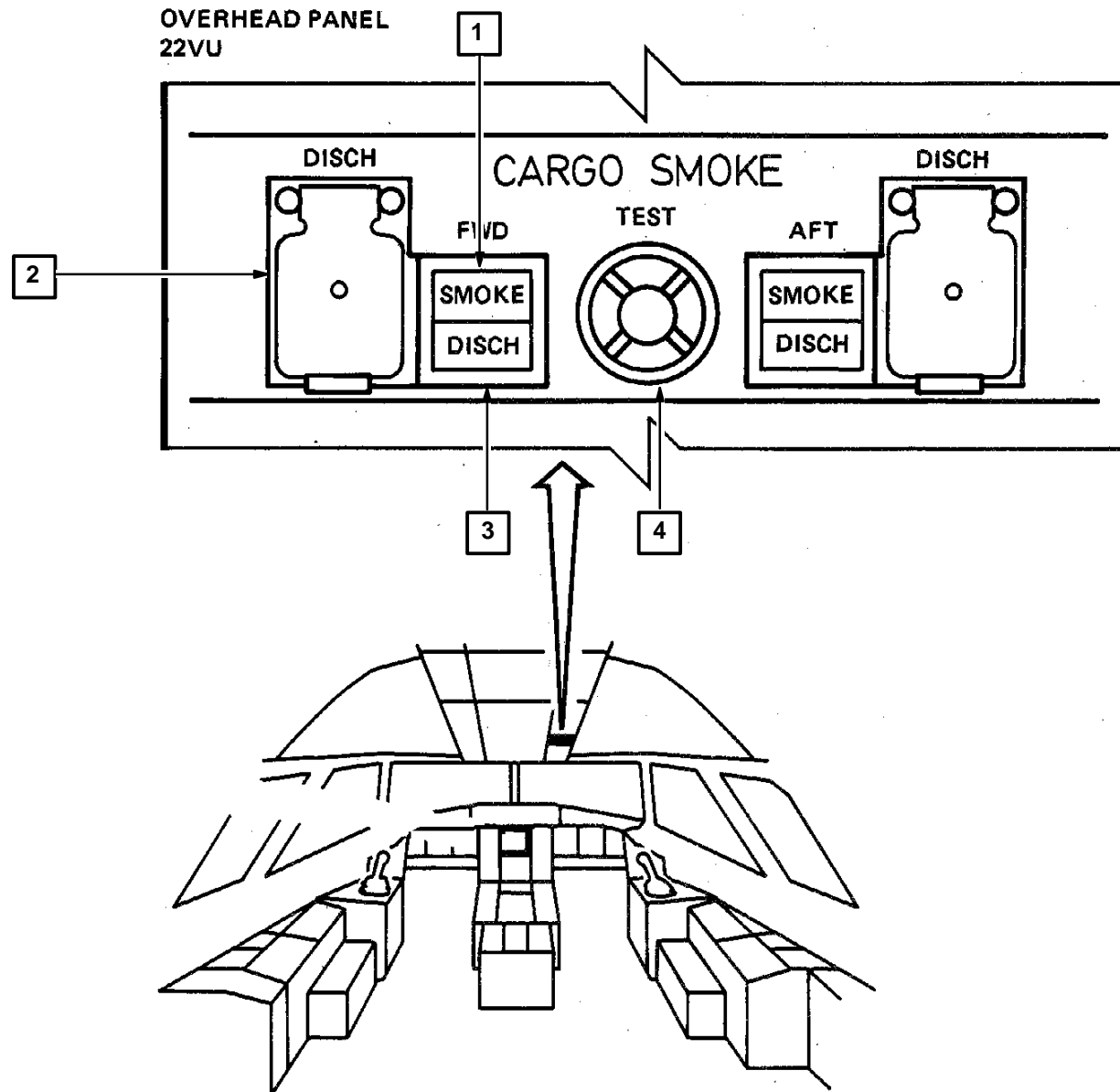


Figure 11 Cargo Smoke Control and Indication

ENG/APU DETECTOR DESCRIPTION**Fire Detectors**

- Pylon Fire Detectors
- Fan Fire Detectors
- Core Fire Detector

Component Description

The detector is pneumatically operated by heating its sensing element which contains helium gas and hydrogen charged core material.

Alarm State

The application of an overall average temperature expands inert gas (helium) which in turn closes the alarm switch. The detector sends a fire signal.

The application of heat to the sensor releases active gas from hydrogen charged core which in turn closes the alarm switch. The detector sends a fire signal.

Fault State

In the event of gas pressure loss (pipe fracture or cut off due to a torching flame), the integrity switch opens and generates a fault signal.

Safety Precautions**CAUTION:**

- The detector responder is hermetically sealed, and as such, is not field repairable.
- Any attempt to disassemble a detector responder will cause serious damage to the unit and render it inoperative.

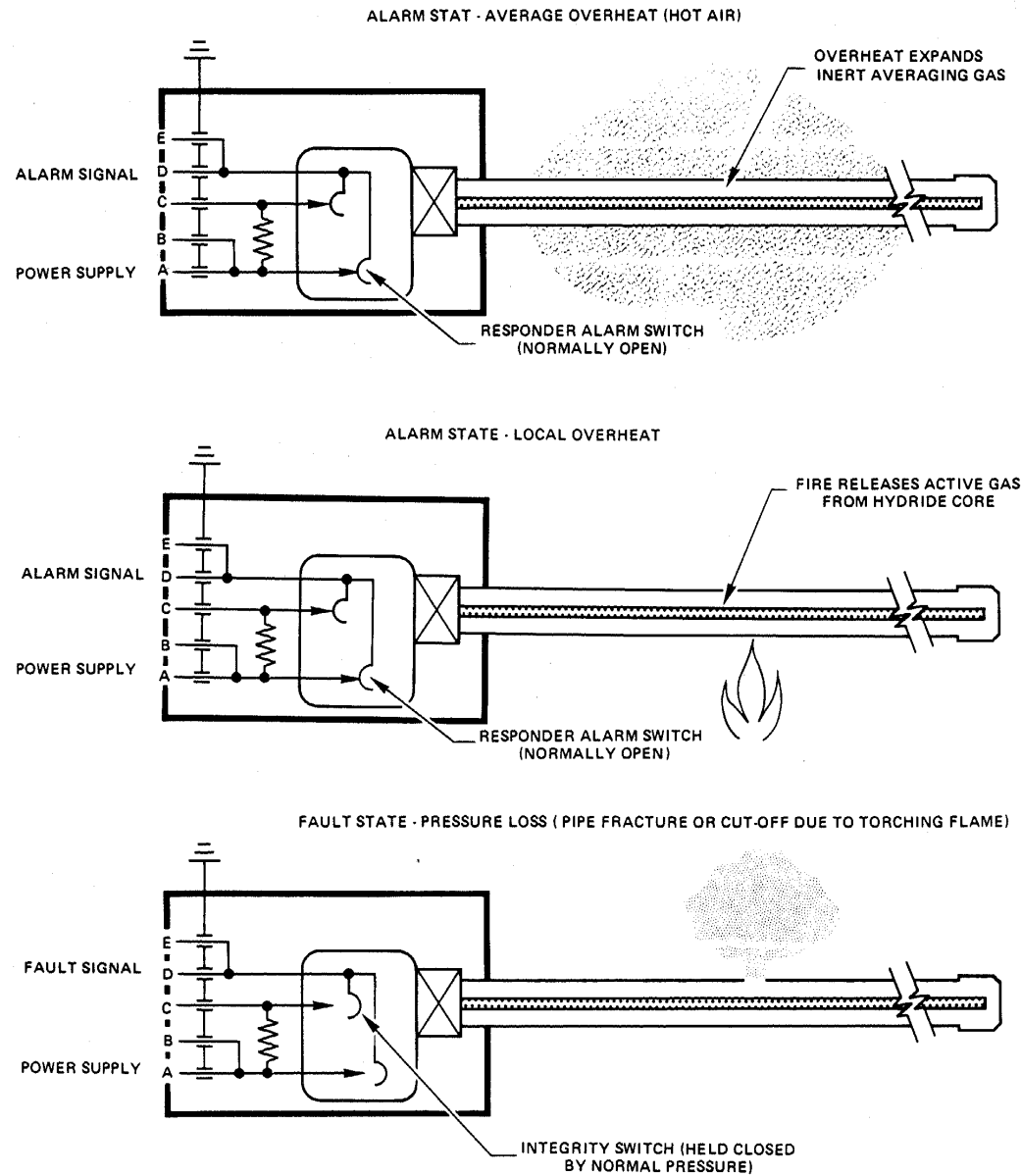


Figure 12 Fire Sensing Element Schematic

SMOKE DETECTOR DESCRIPTION**Operation**

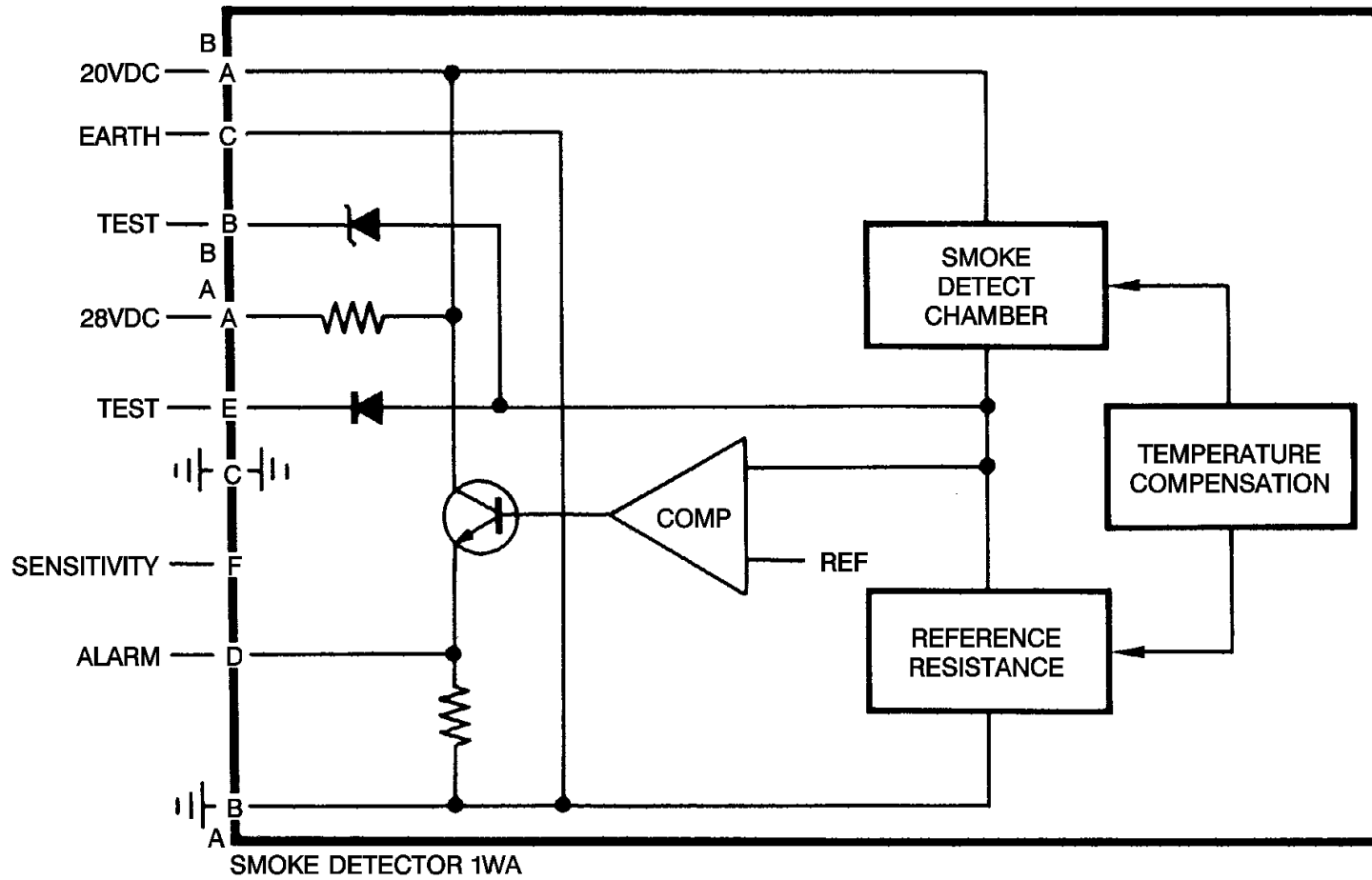
The system includes one self-contained smoke detector which is of the ionisation type and composed of :

- resistor and the ionized chamber which causes a variation of the detector normal voltage.
- a measuring chamber through which the air to be analyzed flows,
- a reference resistor.
- The measuring chamber is ionized by a source of extremely low radioactivity.

When smoke gases enter the detector, they modify the balance between the resistor and the ionized chamber which causes a variation of the detector normal voltage.

Indicating

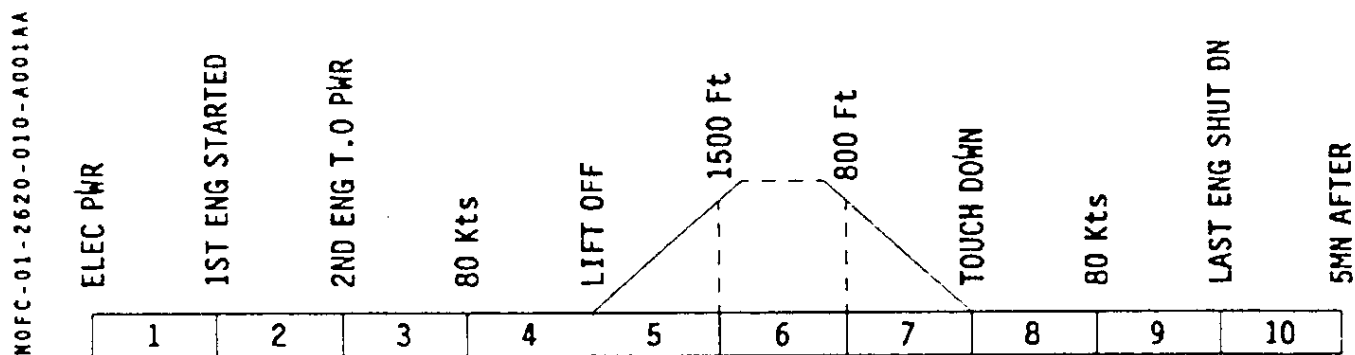
When the reference threshold of the measuring chamber is exceeded, the inner electronic circuit triggers the smoke warnings to the cockpit.



NOTE : CONNECTOR A USED IN AUTONOMOUS MODE
CONNECTOR B USED WITH AN AMPLIFIER

Figure 13 Smoke Detector Schematic

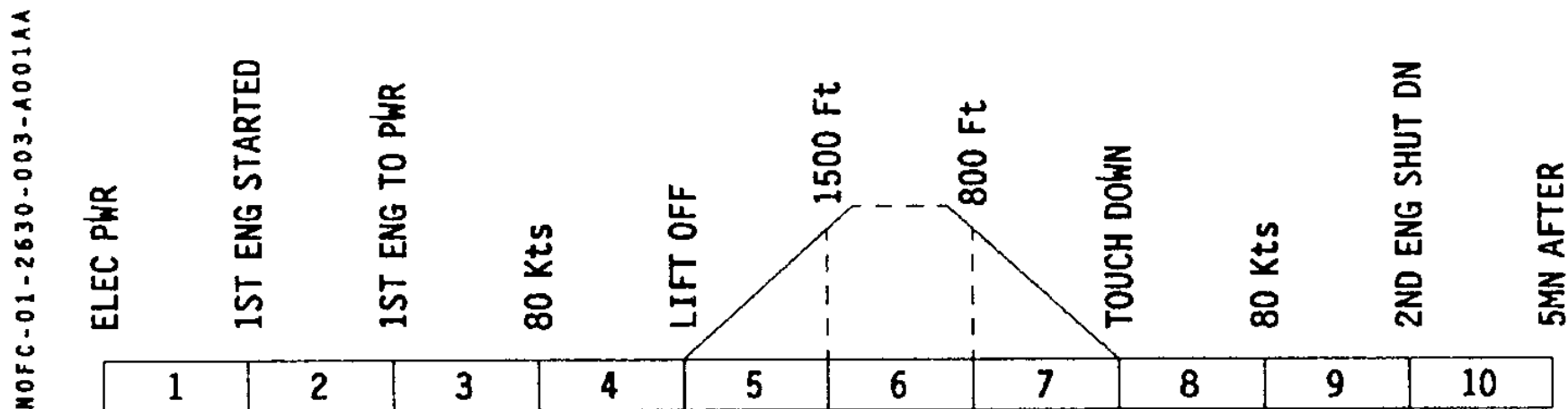
WARNINGS AND CAUTIONS



E / WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
ENG 1 (2) FIRE Fire detected by both loops or by one loop, the other one being faulty	CRC	MASTER WARN	ENGINE	FIRE Its on ENG FIRE pb and on ENG panel	NIL
APU FIRE Fire detected by both loops or by one loop, the other one being faulty			APU	FIRE It on APU FIRE pb	
ENG 1 (2) APU FIRE DET FAULT Both loops inoperative Fire Detector Unit inoperative	SINGLE CHIME	MASTER CAUT	NIL	NIL	3, 4, 5, 7,8
ENG 1 (2) APU LOOP A (B) FAULT	NIL	NIL			

Figure 14 Eng.APU Fire Local and ECAM Warnings

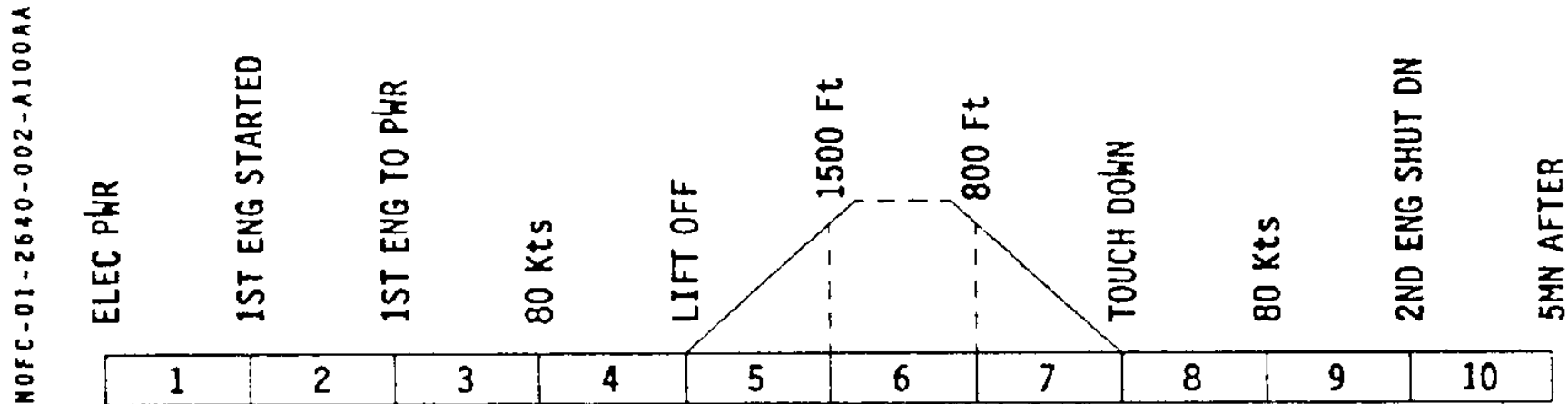
WARNINGS AND CAUTIONS



E / WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
AVIONICS SMOKE Smoke detected in ventilation extraction duct	SINGLE CHIME	MASTER CAUT	ELEC	<ul style="list-style-type: none"> • SMOKE It on EMER ELEC PWR panel • FAULT Its on BLOWER and EXTRACT pb sw 	4, 5, 7, 8

Figure 15 Avionic Smoke Local and ECAM Warnings

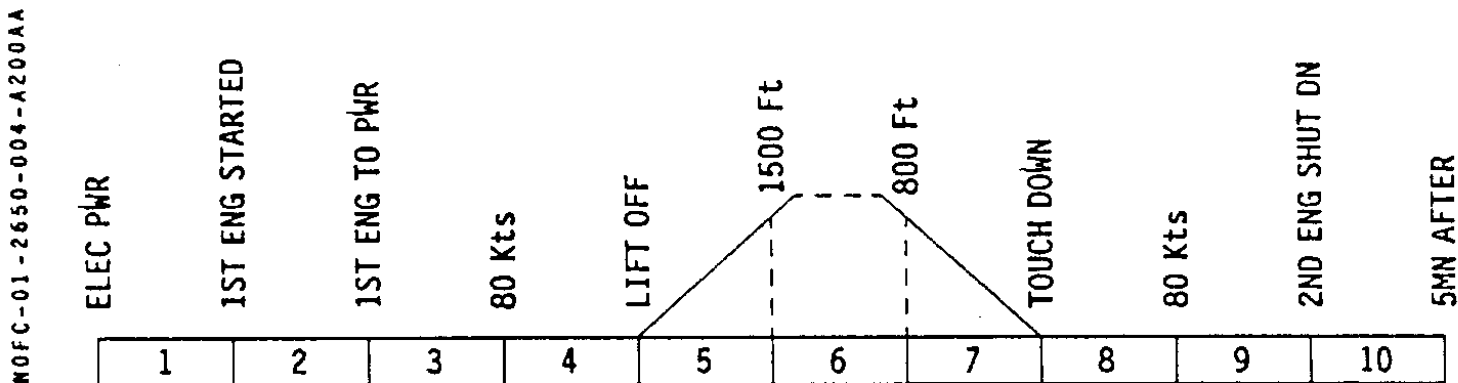
WARNINGS AND CAUTIONS



E / WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
LAVATORY SMOKE Smoke detected in one lavatory	CRC	MASTER WARN	NIL	NIL	4,5,7,8
LAVATORY DET FAULT Lavatory smoke detection fault or Lavatory and galley fan faulty	NIL	NIL			3, 4, 5, 7, 8
LAV + CRG DET FAULT Both SDCU channels failed	SINGLE CHIME	MASTER CAUT			

Figure 16 Lavatory/SDCU Local and ECAM Warnings

WARNINGS AND CAUTIONS



E / WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB			
FWD (AFT) CARGO SMOKE Smoke detected	CRC	MASTER WARN	NIL	SMOKE lt on CARGO SMOKE panel	4, 5, 7, 8			
FWD (AFT) CRG DET FAULT Smoke detection fault	NIL	NIL		NIL	NIL	3, 4, 5, 7, 8		
LAV + CRG DET FAULT Both SDCU channels failed	SINGLE CHIME	MASTER CAUTION				NIL	NIL	4, 5, 7, 8
FWD (AFT) BTL SQUIB FAULT fwd or aft bottle squib failed								4, 5, 7, 8

Figure 17 LDCC/SDCU Local and ECAM Warnings



26-12 ENGINE FIRE DETECTION

SYSTEM DESCRIPTION

The fire detection system is of the electro-pneumatic type. On each engine there are two continuous loops for the fire detection.

The loops are connected in parallel to a Fire Detection Unit (FDU). The connection is made through an AND logic to avoid spurious FIRE warnings. In case of failure of one loop, the AND logic becomes an OR logic. The aircraft can be released in this configuration.

The fire detection loops are monitored by the FDU. The monitoring device indicates the loss of a fire detection loop to the crew members (Flight Warning System).

For one engine, each loop:

- comprises three fire detectors connected in parallel. The detectors are installed in the nacelle and pylon fire zones.
- is connected to a separate channel of the FDU
- is connected through the related channel, to four of the eight lamps in a red warning light common to the two loops. This warning light is integral with the ENG/FIRE pushbutton switch located on the ENG/FIRE control panel (overhead panel).

The fire detection system can be tested using the TEST pushbuttons on the ENG/APU fire control panel (ovhd pnl).

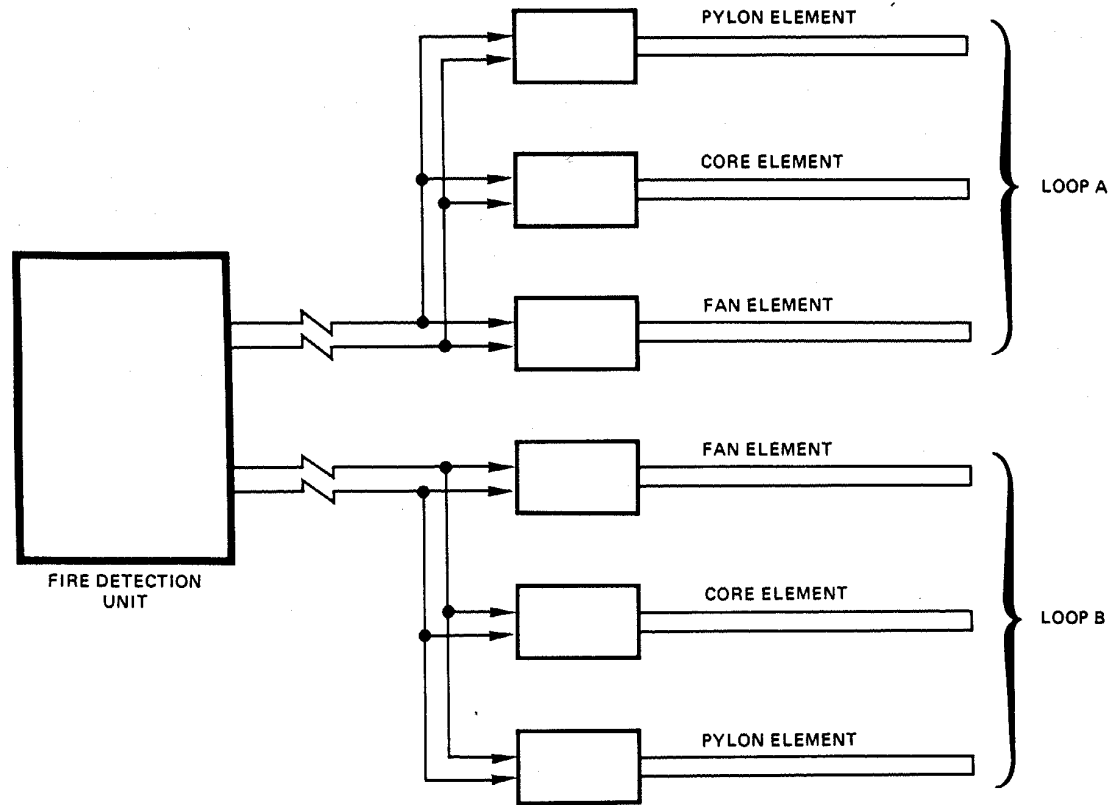


Figure 18 Eng.Fire Detection Schematic



FIRE DETECTION UNIT

Description

The Fire Detection Unit (FDU) processes the signals generated by the responder of the detectors.

There are three functional modules:

- two independent channels (1 for each detection loop)
- one monitoring circuitry (for maintenance purpose only).
- The channels
Each channel has its own power supply.
- Fire detection function
The two channels operate normally together, with an AND logic, for the fire detection. However, if one loop is inoperative, each loop can operate independently in the fire detection function.
- Input signals
Each channel receives and analyzes continuously the signal given by its detection loop. The analysis is done by means of three comparators:
 - the FIRE comparator
 - the ELECTRICAL FAILURE comparator
 - the INTEGRITY comparator

Output signals

The output signals are generated via discrete signals and/or ARINC 429 bus. The fire warning signals (aural and/or visual) thus generated are transmitted to the cockpit.

- Monitoring circuitry
The monitoring circuitry analyses and monitors continuously the fire detection system.
- In case of failure of the system the monitoring circuitry:
 - memorizes the fault in a non-volatile memory
 - isolates the faulty channel
 - generates the appropriate discrete signals (LOOP A(B) INOP ENG 1 (2) to the FWC 1(2)
 - transmits continuously a system status message to the CFDS the ARINC 429 bus.

FIRE warnings are generated via discrete signals.

There is a FIRE warning signal if any of the following conditions occurs:

- FIRE A and FIRE B
- FIRE A and FAULT B
- FAULT A and FIRE B
- FAULT A and FAULT B in less than 5 seconds.

The FIRE warning signals thus generated are transmitted to the cockpit, at the following locations:

- ENG/FIRE control panel : ENG/FIRE pushbutton switch
- ENG MASTER control panel : ENG/FIRE/FAULT annunciator
- MASTER WARN lights
- EWD: ENG 1 (2) FIRE and fire extinguishing procedure
- SD: engine page.

The Continuous Repetitive Chime (CRC) sounds.

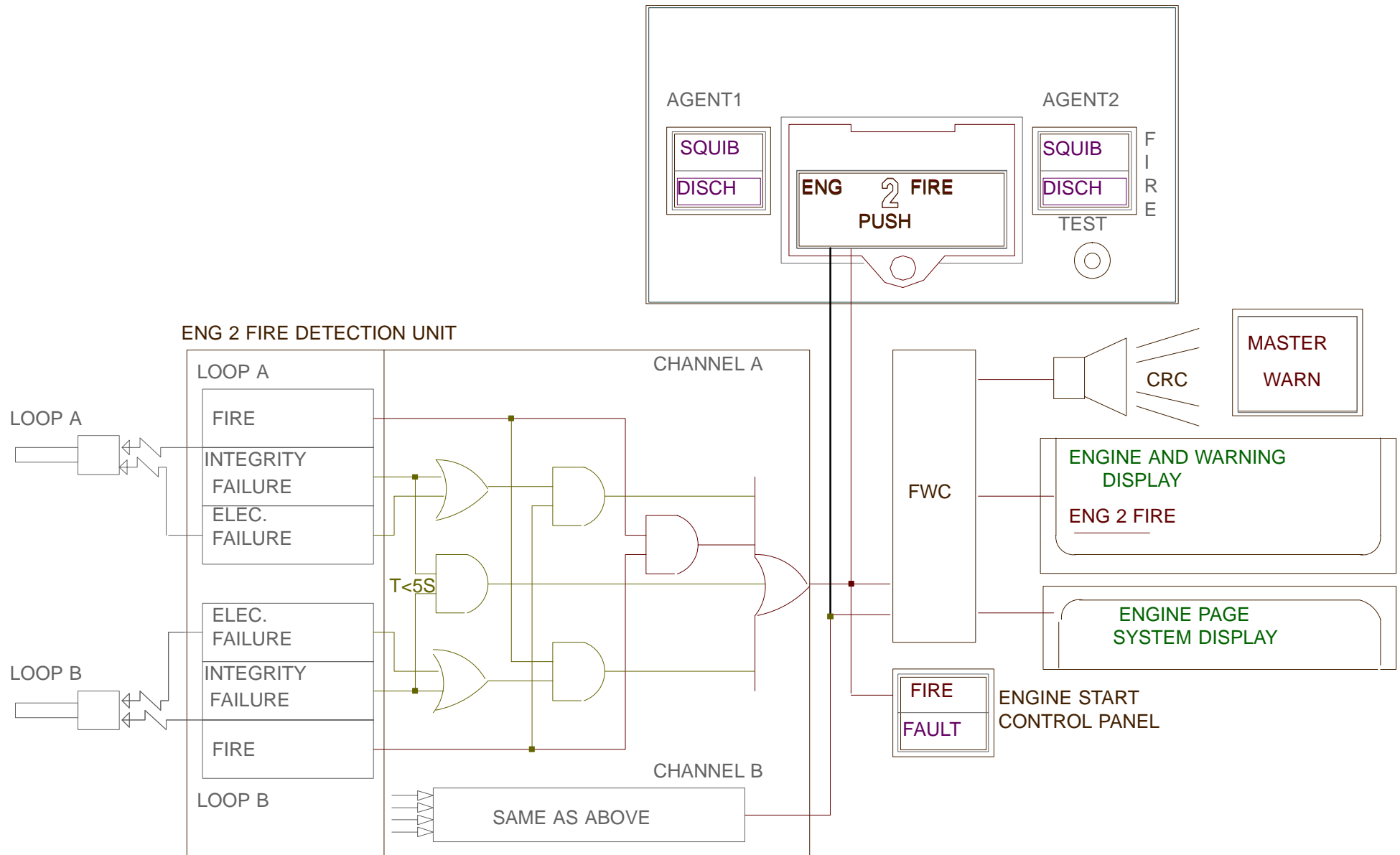


Figure 19 Eng.Fire Detection Logic

**LOOP FAULT WARNINGS**

FAULT warnings are generated via discrete signals.

- There is an inoperative signal if any of the following conditions occurs:
 - an electrical failure (loss of power, connector not connected)
 - a failure in a detector
 - a failure in a detection circuit
 - the detection of a single fire detection loop for a time greater than 16 sec while the other loop is in normal condition.
- the following indication occurs:
 - EWD: ENG 1 (2) LOOP A (B) FAULT

NOTE : In addition the BITE failure message in plain language is transmitted continuously via the ARINC 429 bus to the CFDS.

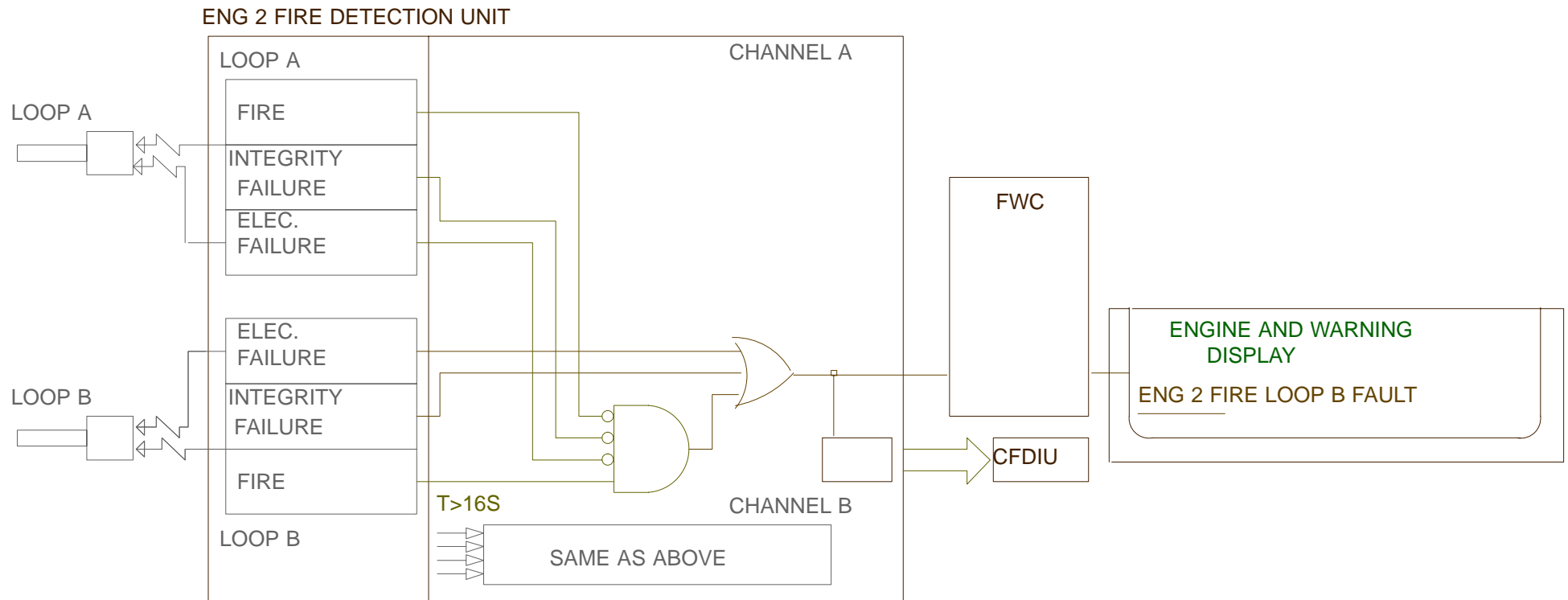


Figure 20 Eng.Fire Loop Fault



DETECTION FAULT WARNINGS

Break in both loops occurring over 5 seconds.

- The FAULT warning signals thus generated are transmitted to the cockpit, at the following locations:
 - MASTER CAUTION light
 - EWD: ENG 1 (2) FIRE DET FAULT
 - The Single Chime (SC) sounds.

NOTE : In addition the BITE failure message in plain language is transmitted continuously via the ARINC 429 bus to the CFDS.

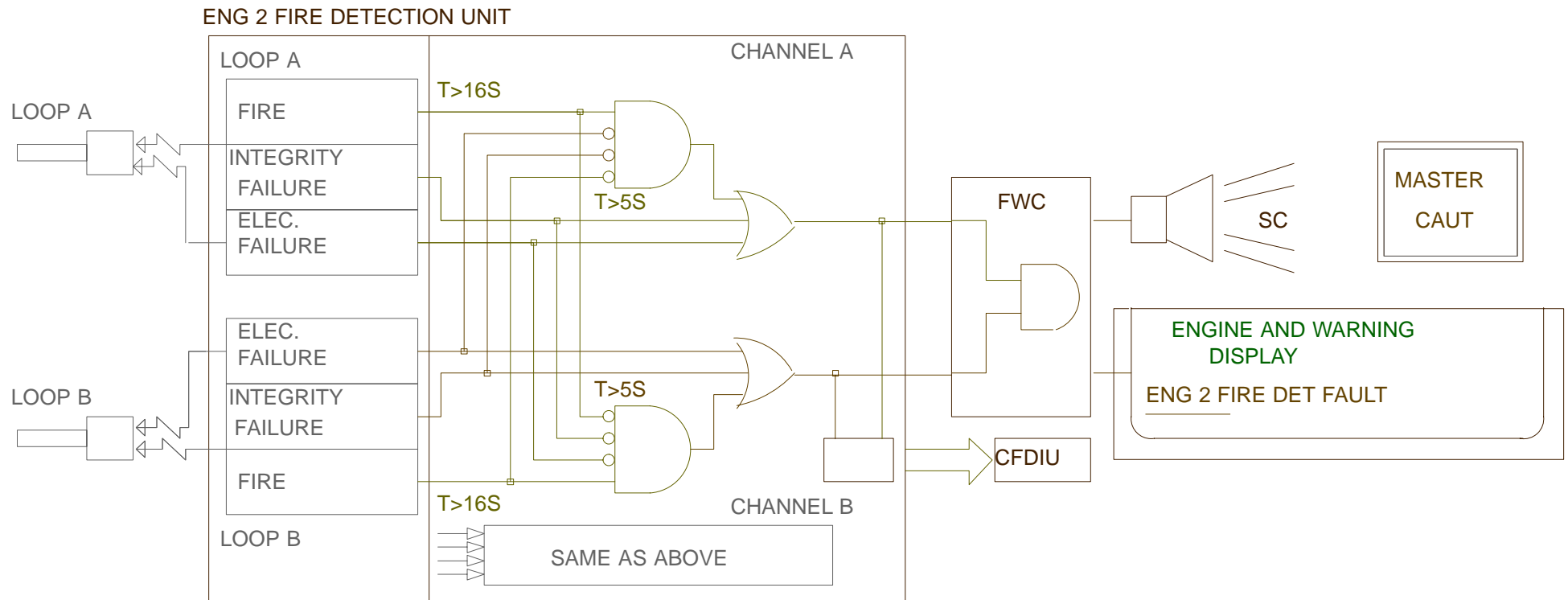


Figure 21 Eng.Fire Detection Fault

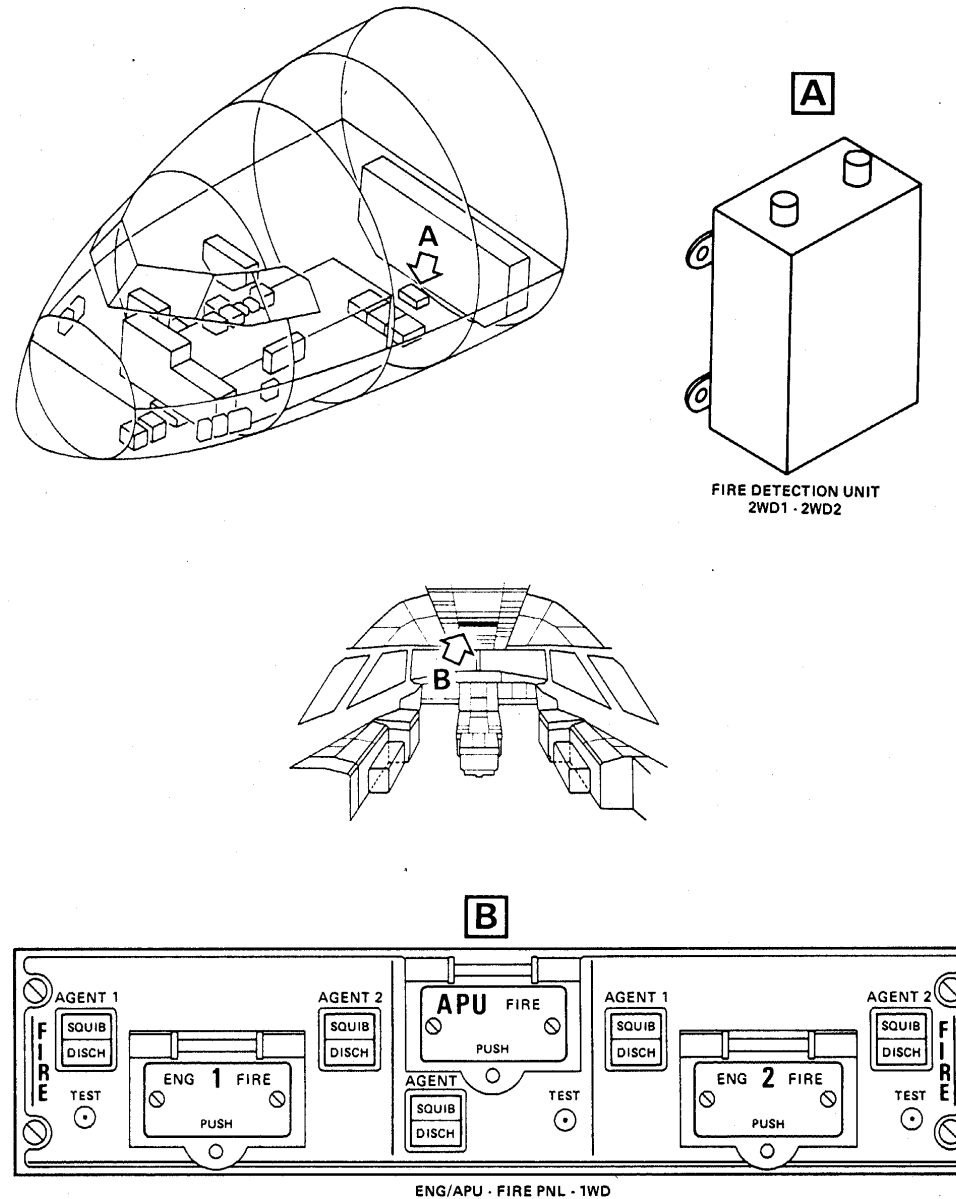


Figure 22 Eng.Fire Component Location

ENGINE BITE TEST

via MCDU

C. Test combinations used by the BITE are as follows :

- (1) Loop A NORMAL and Loop B NORMAL
- (2) Loop A FIRE and Loop B FIRE
- (3) Loop A INTEGRITY FAULT and Loop B FIRE
- (4) Loop A NORMAL and Loop B NORMAL
- (5) Loop A FIRE and Loop B INTEGRITY FAULT
- (6) Loop A FIRE for less than 17 seconds while Loop B is NORMAL
- (7) Loop A FIRE for greater than 17 seconds while Loop B is NORMAL
- (8) Loop B FIRE for less than 17 seconds while Loop A is NORMAL
- (9) Loop B FIRE for greater than 17 seconds while Loop A is NORMAL
- (10) Loop A NORMAL and Loop B NORMAL
- (11) Loop A CONTAMINATION FAULT and then Loop B CONTAMINATION FAULT within 5 seconds
- (12) Loop B CONTAMINATION FAULT and then Loop A CONTAMINATION FAULT within 5 seconds

NOTE : Test wait (1 min.)

D. The list of maintenance messages sent to the CFDIU by the FDU is as follows

:-----					
-----	MAINTENANCE	MESSAGES	CLASS	INT/EXT	
ATA REF					
:-----					

01	CHECK ENG (*)	FIRE LOOP A	1	I	26-12-15
02	CHECK ENG (*)	FIRE LOOP B	1	I	26-12-15
03	CHECK FDU ENG (*)	SUPPLY	1	I	26-12-00
04	CHECK FDU ENG (*)	LOOP A WARN CKT	3	I	26-12-00
05	CHECK FDU ENG (*)	LOOP B WARN CKT	3	I	26-12-00
06	CHECK FDU ENG (*)	FIRE A WARN CKT	3	I	26-12-00
07	CHECK FDU ENG (*)	FIRE B WARN CKT	3	I	26-12-00
08	CHECK FDU ENG (*)	LGCIU INTFC	3	E	26-12-00
09	CHECK FDU ENG (*)	PIN PROG	3	I	26-12-00
10	CHECK FDU	PIN PROG	3	I	26-10-00
11	FDU ENG (*)		3	I	26-12-34

26-13 APU FIRE DETECTION

APU FIRE DETECTION INTRODUCTION

The APU fire and overheat detection system operates on the pneumatic principle. It detects and indicates a fire or overheat condition in the APU compartment with two independent fire detection loops. The detection system is arranged with different detection levels for different combinations of fault and fire information.

The main components of the fire detection system are:

- two identical and independent fire detectors (loop A and B),
- a Fire Detection Unit (FDU),
- an APU FIRE control panel.

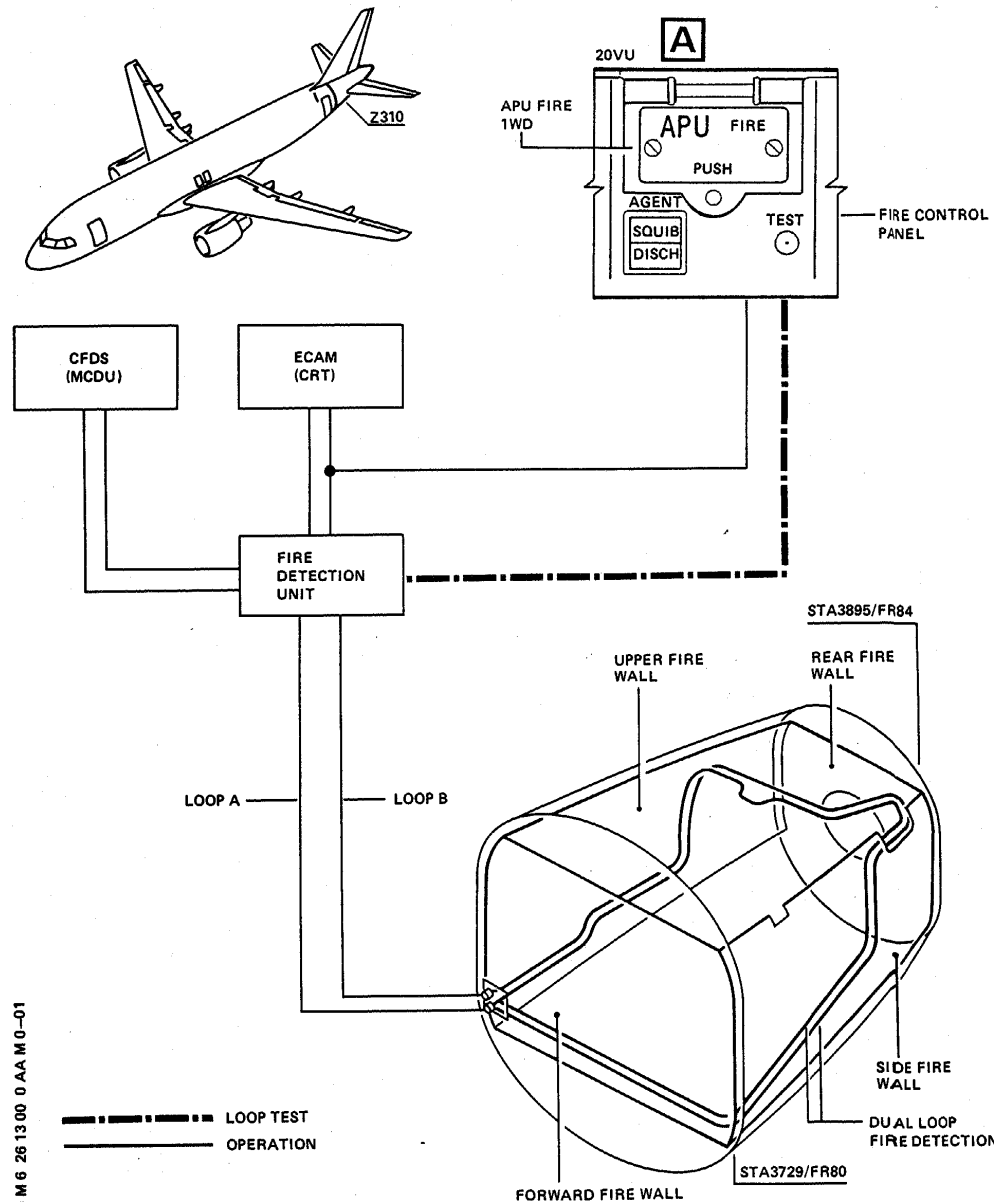


Figure 23 APU Fire Functional Schematic

APU FIRE/LOOP/DETECTION FAULT

- STATUS
- INOP SYS: APU FIRE DET

APU Fire

The FIRE warning signals thus generated are transmitted to the cockpit, at the following locations:

- APU/FIRE control panel : APU/FIRE pushbutton switch
- MASTER WARN lights
- EWD: APU FIRE and fire extinguishing procedure
- SD: APU page.

The Continuous Repetitive Chime (CRC) sounds.

The fire warning signal is created by the channels A and B, if one of these conditions appears:

- Fire A and Fire B,
- Fire A and Fault B,
- Fault A and Fire B,
- Fault A and Fault B in less than 5 sec.

Loop Fault Warnings

The loop fault warning is provided when one detection loop is faulty. The loop fault warnings are:

- On the EWD appears:
 - APU FIRE LOOP A (B) FAULT
- On the SD appears:
 - STATUS
 - INOP SYS: APU LOOP A(B)

Detection Fault

The fire detection fault warning is provided when both loops are faulty. The fire detection fault warnings are:

- on the glareshield panels :
 - the MASTER CAUT lights come on,
 - a Single Chime (SC) sounds.
- on the EWD appears:
 - APU FIRE DET FAULT
- On the SD appears:

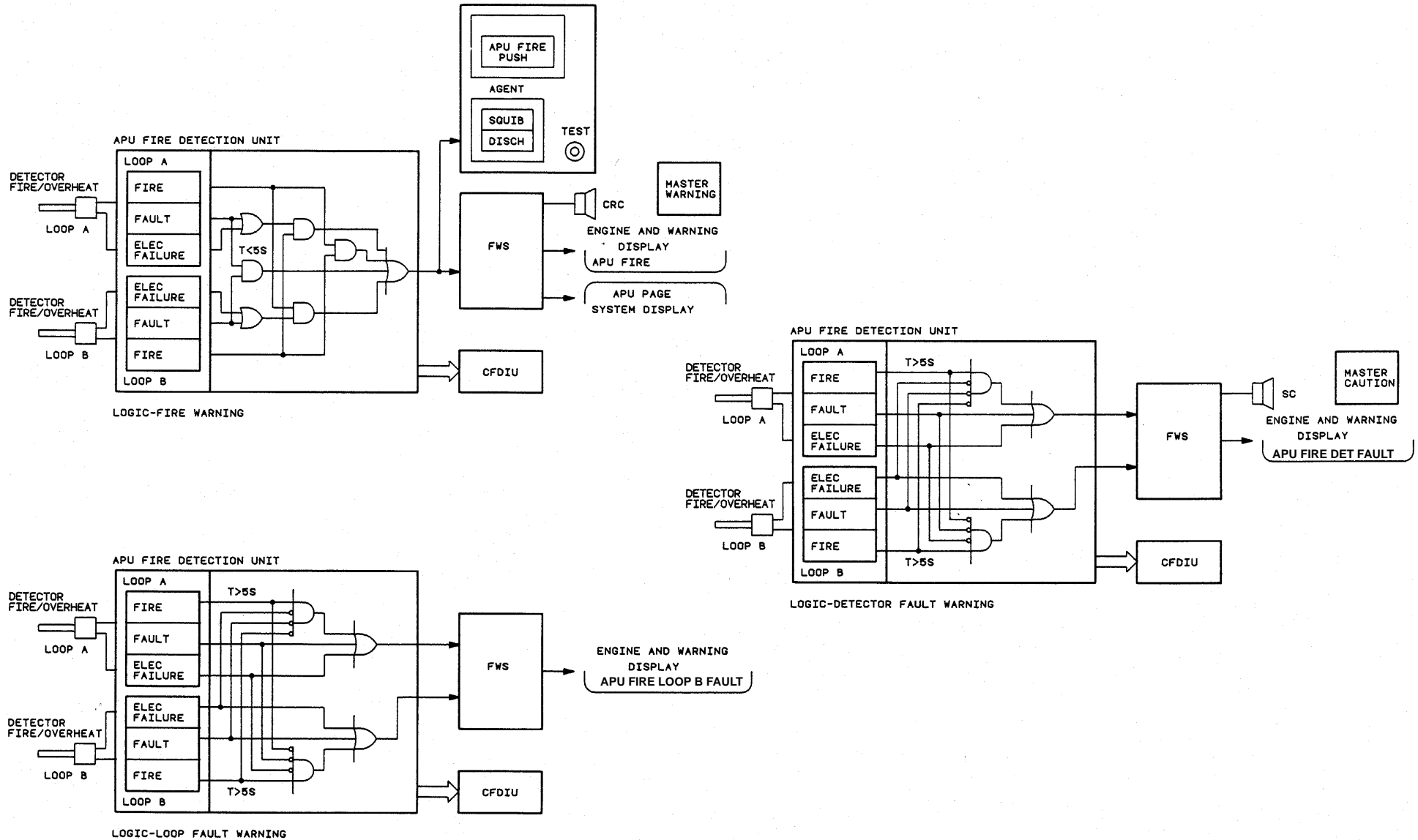
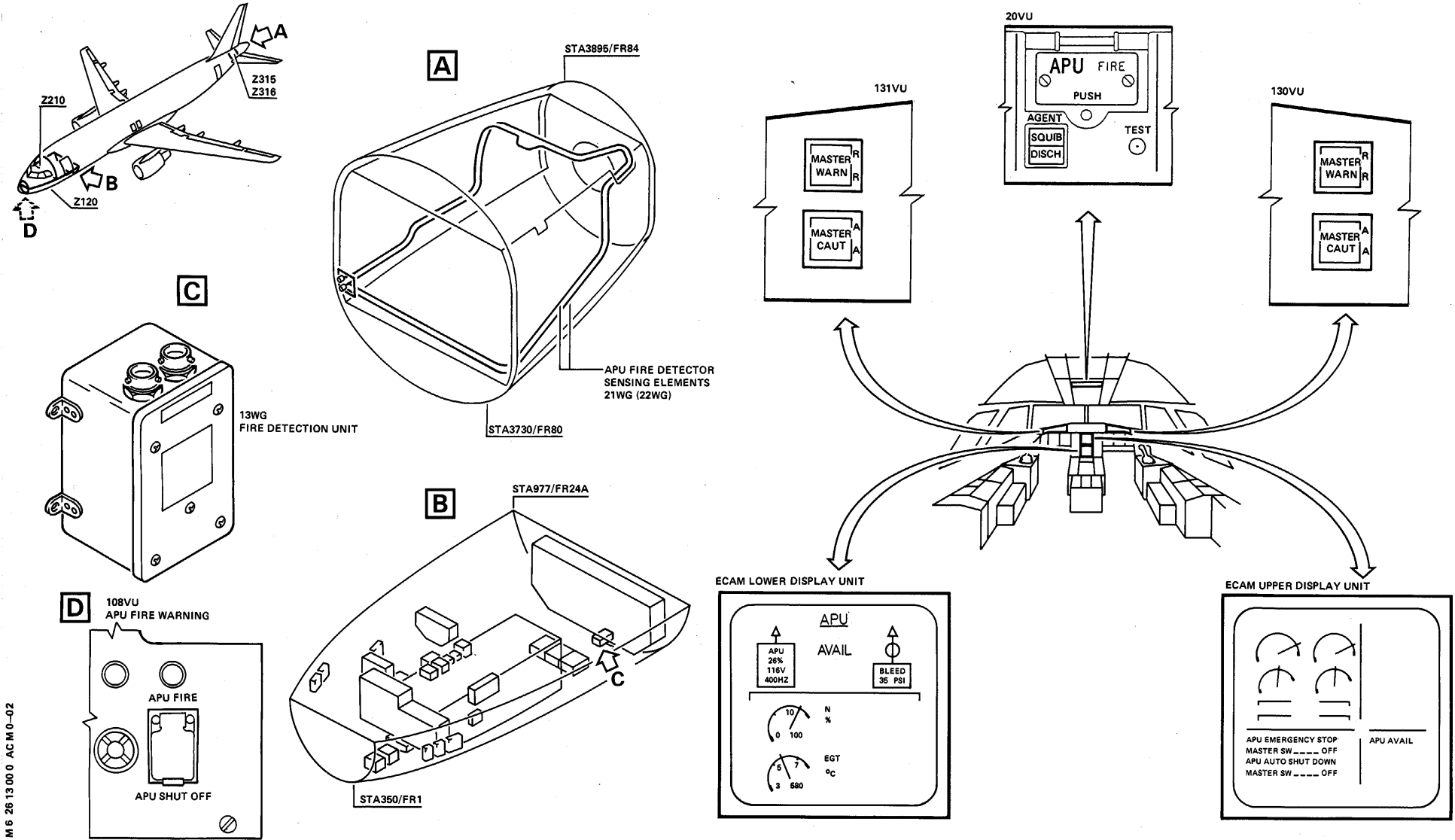


Figure 24 APU Fire Detection Logic



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Figure 25 APU Fire Component Location

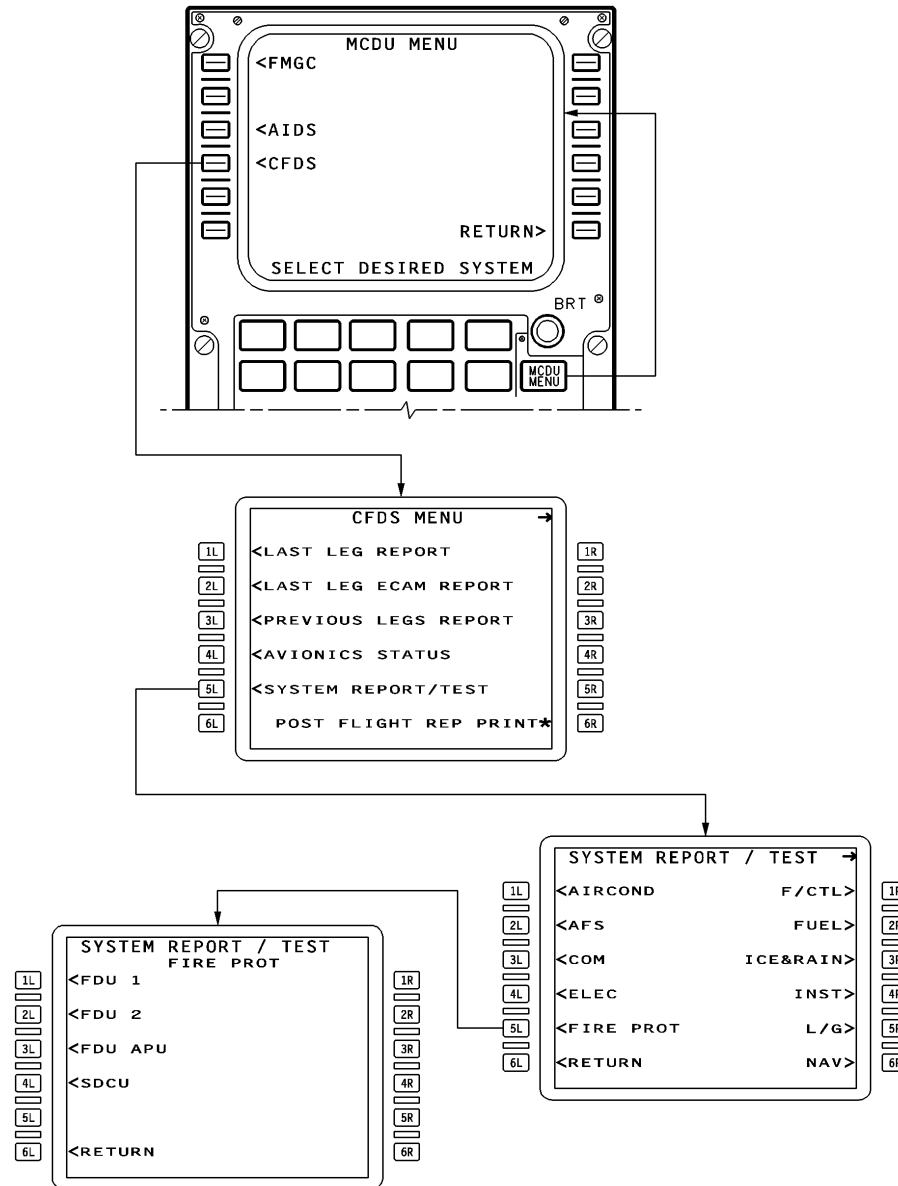


Figure 26 Fire Detection Unit Bite Test

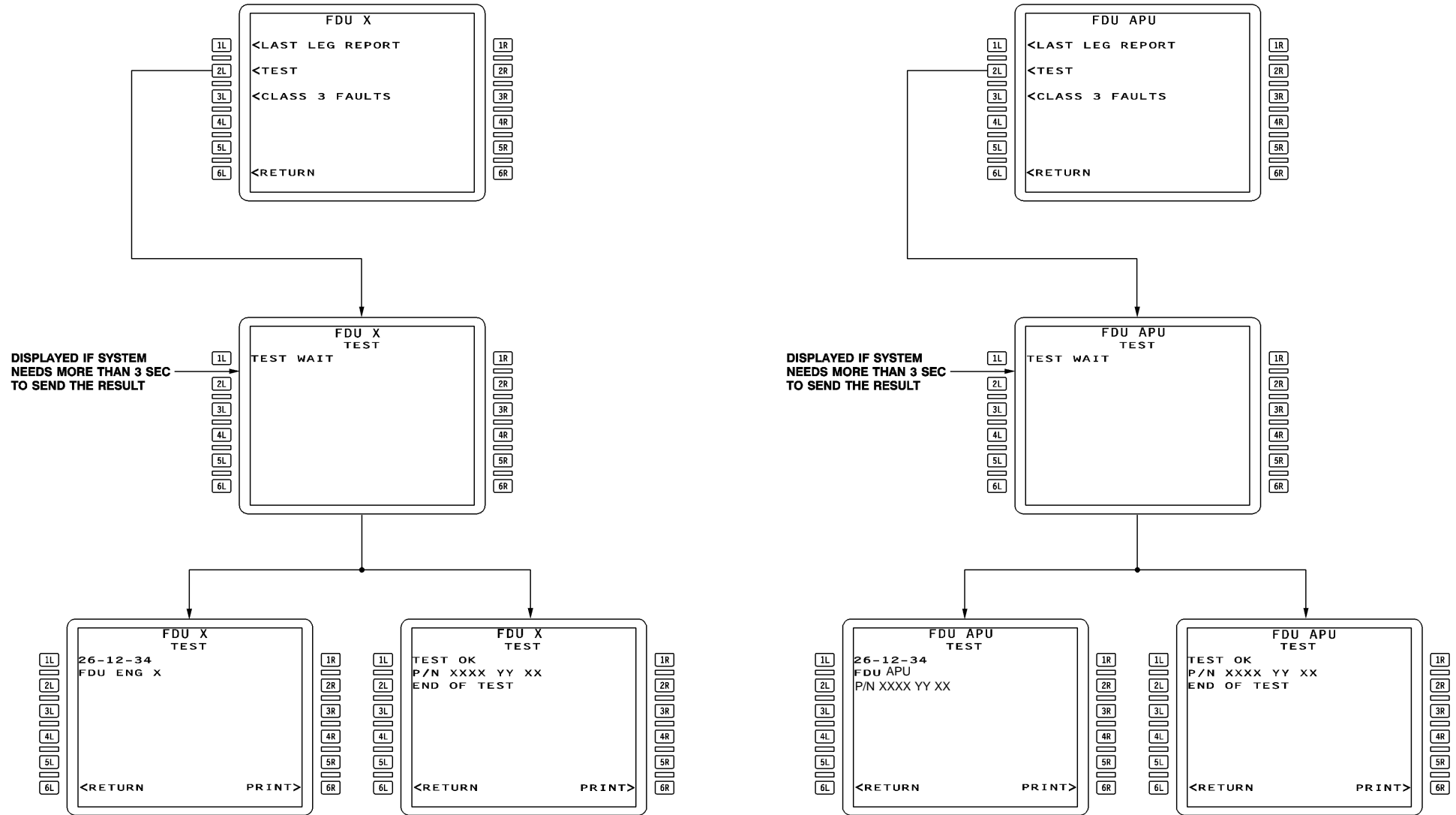


Figure 27 Fire Detection Unit Bite Test cont.

26-15 AVIONIC SMOKE

SYSTEM DESCRIPTION

The avionics compartment smoke detection system has one smoke detector. The smoke detector detects smoke in the avionics compartments (included cockpit panels). The smoke detector is installed at the air extraction duct. Piccolo tubes, which are installed in the extraction duct, connect the smoke detector with the extraction duct. When smoke appears in the avionics compartment the avionics compartment ventilation system removes it through the extraction duct. The piccolo tubes pass the air particles into the smoke detector. The smoke detector detects the smoke and transmits signals to :

- The Avionics Equipment Ventilation Computer (AEVC)
 - the overhead Ventilation control panel, it shows the applicable BLOWER and EXTRACT FAULT indication.
- The Electrical Power System,
 - the overhead panel EMERG ELEC PWR, it shows the applicable SMOKE indication, in the GEN 1 LINE pushbutton switch.
- the Flight Warning Computer (FWC), it displays on the Engine/Warning Display (EWD) the applicable warning message.

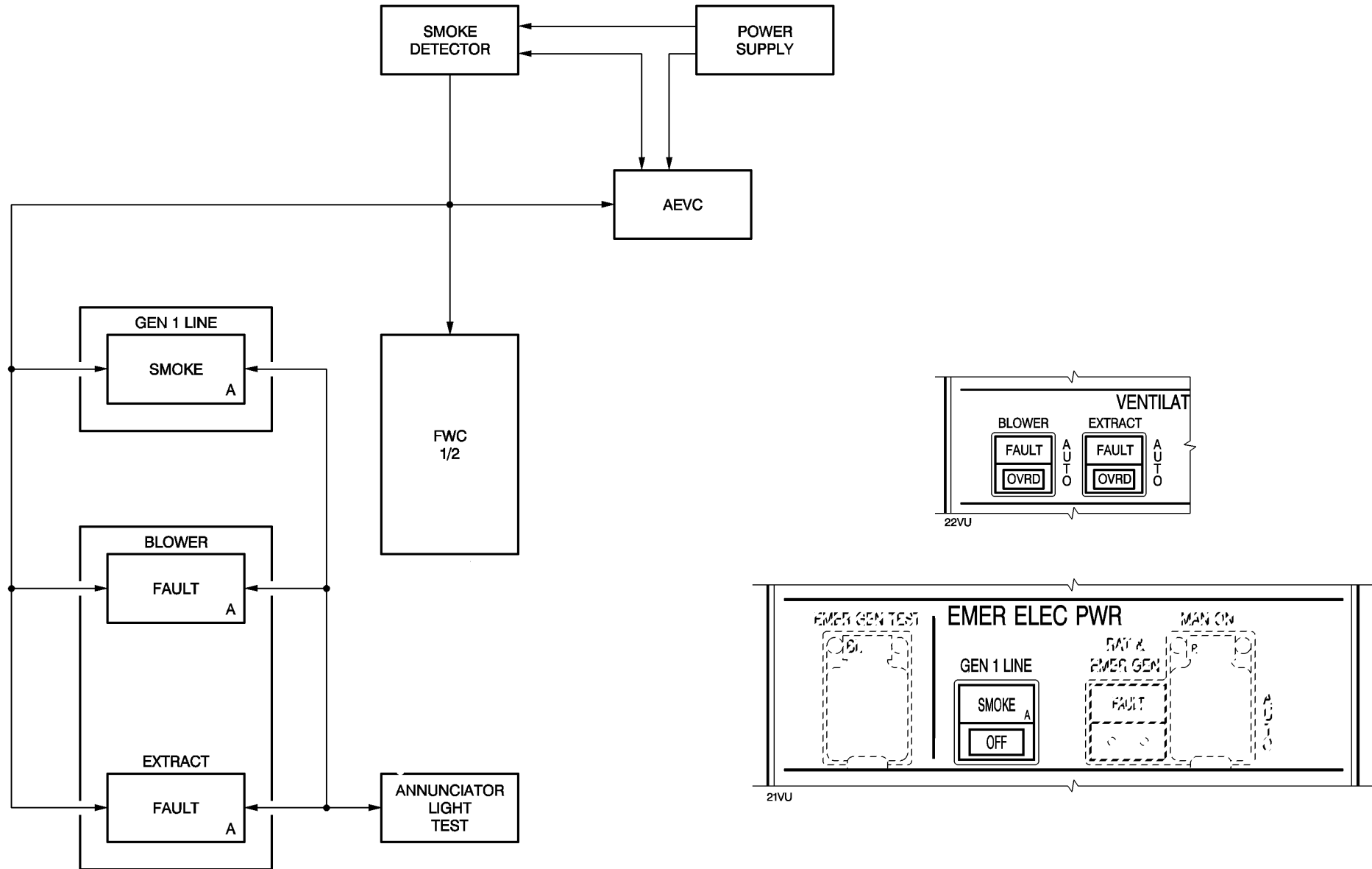


Figure 28 Avionic Smoke Detection System Schematic



Student Note

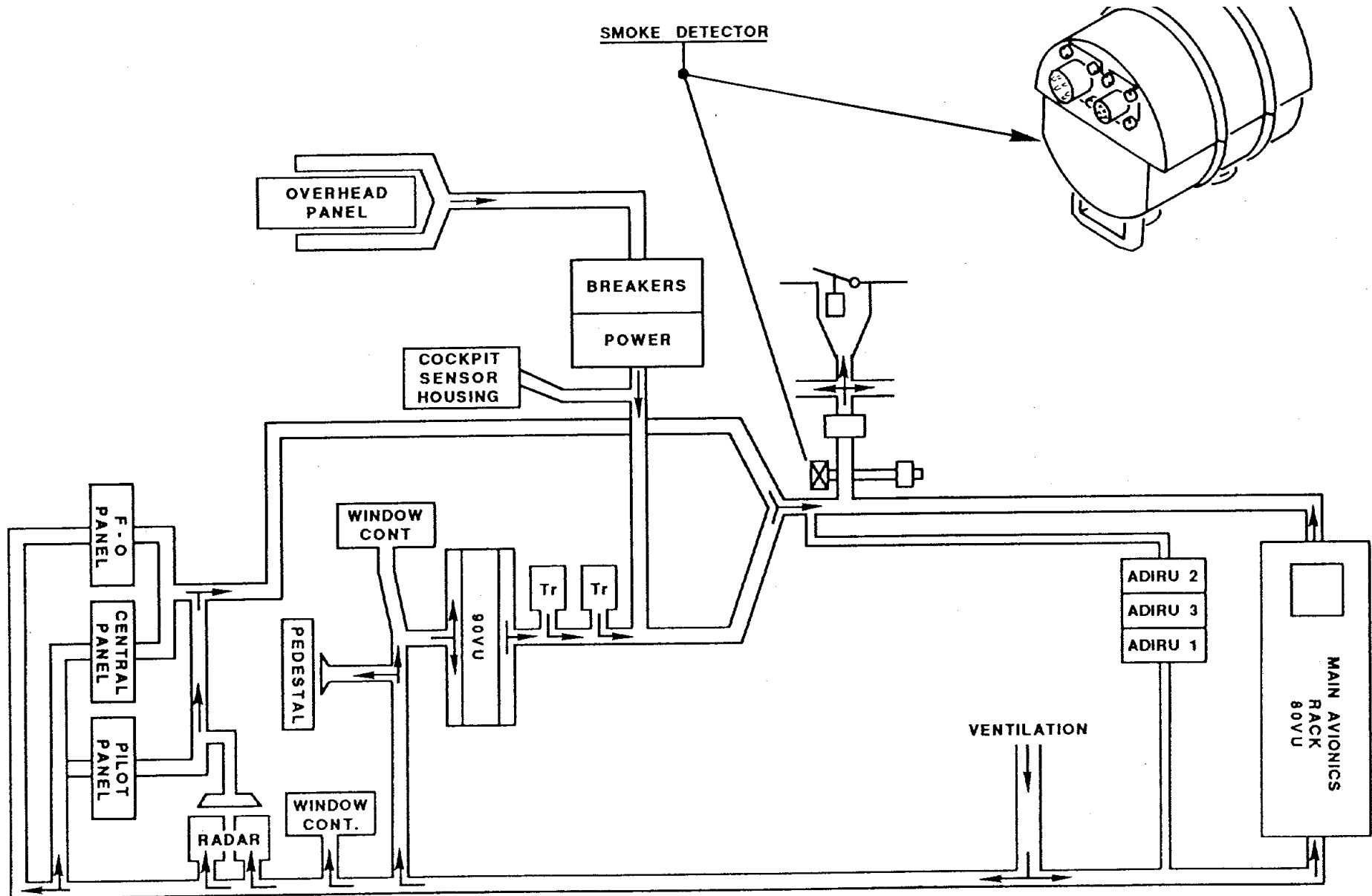


Figure 29 Avionic Ventilation Diagramm

AVIONIC SMOKE PNEUMATIC PROCEDURE

The avionics-compartment smoke-detection system confirms smoke in the avionics compartment. The smoke detection system comprises one smoke detector installed on the air extraction duct. The smoke detector triggers the smoke warnings to the cockpit when the alarm threshold is reached. In case of smoke, pneumatic procedures are initiated.

Avionic ventilation is provided by air conditioning system and extracted over-board:

- Valve F opening,
- valve B partial opening,
- valves A, E and D closing.
- Blower fan (A) stopping,
- extract fan (B) remains energized.

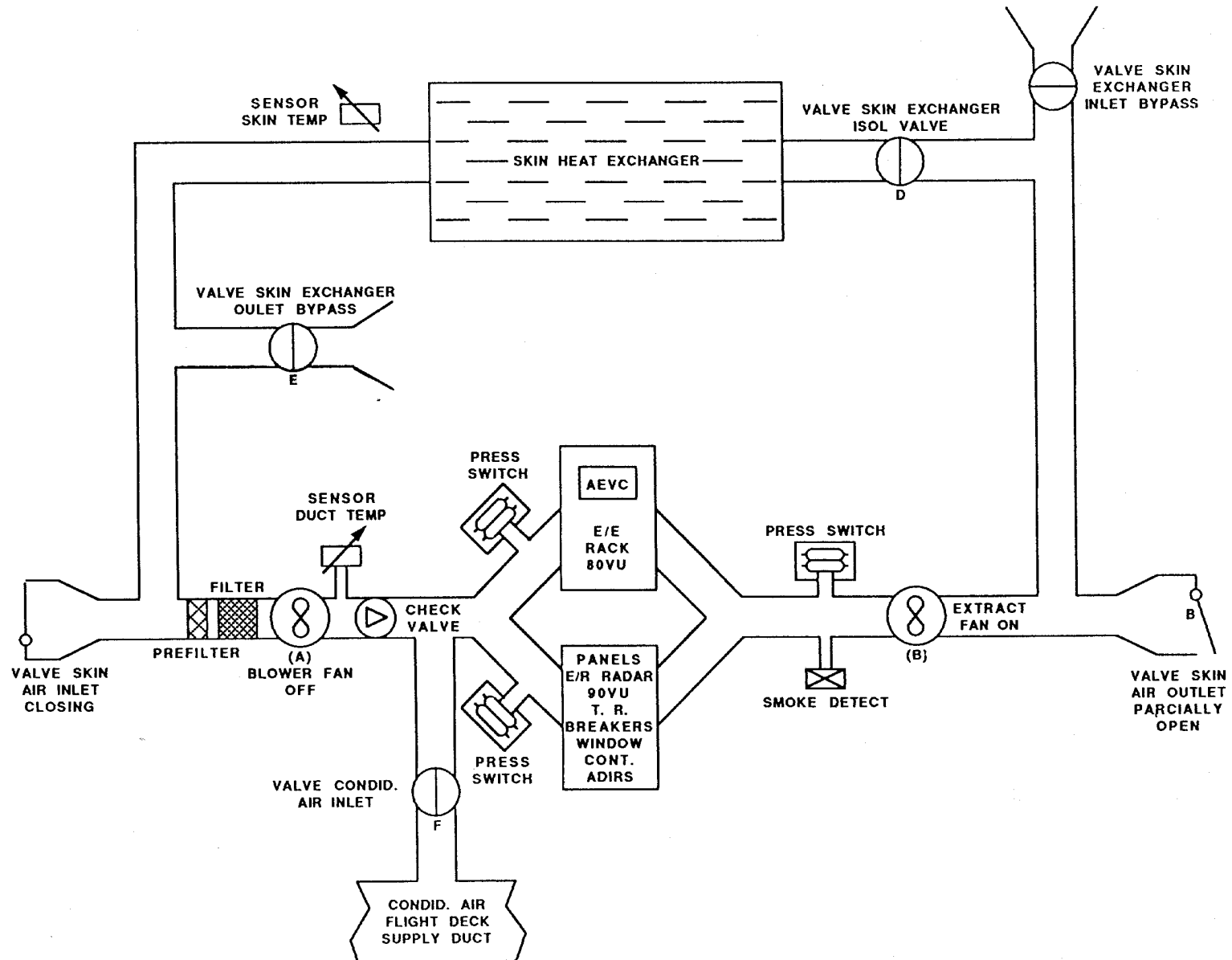


Figure 30 Avionic Equipment Ventilation

AVIONIC SMOKE ELECTRICAL PROCEDURE

An electrical procedure is applied to eliminate the cause of the smoke if the smoke emission persists more than 5 mn:

- EMERG ELEC GEN 1 LINE..OFF
- GEN 1 LINE contactor opens. GEN 1 remains in operation and supplies one fuel pump in each wing tank. AC BUS 1 is supplied by GEN 2 through bus tie contactor.
- EMER ELEC PWR.....MAN ON

The Ram Air Turbine (RAT) is extended and the emergency generator is connected to the aircraft network.

BITE/Test

Built-In Test Equipment (BITE)The smoke detector is tested by the AEVC upon manual test indication from the MCDU.

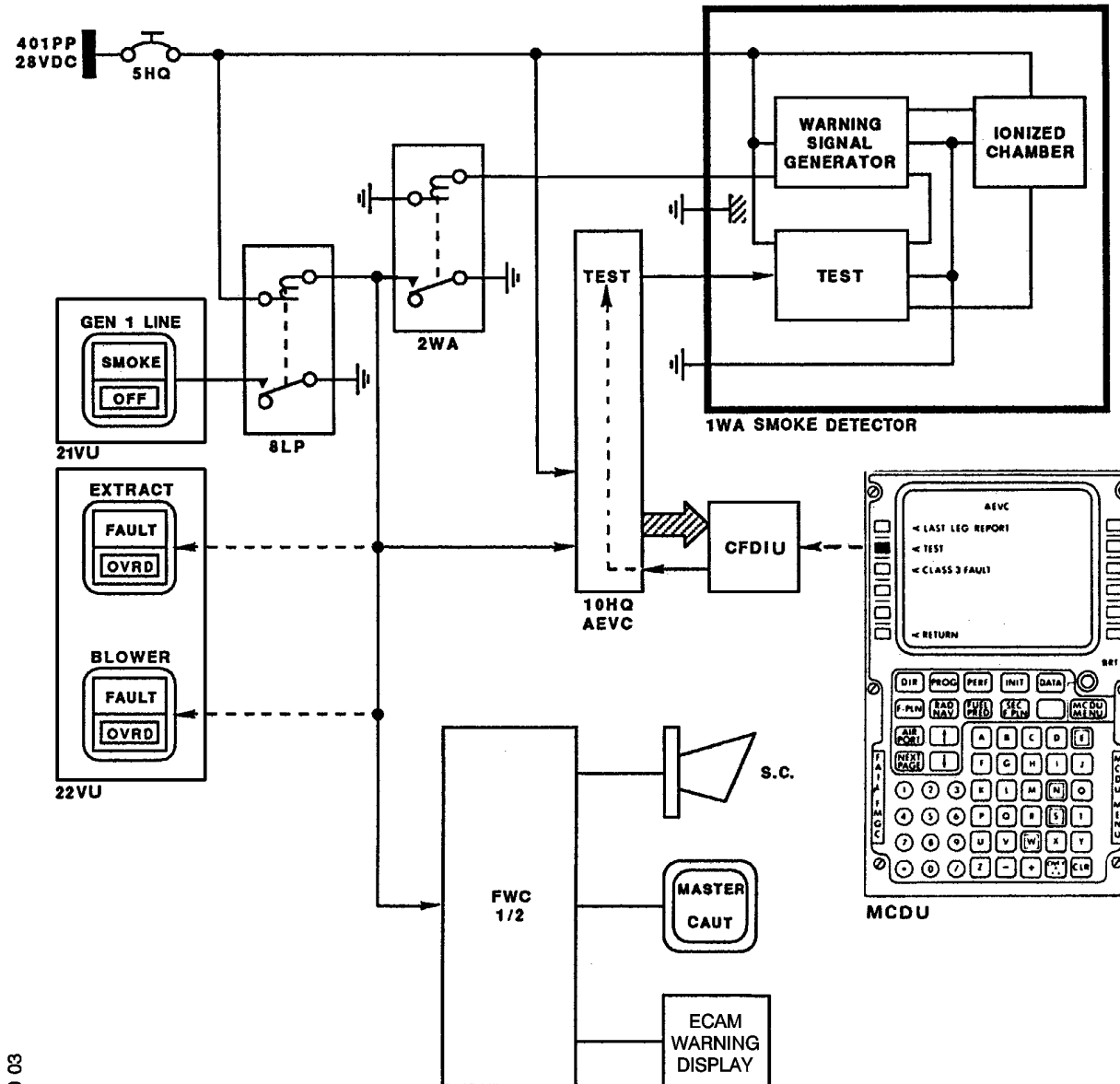


Figure 31 Avionic Smoke Det. Interface



Student Note

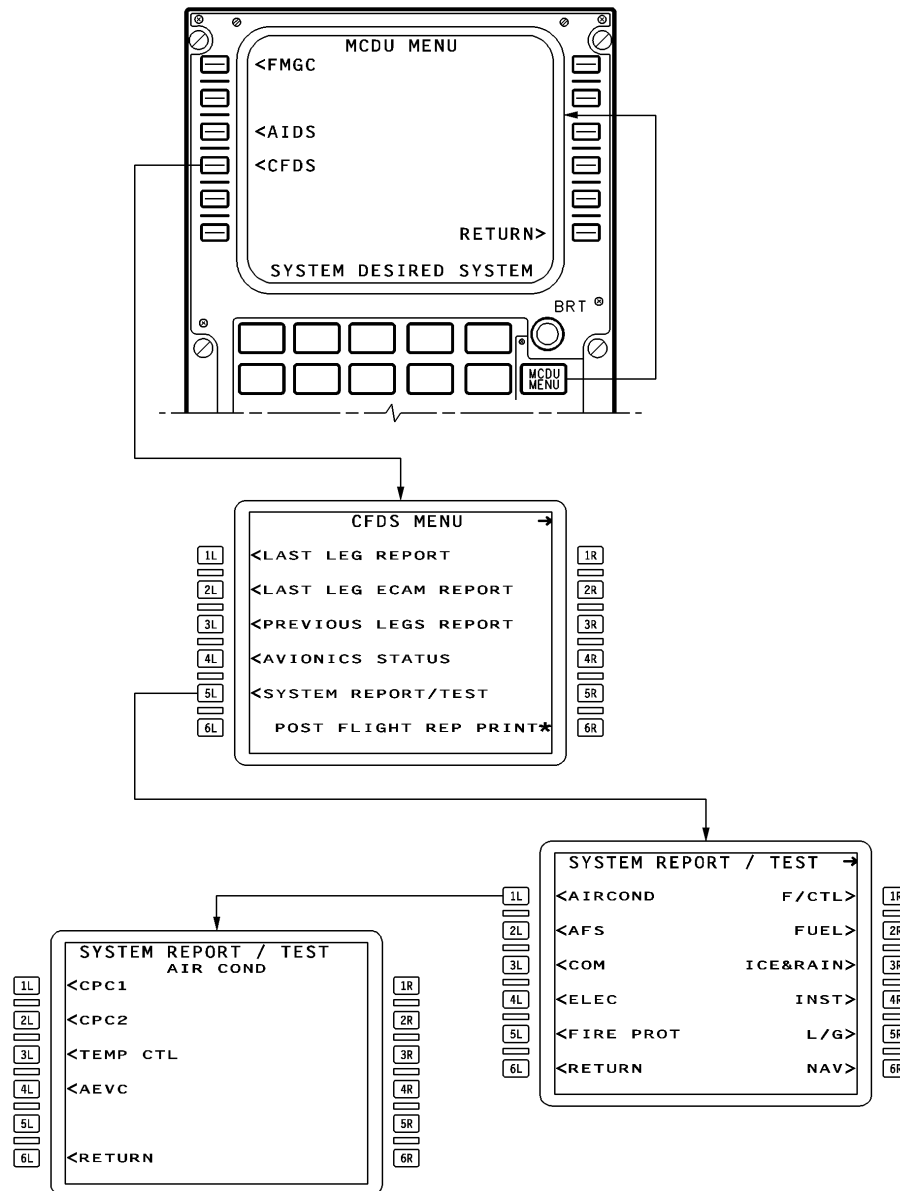


Figure 33 AEVC Bite Test

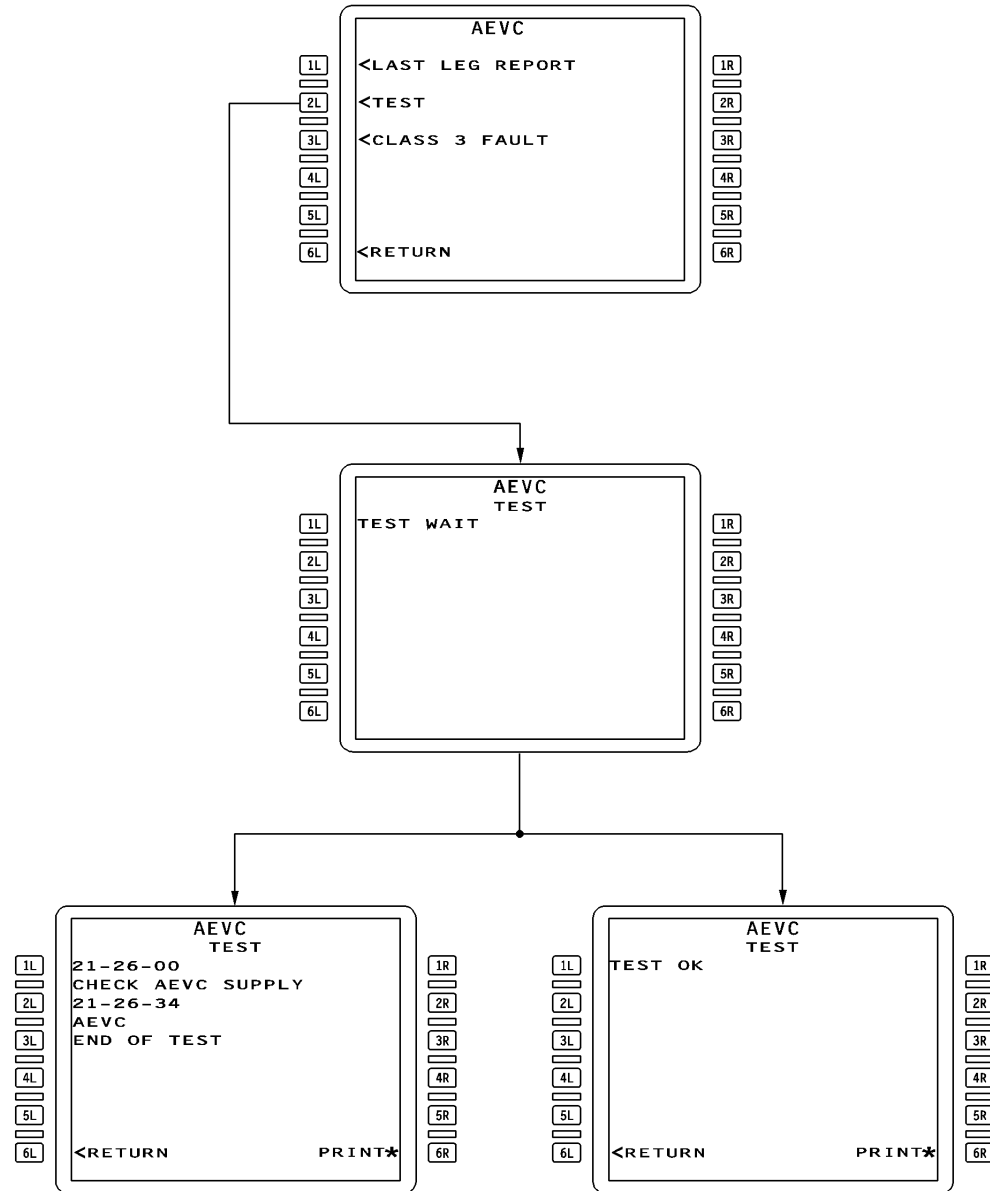


Figure 34 AEVC Bite Test cont.

26-16 LDCC SMOKE

SYSTEM DESCRIPTION

Normal Operation

Smoke detected in the cargo compartment will cause:

- the respective SMOKE warning light to come on,
- the red light in the MASTER WARNING pushbutton switch to flash,
- the aural repetitive chime to sound,
- the ECAM upper display unit to show the messages:
 - SMOKE FWD/AFT CARGO SMOKE
 - ISOL VALVE (of affected compartment) ... OFF (if not automatically closed)
 - AGENT ... DISCH .
- In case of smoke warning the isolation valves of the cargo-compartment ventilation system close automatically. They remain closed independently of the smoke warning signals.

Operation with one Faulty Smoke Detector

When only one detector sends an alarm, the SDCU checks the second detector automatically. If this test shows a normal function of the second detector, the result is no indication in the cockpit. The alarm of the detector is a false warning. If this test shows an abnormal function of the second detector, the warning signals come on . The alarm of the first detector is the correct warning.

In case of failure(s) the ECAM SD shows under MAINT STATUS : SDCU as a Class 2 failure.

System Test

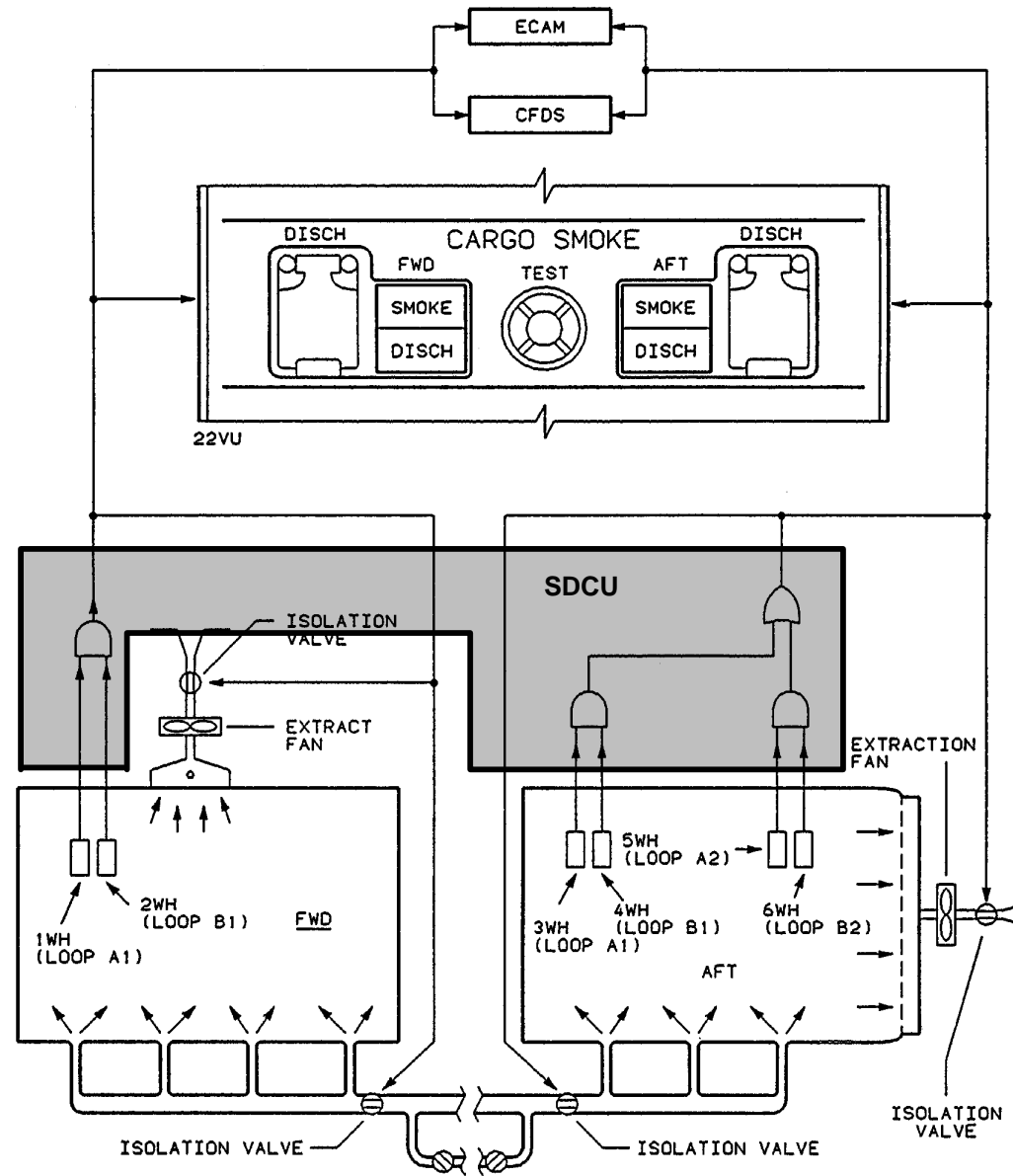
When you press the (PTT) pushbutton switch for more than 2 s a test of the smoke detectors is initiated. The SDCU tests the smoke detectors automatically.

The indications are:

- the FWD SMOKE and AFT SMOKE warning lights come on,
- twice for approx. 2 s, with a delay of approx. 5 s. in a normal condition.
The system also passes the test, when the lamps come on once in the case of:

- a wiring failure on the detector's bus system,
- a failure of one SDCU channel,
- the respective SMOKE warning light does not come on, if both smoke detectors, installed in one cavity, do not operate.

The test stops approx. 10 s after the PTT pushbutton switch is released. After the PTT pushbutton is pressed, the isolation valves of the cargo-compartment ventilation-system close and the extraction fan stops . When the test stops, the isolation valves open and the extraction fan starts. The information is stored in the Centralized Fault Display System (CFDS).



NOTE: Ventilation in the Fwd Cargo Compartment is optional

Figure 35 LDCC Smoke Det. Block Diagramm



Student Note

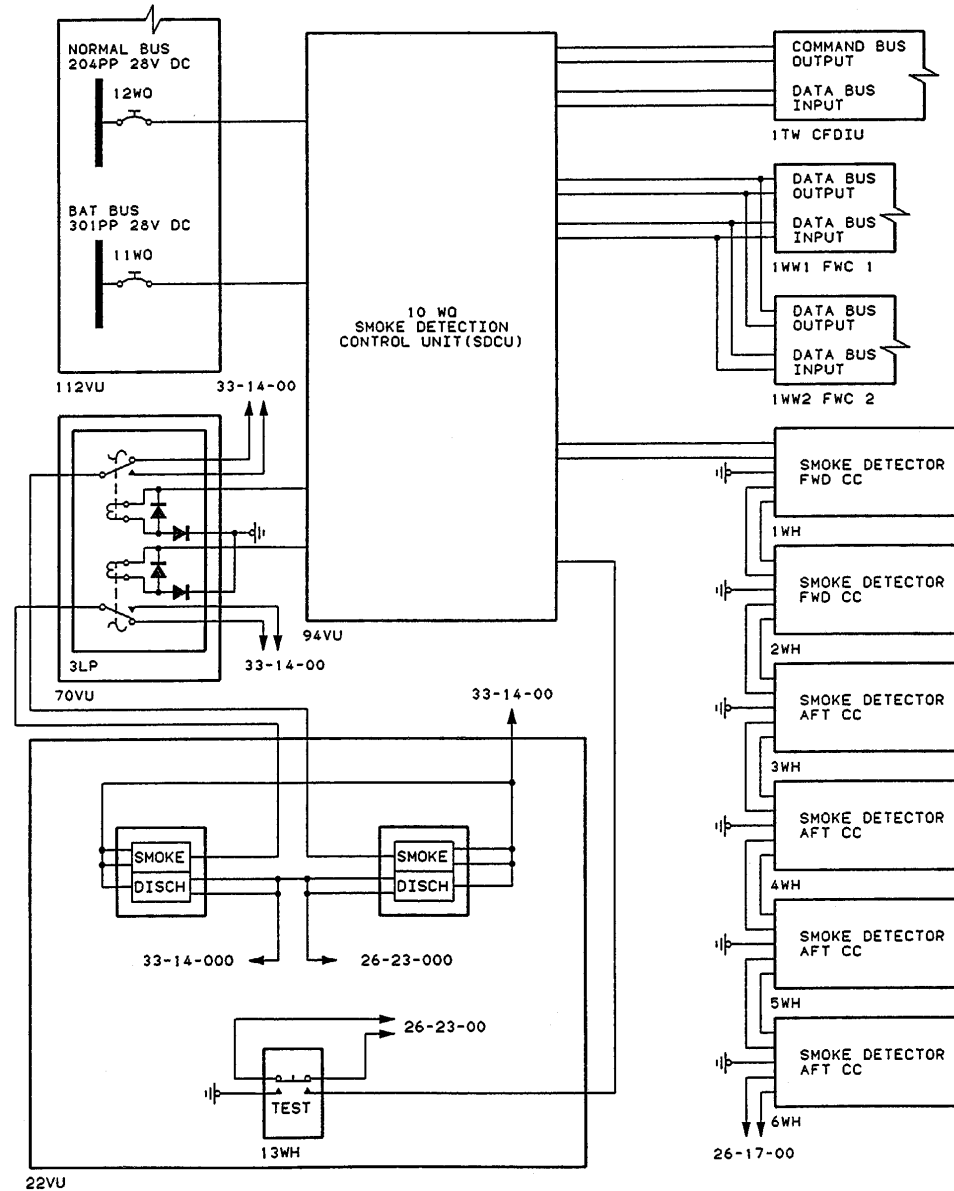


Figure 36 LDCC Smoke Detection Schematic

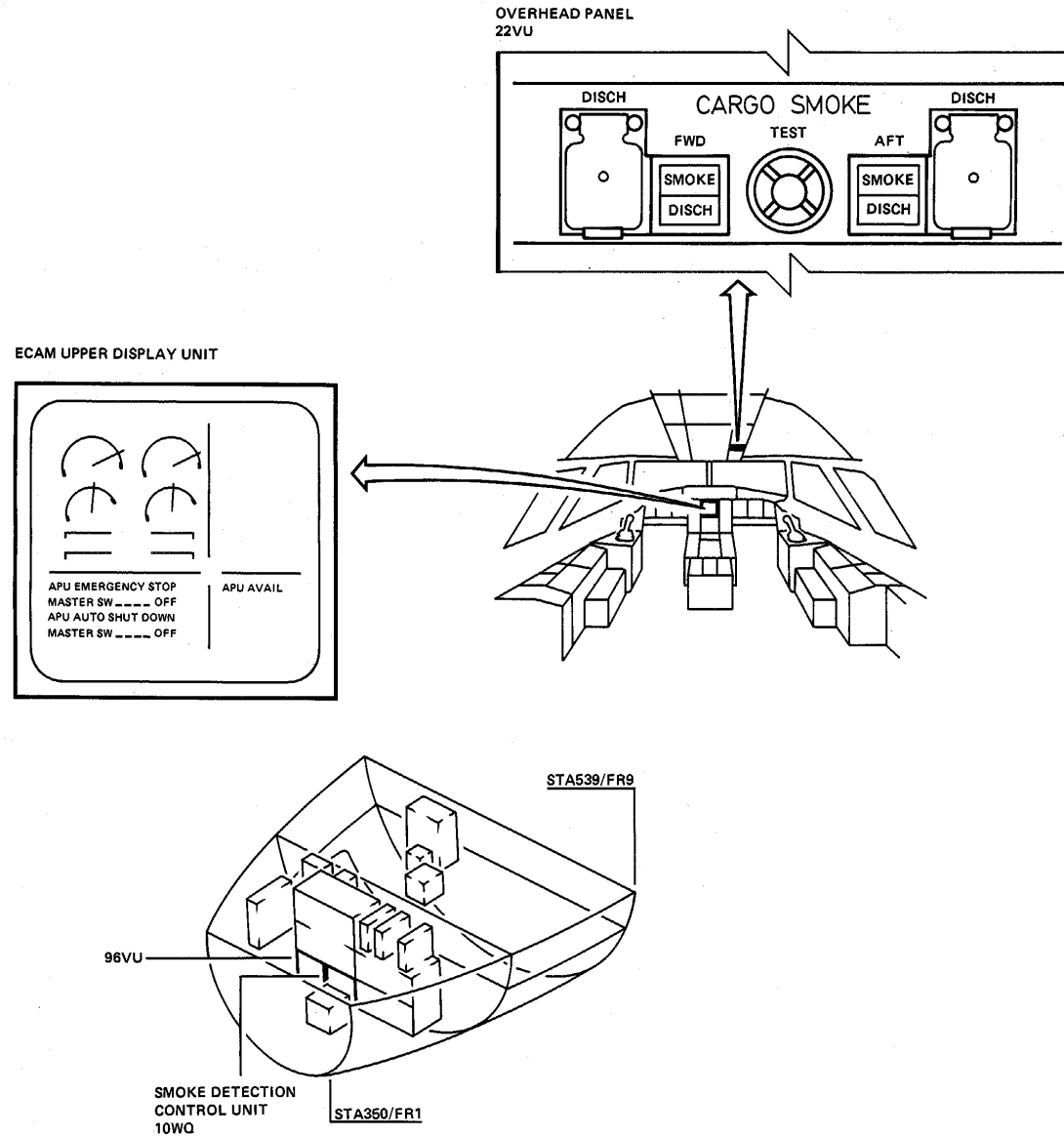


Figure 37 LDCC Component Location

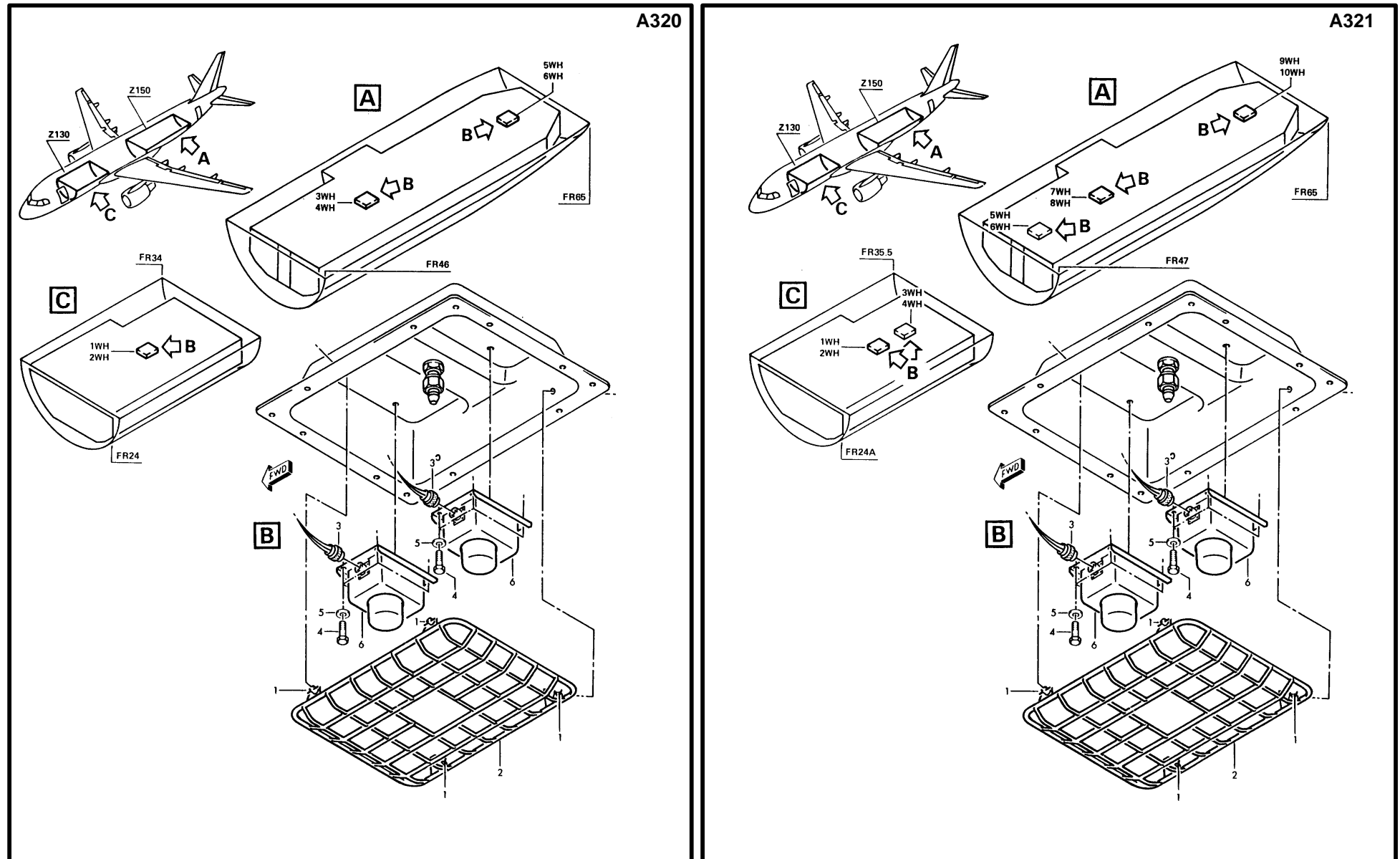


Figure 38 LDCC Smoke Detector Location

26-17 LAVATORY SMOKE

SYSTEM DESCRIPTION

General

The lavatory smoke-detection system detects smoke in the lavatories and sends a signal to the Smoke-Detection Control Unit (SDCU). The detectors are of the ionization type. A safety bus system connects the detectors to the SDCU.

Normal Operation

The smoke detection system has a detector installed in each lavatory ceiling in the air outlet cavity. The detectors are of the ionization type. A safetybus system is used to connect the detectors to the SDCU. The detectors send electrical signals to the SDCU. The SDCU is installed in the avionics compartment. The SDCU has two channels which are the same but operate independently.

When the SDCU receives the smoke signal from one detector it supplies a smoke warning signal to:

- the Flight Warning Computer (FWC), it displays on the Engine/Warning Display (EWD) the applicable warning message,
- the Cabin Intercommunication Data System (CIDS), it shows on several panels in the cabin in which lavatory the smoke is detected.

Abnormal Operation

When the SDCU receives a fault signal from the detector it supplies a fault signal to:

- the FWC, it shows the applicable message on the SD (STATUS Page) under MAINT STATUS,
- the Central Fault Display Interface Unit (CFDIU), it shows the relevant fault message on the Multipurpose Control and Display Unit (MCDU).

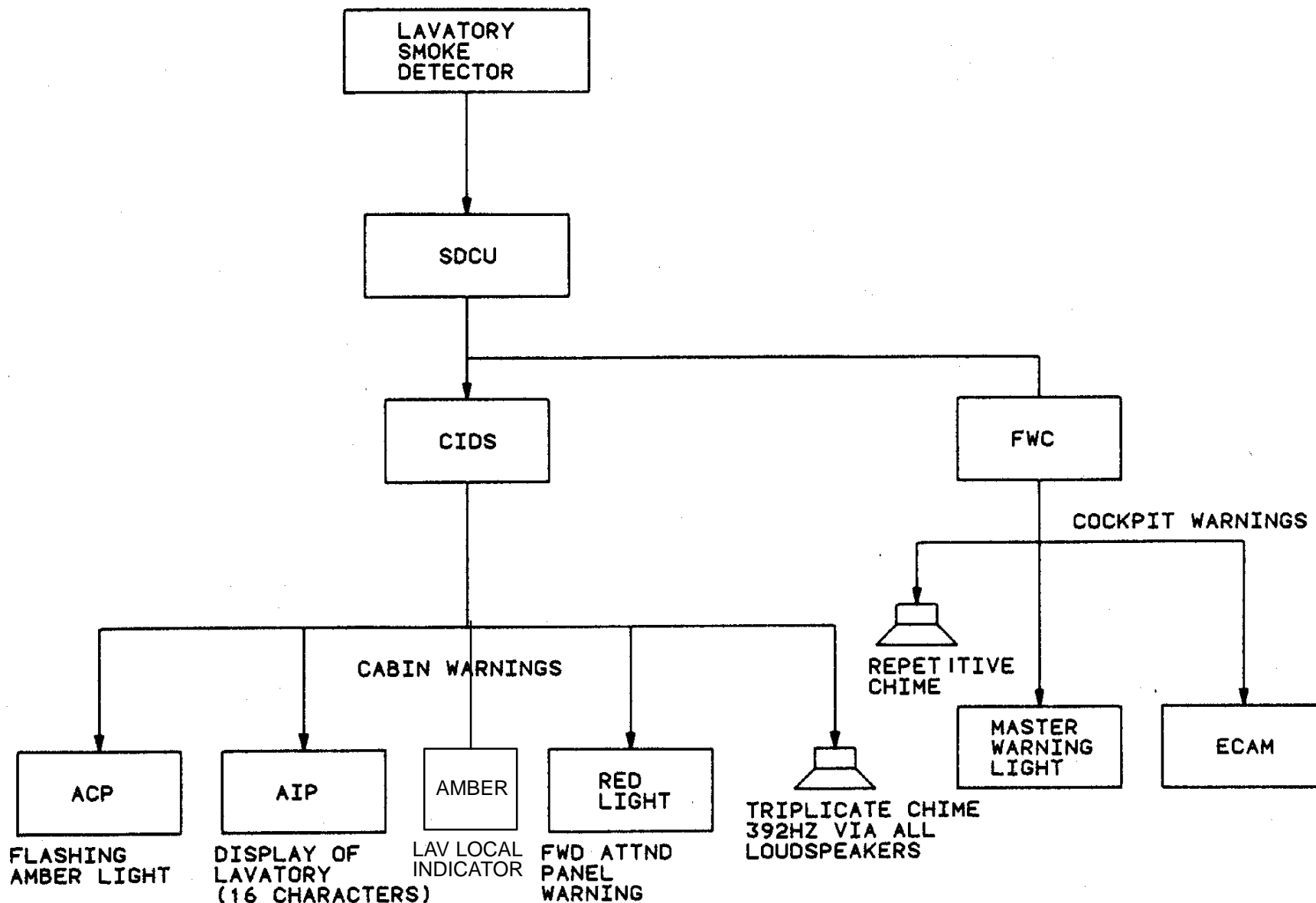
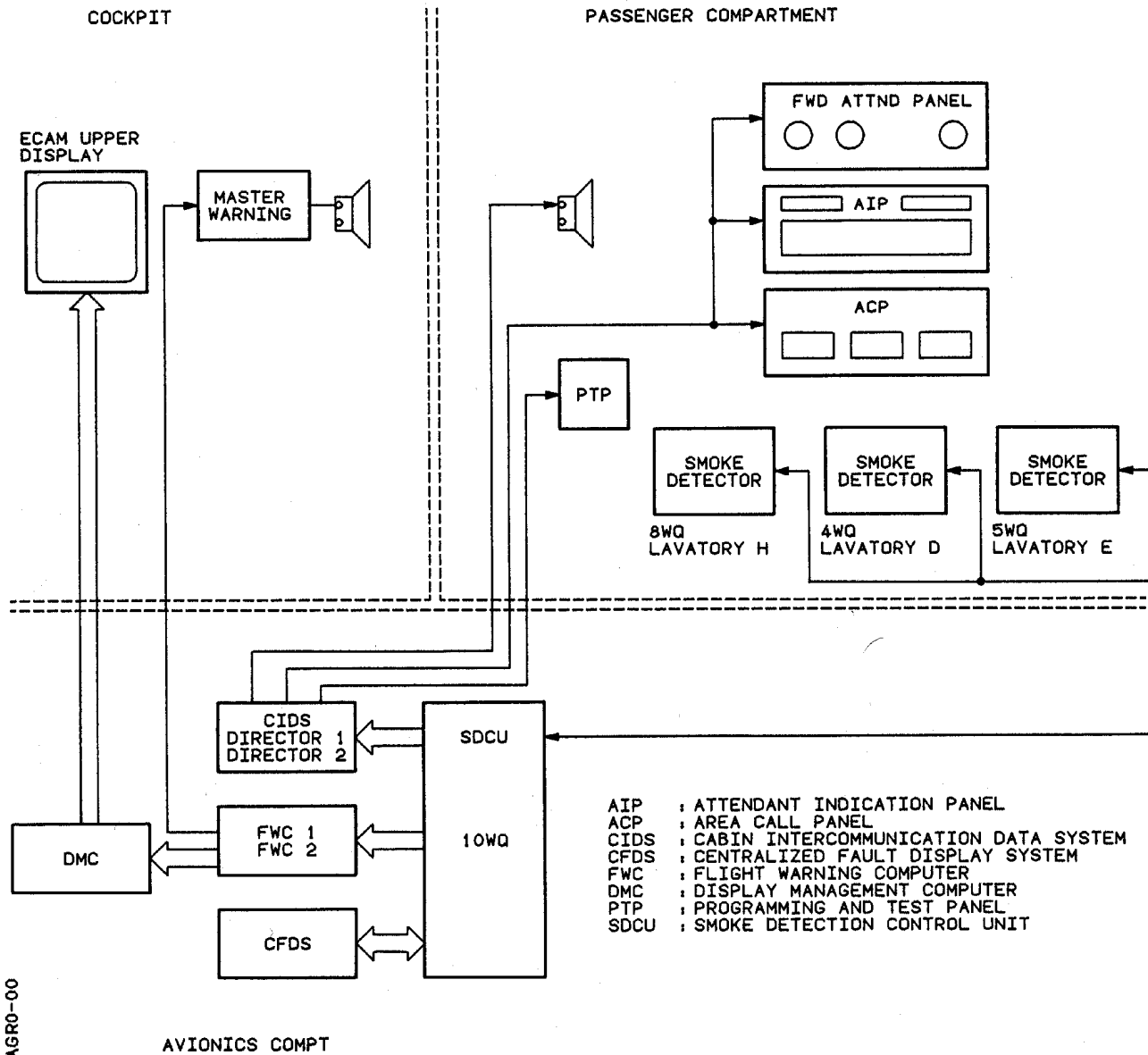


Figure 39 Lavatory Smoke Block Diagramm



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Figure 40 SDCU Smoke Warning and Signalisation

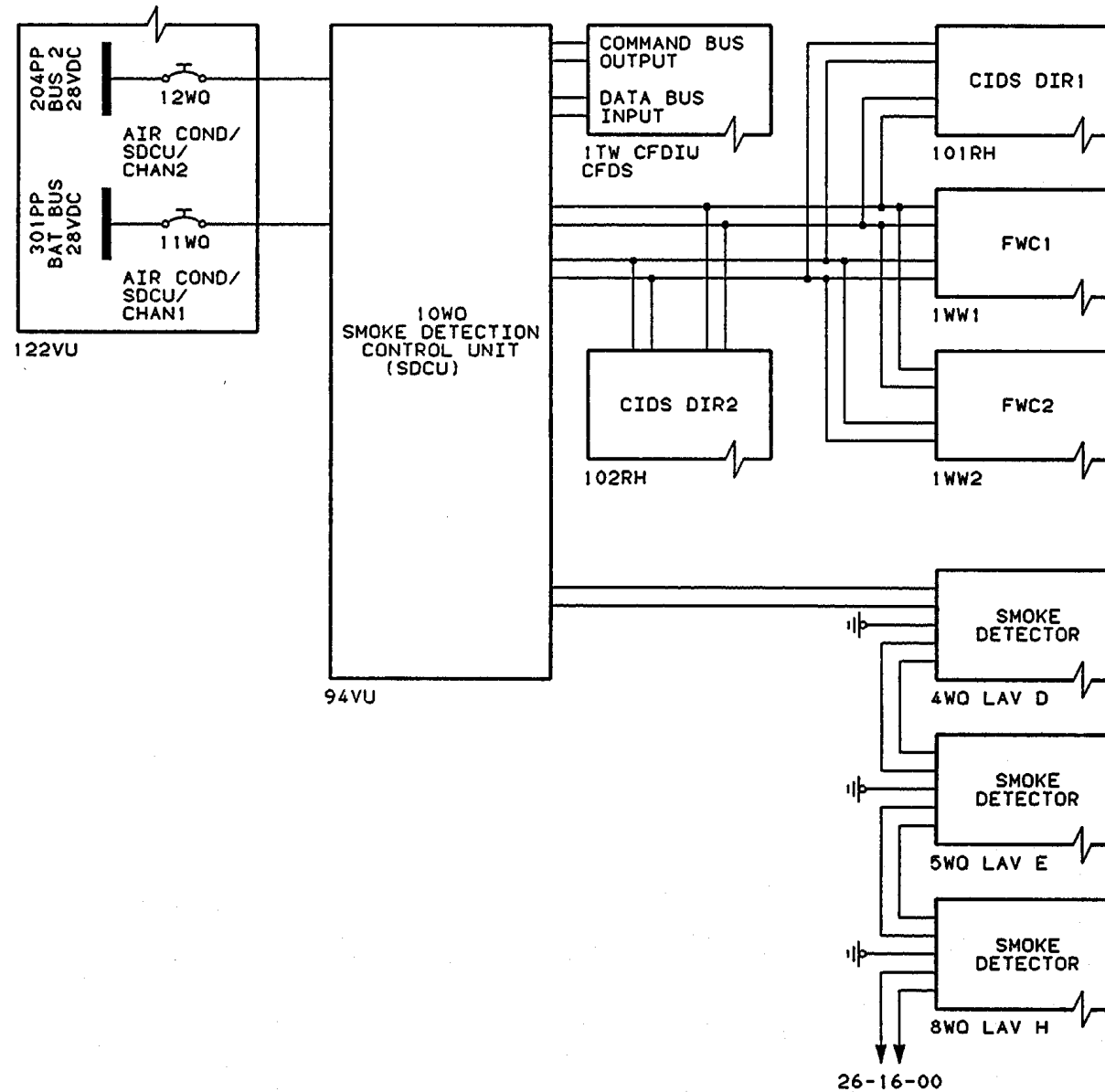
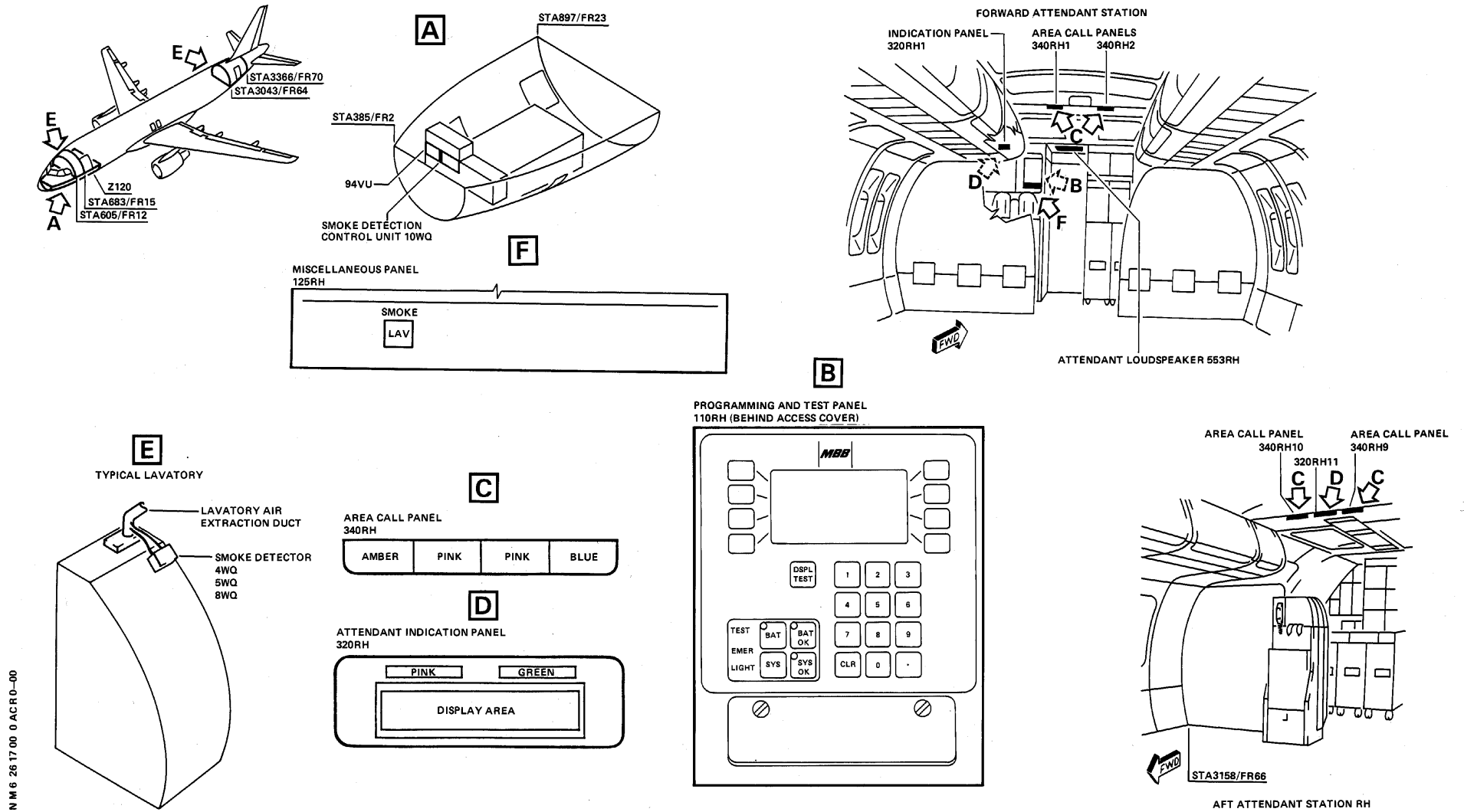


Figure 41 Lavatory Smoke Detection Schematic



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Figure 42 Lavatory Smoke Component Location

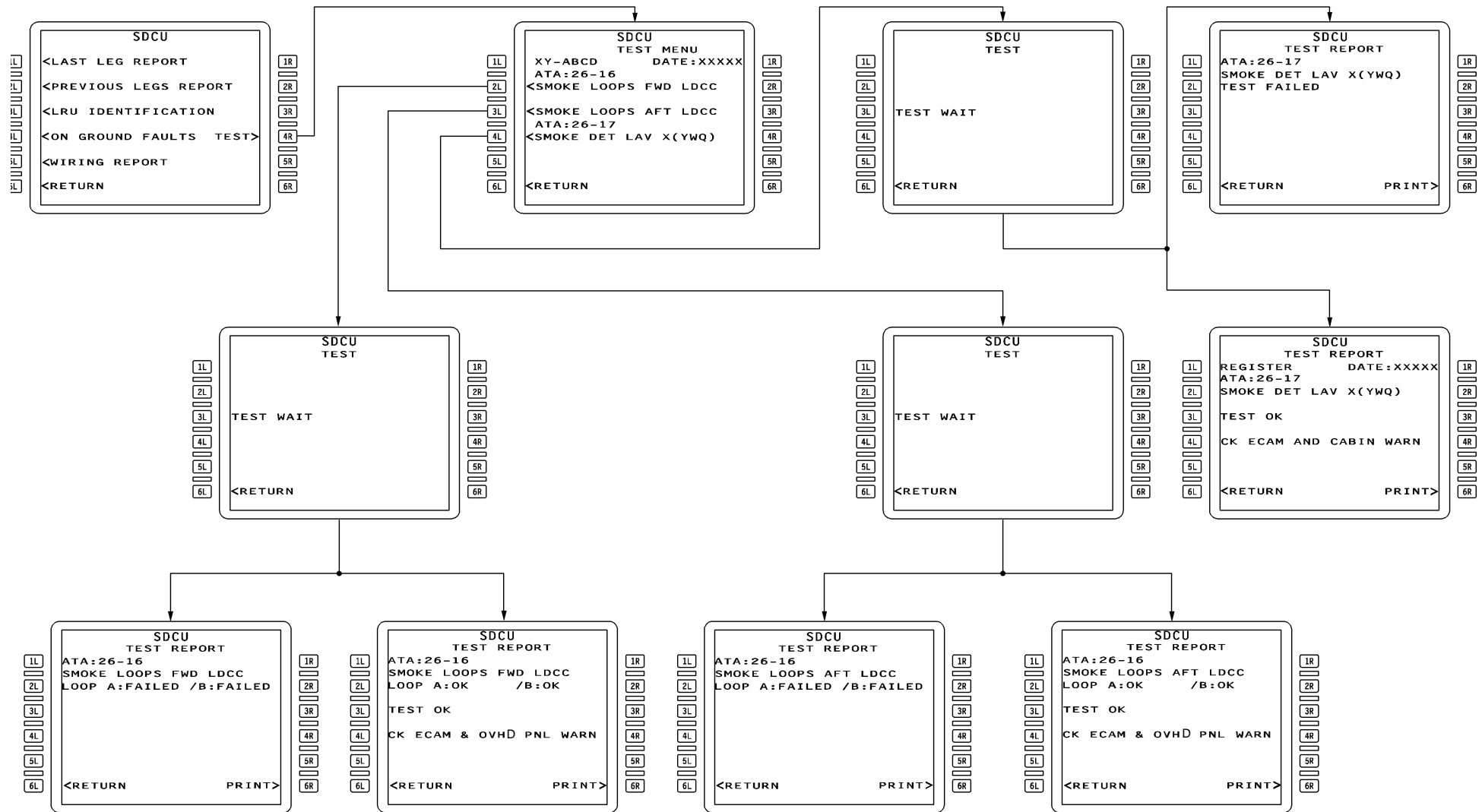


Figure 43 SDCU Bite Test

26-21 ENGINE FIRE EXTINGUISHING

SYSTEM DESCRIPTION

General

The fire extinguishing system is activated when a fire is detected by the fire and overheat detection system (Ref. ATA chapter 26-12). The system has two main functions:

1. to extinguish at its early stage any fire occurring in the nacelle protected zones.
A fire can be due to excessive overheat or flammable fluid leaks and can endanger the aircraft safety.
2. to prevent engine fire from spreading:
the engine is isolated from the rest of the aircraft ; the various supplies such as hot air, fuel, hydraulics, electrical power are closed.

Operation

After activation of the engine fire warning:

- throttle lever pulled to : Idle and
- ENG.MASTER switch : OFF,
- fire pushbutton will be activated (unlocked and pushed), :
 - LP Fuel Shutoff Valve : closed,
 - generator : deenergized,
 - bleed air : shutoff,
 - corellating pack valve: closed,
 - SQUIB-Lights of the AGENT-Disch Switches : On
- the first fire ext. bottle will be fired by the AGENT1 Switch .
- when the fire is not extinguished within 30 sec

the second fire extinguisher bottle will be fired by AGENT 2 Switch.

- Bottle discharge will be indicated by DISCH-lights (low pressure warning) .

After activation of fire warning the fire procedure is shown on ECAM. When the required action is performed the result is shown on ECAM.

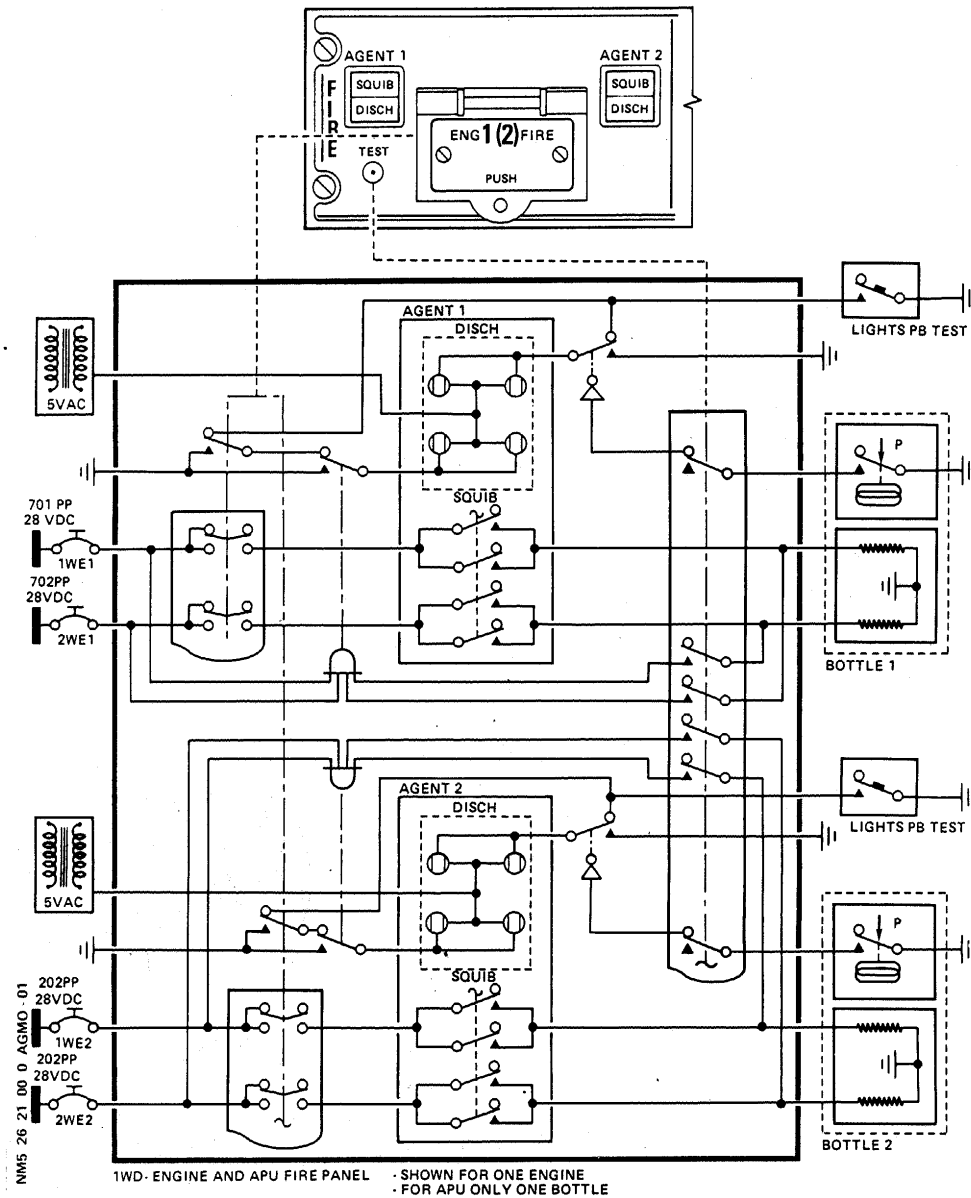


Figure 44 Engine Fire Extinguishing Schematic

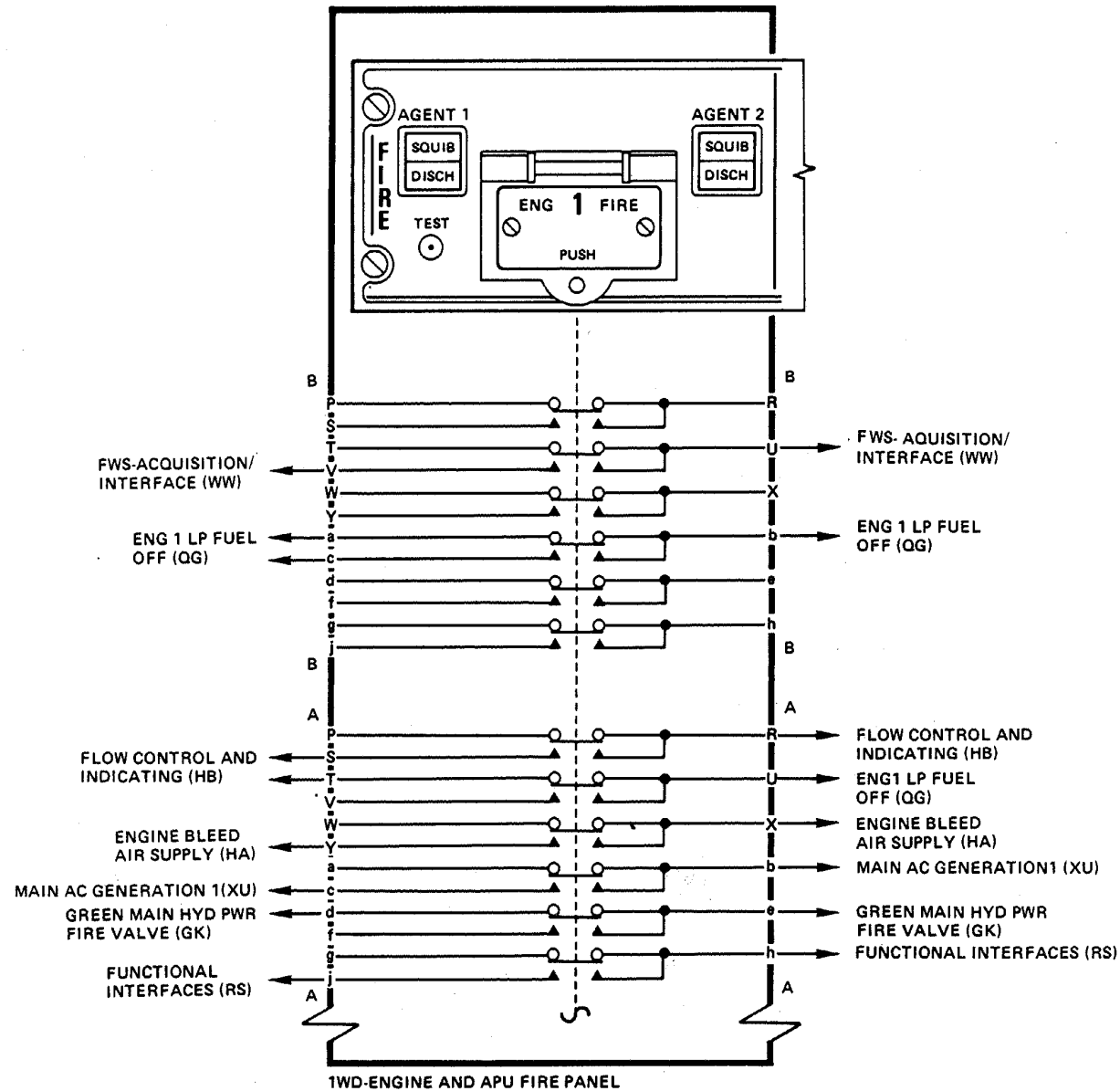


Figure 45 Engine Fire Pushbutton Switch

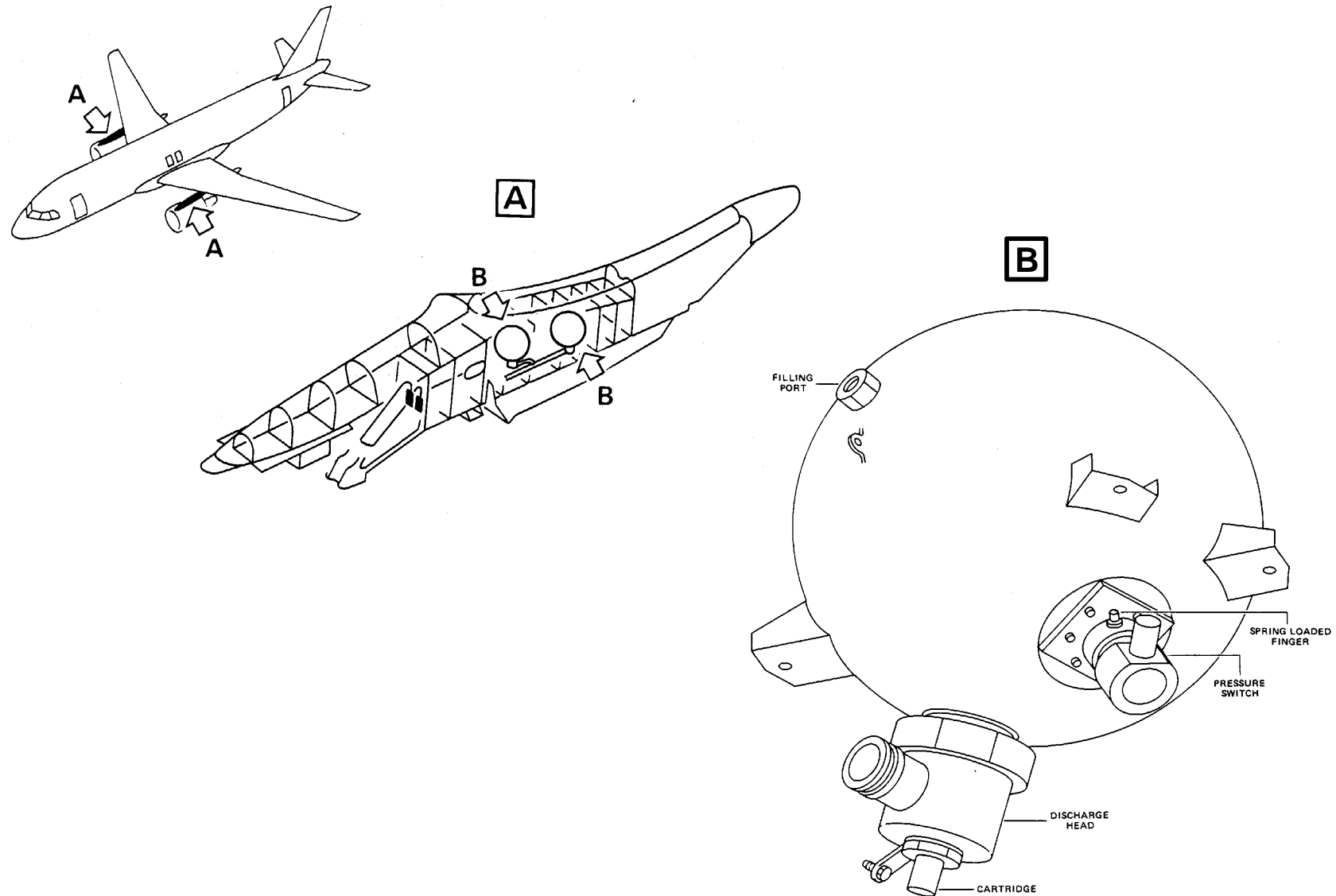


Figure 46 Eng.Fire Ext.Bottle Location

**Test of the Pressure Switch**

The pressure switch located on the fire extinguisher bottle is fitted with a manual test device. A spring loaded finger is required to do the test.

The manual test checks the condition of the electrical contact.

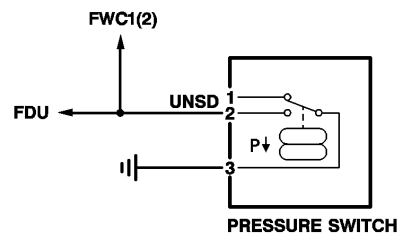
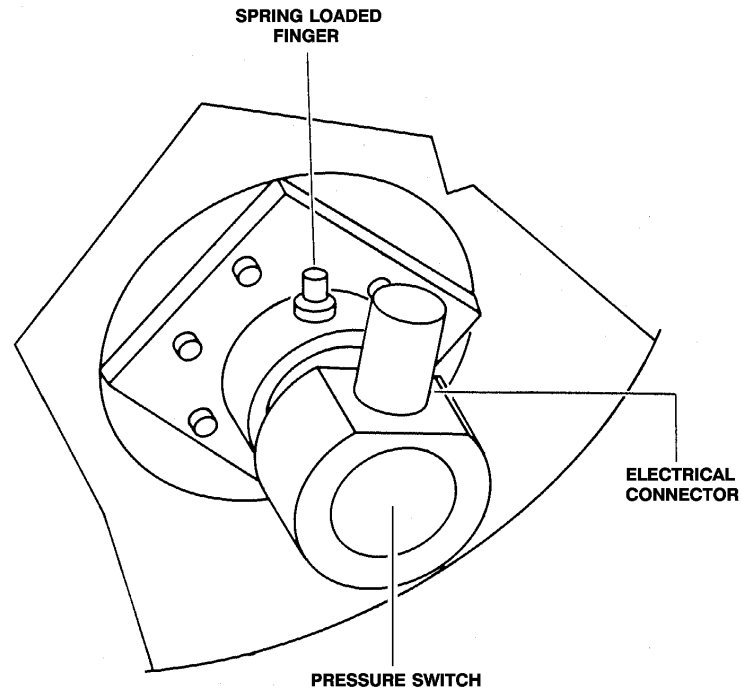
Rotation of the test screw opens the contact (continuity between pins 1 and 3).

The DISCH legend on the ENG/APU FIRE control panel comes on.

In the rest position, the DISCH legend goes off.

NOTE : P > minimum pressure = continuity between pins 2 and 3

P < minimum pressure = continuity between pins 1 and 3.



IF P > 31 BARS, CONTINUITY BETWEEN 2 AND 3
IF 15.5 < P < 19 BARS, CONTINUITY BETWEEN 1 AND 3

Figure 47 Engine Fire Ext. Bottle Pressure Switch

26-22 APU FIRE EXTINGUISHING

SYSTEM DESCRIPTION

General

The APU fire extinguishing system extinguishes fires detected in the APU compartment.

In flight, the crew must operate the system manually from the cockpit. On the ground, the fire and overheat detection system activates the extinguishing system automatically.

The fire extinguishing bottle has a pressure relief device which lets the extinguisher agent flow overboard if the pressure in the bottle increases to a given level. The pressure relief device can operate in flight or on ground.

APU Fire Extinguishing In Flight

In flight the crew must operate the system manually from the ENG/APU FIRE panel 20 VU in the cockpit. When you push the APU FIRE pushbutton switch:

- the 28 V DC power supply from the circuit breakers 3WF and 4WF is connected to the fire emergency-stop relays 5WF and 6WF (this energizes the relays),
- the relays 5WF and 6WF connect the power supply from the circuit breakers 1QF and 2QF to the APU low-pressure fuel-shutoff-valve actuator 3QF (Ref. 28-29-00)(the APU low-pressure fuel-shutoff-valve 14QM closes),
- the relay 5WF also sends a signal to the APU Electronic Control Box (ECB) 59KD (Ref. 49-62-00)(the ECB starts the APU emergency shutdown sequence),
- the 28VDC power supply from the circuit breakers 1WF and 2WF is connected to the AGENT pushbutton switch 10WF (the AGENT pushbutton switch is armed),
- the white SQUIB legend in the AGENT pushbutton switch comes on).

To fire the cartridge you must push the AGENT pushbutton switch:

- the 28VDC power supply from the circuit breakers 1WF and 2WF is connected to the squibs A and B in the cartridge (the cartridge fires and ruptures the diaphragm in the bottle discharge outlet),
- the extinguisher agent is released and flows into the APU compartment,

- the pressure in the bottle decreases, the pressure switch closes and sends a signal to the APU FIRE panel 20VU (the amber DISCH legend in the AGENT pushbutton switch comes on).

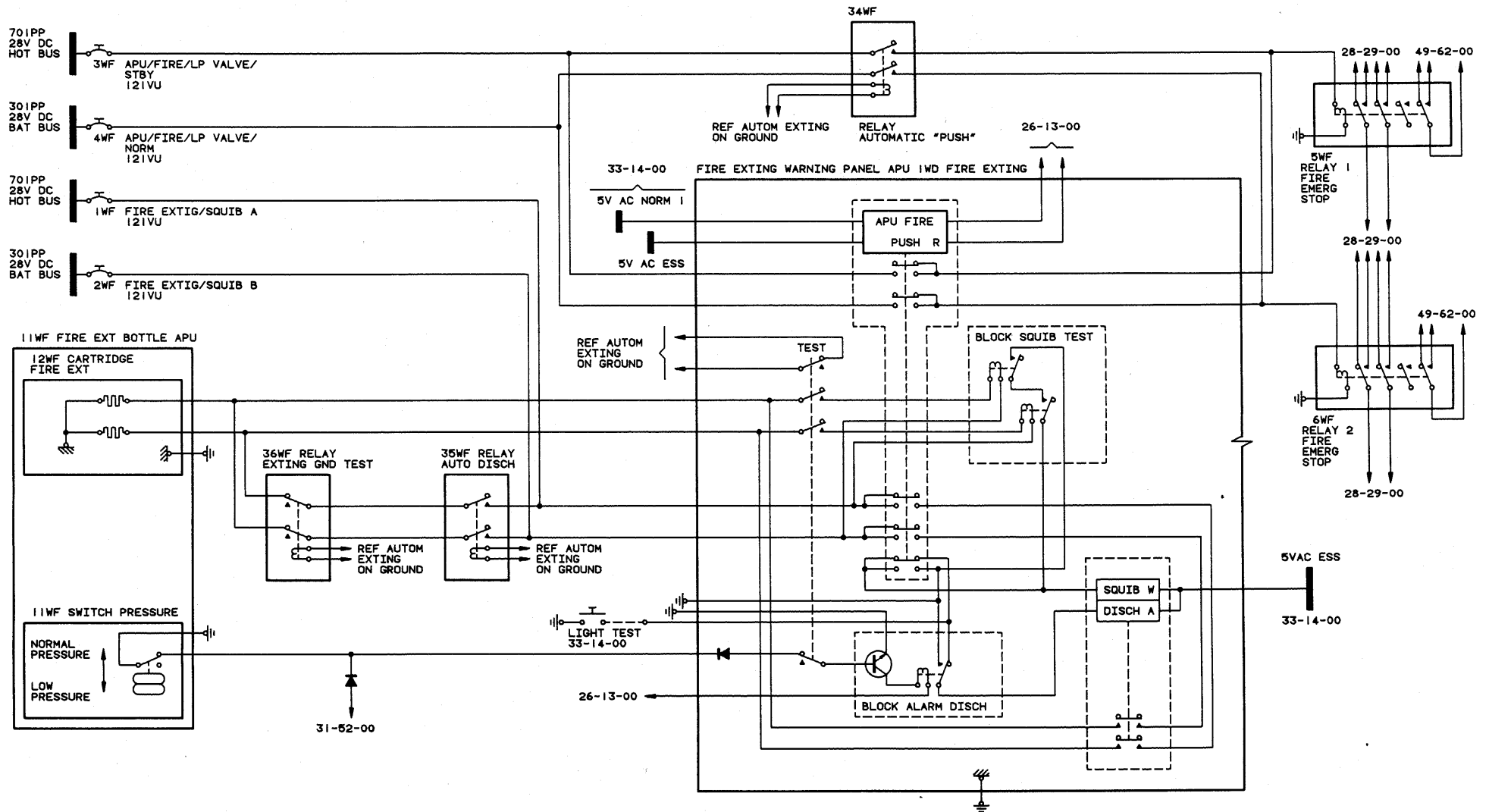


Figure 48 APU Fire Extinguishing in Flight



APU FIRE EXTINGUISHING ON GROUND

Operation

On the ground the the the automatic fire- extinguishing cicuit controls the extin- guishing sequence.

The Landing Gear Control Interface Unit (LGCIU) 5GA1 closes the FLIGHT/ GROUND relay 43WF when the landing gear is compressed.

The automatic fire-extinguishing circuit controls the extinguishing sequence:

- the circuit breaker 30WF and the FDU 13WG energize the AUTO TIME DELAY PUSH relay 39WF (it operates three seconds after fire warning),
- the relay 39WF energizes the HORN SUPPLY relay 4WC through the HORN OFF relay 44WF (the ground crew horn 15WC comes on),
- the relay 39WF also energizes the APU FIRE light 40WF on the external power panel 108VU (the red APU FIRE light 40WF comes on),
- the AUTO PUSH relay 34WF connects the 28VDC power supply from the cicuit breakers 3WF and 4WF to the FIRE EMER STOP 1(2) relays 5WF and 6WF (this energizes the relays),
- the relays 5WF and 6WF connect the power supply from the circuit break- ers 1QF and 2QF to the APU low-pressure fuel-shutoff-valve actuator 3QF (the APU low-pressure fuel-shutoff-valve 14QM closes),
- the relay 5WF also sends a signal to the ECB 59KD (Ref. 49-62-00) (the ECB starts the APU emergency shutdown sequence),
- the AUTO DISCH relay 35WF connects the 28VDC power supply from the circuit breakers 1WF and 2WF through the EXTING GND TEST relay 36WF to the squibs A and B in the cartridge (the cartridge fires and ruptures the diaphragm in the bottle discharge outlet),
- the extinguisher agent is released and flows into the APU compartment,
- the pressure in the bottle decreases, the pressure switch closes and sends a signal to the APU FIRE panel 20VU (the amber DISCH legend in the AGENT pushbutton switch comes on).

Reset

When you push the APU SHUT OFF pushbutton switch 1KL or you release the APU FIRE pushbutton switch the 28VDC power supply from the circuit breaker 30WF is connected to the HORN OFF relay 44WF (this energizes the relay and the ground crew horn 15WC stops)

When the fire or overheat condition is no longer available the FDU de-ener- gizes the AUTO TIME DELAY relay 39WF (this de-energizes all relays in the automatic fire-extinguishing circuit).

Automatic -Fire Extinguishing-Ground Test

On the APU AUTO EXTING section of the overhead panel 50VU, the TEST pushbutton switch 31WF starts the test of the automatic fire-extinguishing sys- tem. This pushbutton switch operates the TEST ON relay 33WF.

The ON indicator light in the TEST pushbutton switch comes on.

All relays described before are energized building a loop such that indicator light relay LP can be energized.

On the APU AUTO/EXTING panel 50VU, the OK indicator light in the TEST pushbutton switch comes on (this indicates a successful test).

When you push the RESET switch 32WF:

- the self-holding circuit of the TEST ON relay 33WF is de-energized,
- all other relays are de-energized. (the fire extinguishing bottle is connected again to the automatic fire-extinguishing on ground circuit),
- the ground crew horn 15WC and the APU FIRE light 40WF go off,
- the ON and OK indicator lights go off in the TEST pushbutton switch 31WF.

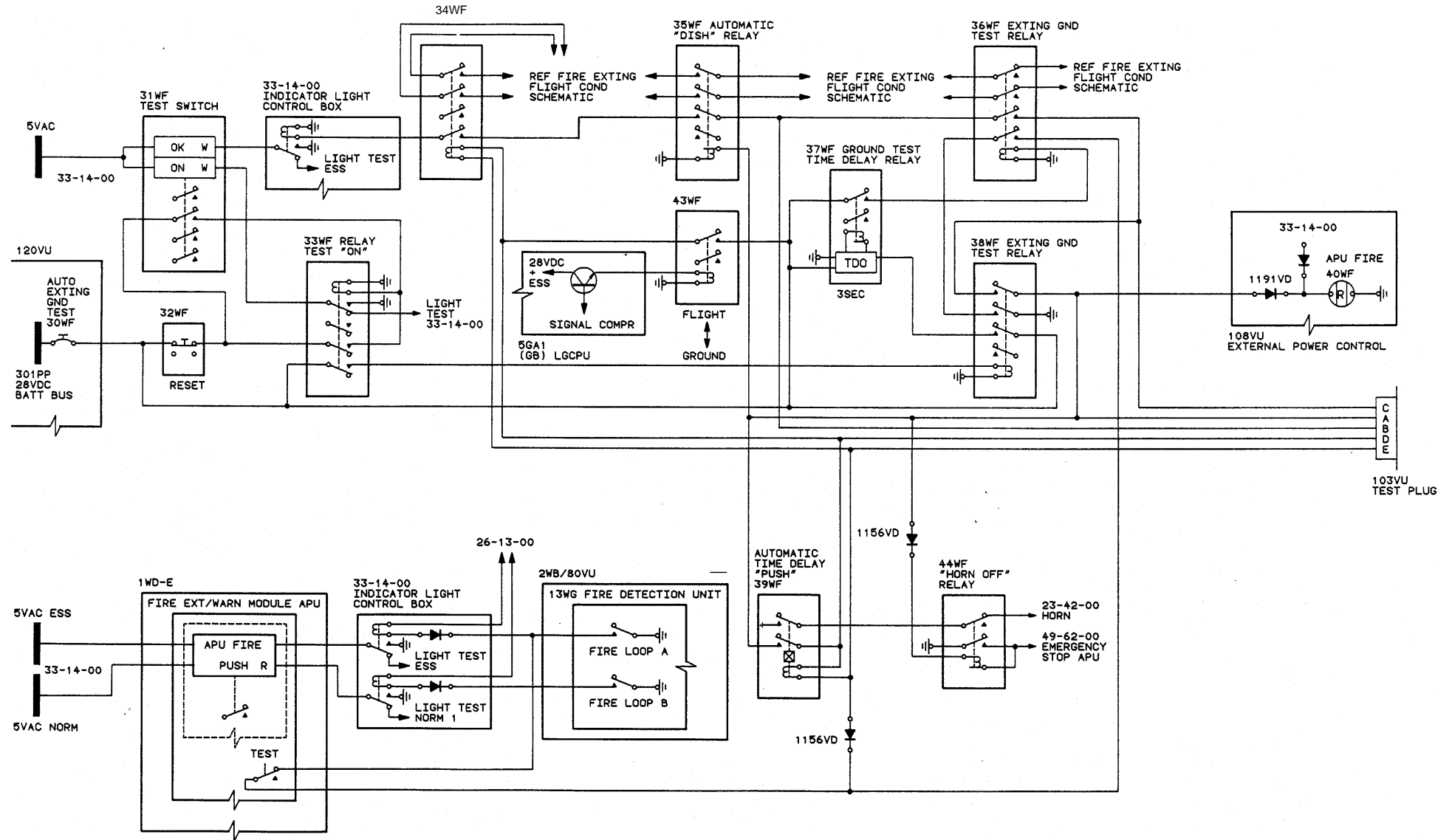
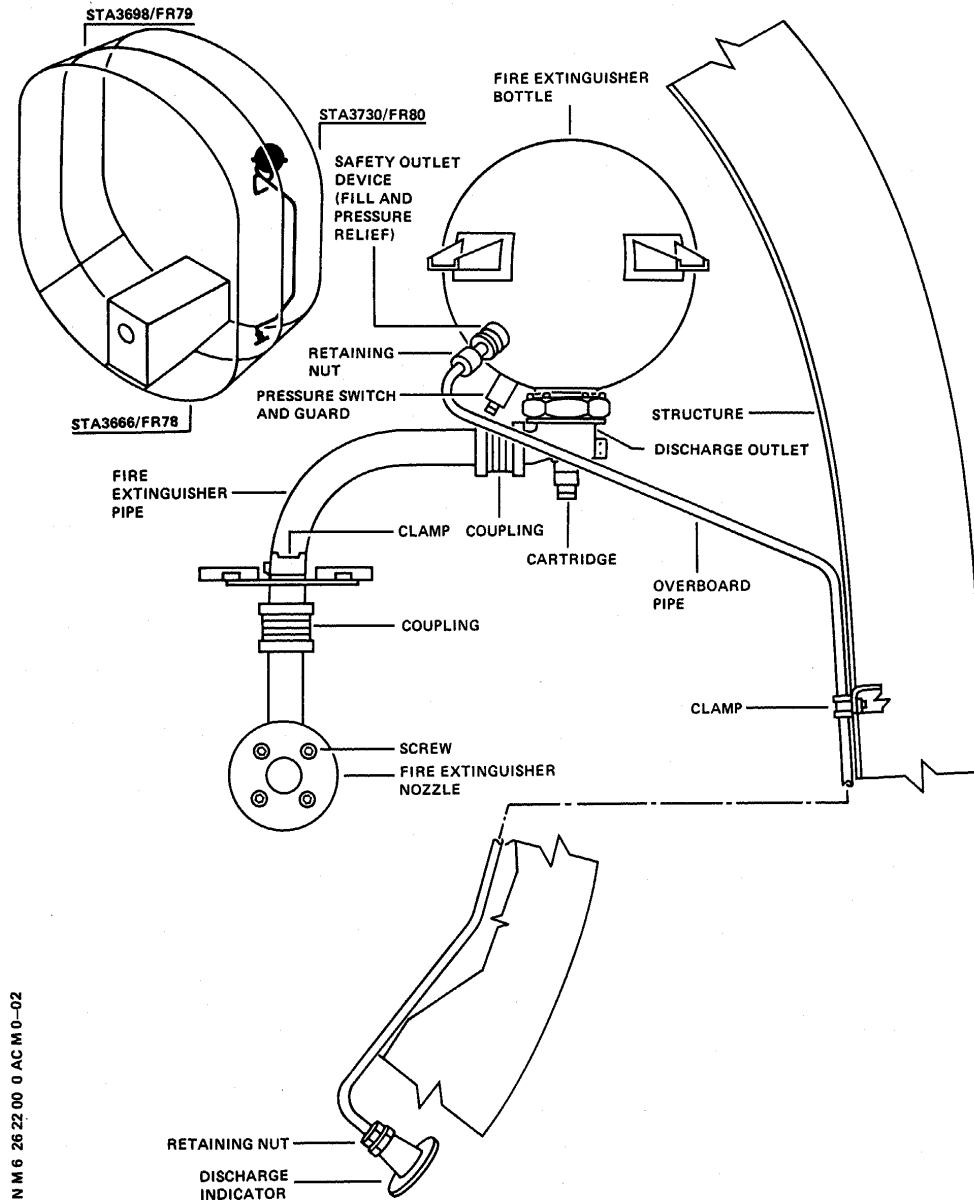


Figure 49 APU Automatic Fire Exting. on Ground



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Figure 50 APU Fire Ext. Bottle Location

26-23 LDCC EXTINGUISHING

SYSTEM DESCRIPTION

General

The LDCC (Lower Deck Cargo Compartment) fire-extinguishing system has one fire extinguisher bottle. The bottle contains the extinguishing agent. She is hermetically sealed and pressurized with nitrogen. The bottle is installed behind the FWD cargo-compartment sidewall-panel . The bottle has two discharge outlets (one for the FWD cargo compartment and one for the AFT/BULK cargo compartment). The discharge outlets are sealed with metal diaphragms. A discharge head is installed on each discharge outlet. Distribution pipes connect the discharge heads to the spray nozzles in the cargo compartments. An electrically-operated explosive cartridge is installed in each discharge head. Each cartridge has one squib. When electrical power is supplied to the squibs the cartridges fire and rupture the metal diaphragms in the bottle discharge outlets.

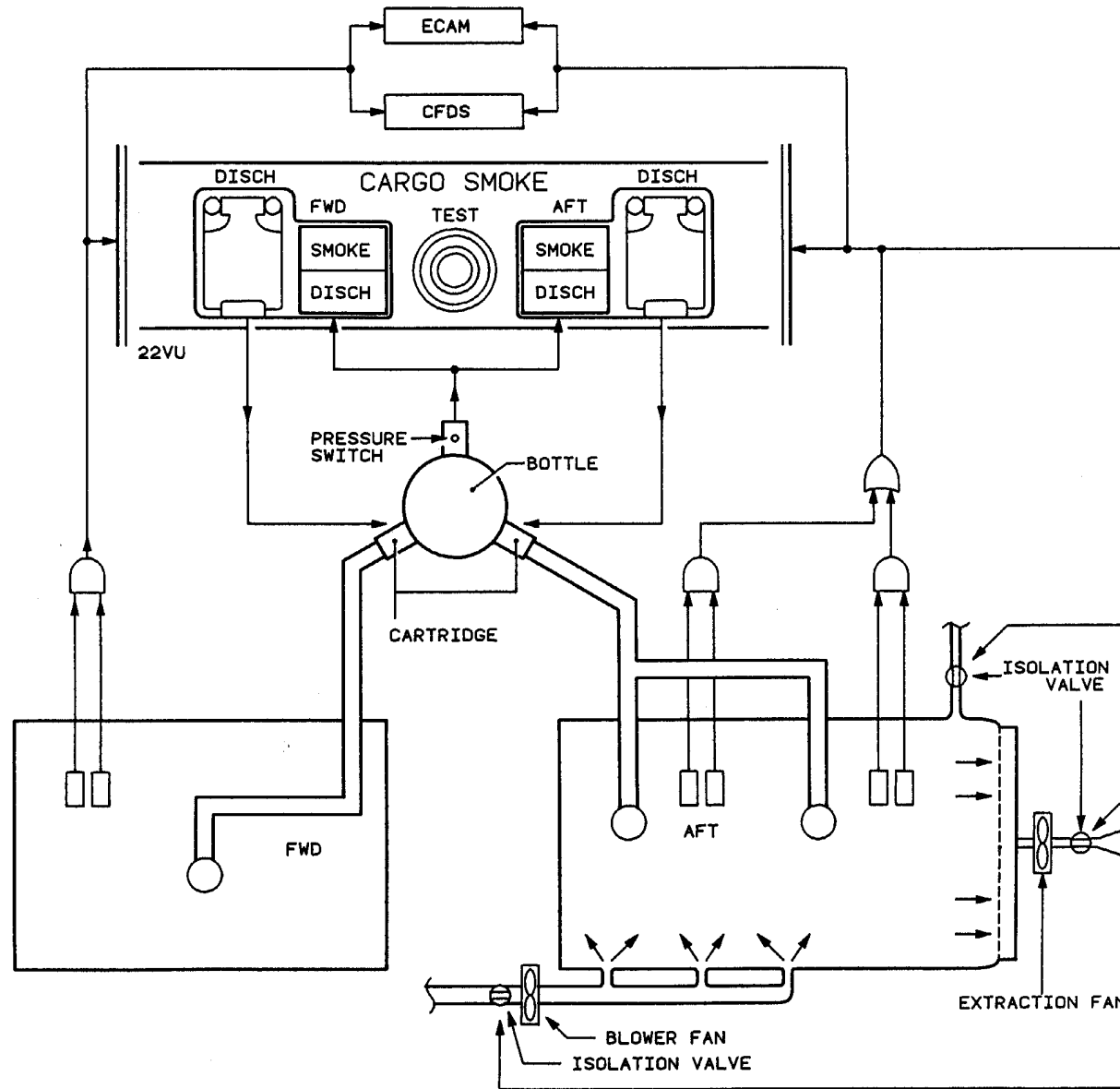


Figure 52 LDCC Extinguishing System



LDCC EXTING. OPERATION / TEST**Operation**

The AGENT pushbutton switches on the panel 22VU control the 28VDC power supply to the squib in the cartridges:

- the FWD AGENT pushbutton switch fires the FWD cartridge in the bottle,
- the AFT AGENT pushbutton switch fires the AFT cartridge in the bottle.

The extinguishing agent from the bottle flows directly to the cargo compartments.

When the agent has been released (or the bottle has a leak) the pressure switch on the bottle sends a signal to the SDCU. The SDCU sends the signal to:

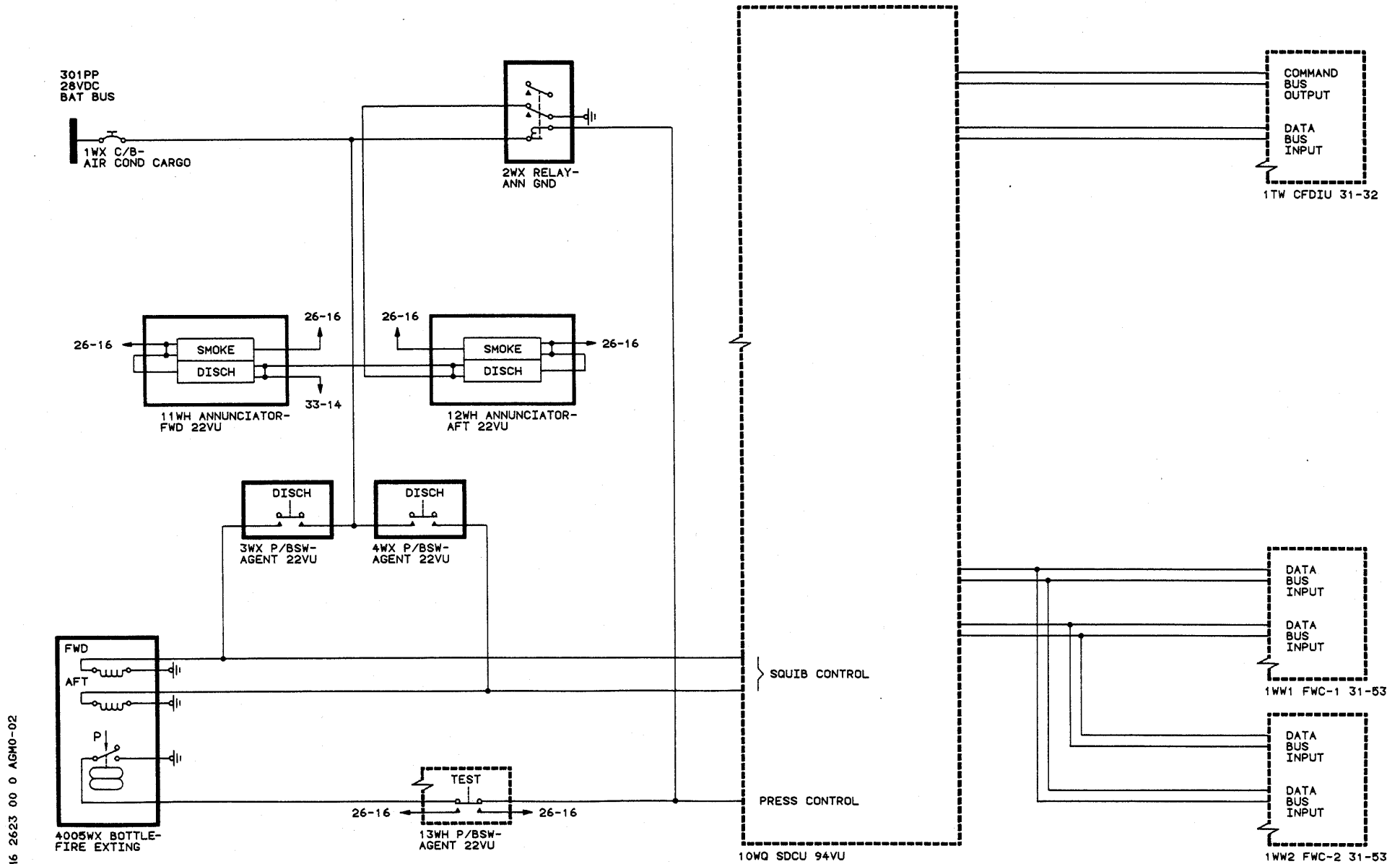
- the FWC, the CFDIU and the DISCH indicator.

BITE Test

The SDCU constantly monitors the pressure of the bottle. It also does a check of all squibs and related wiring:

- on power up,
- at 30 minute intervals,

The two DISCH lights on the overhead panel 22VU and the EWD indicate low pressure in the bottle. A cartridge or squib fault is indicated on the EWD and the MCDU.



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Figure 53 LDCC Fire Extinguishing Schematic



Student Note

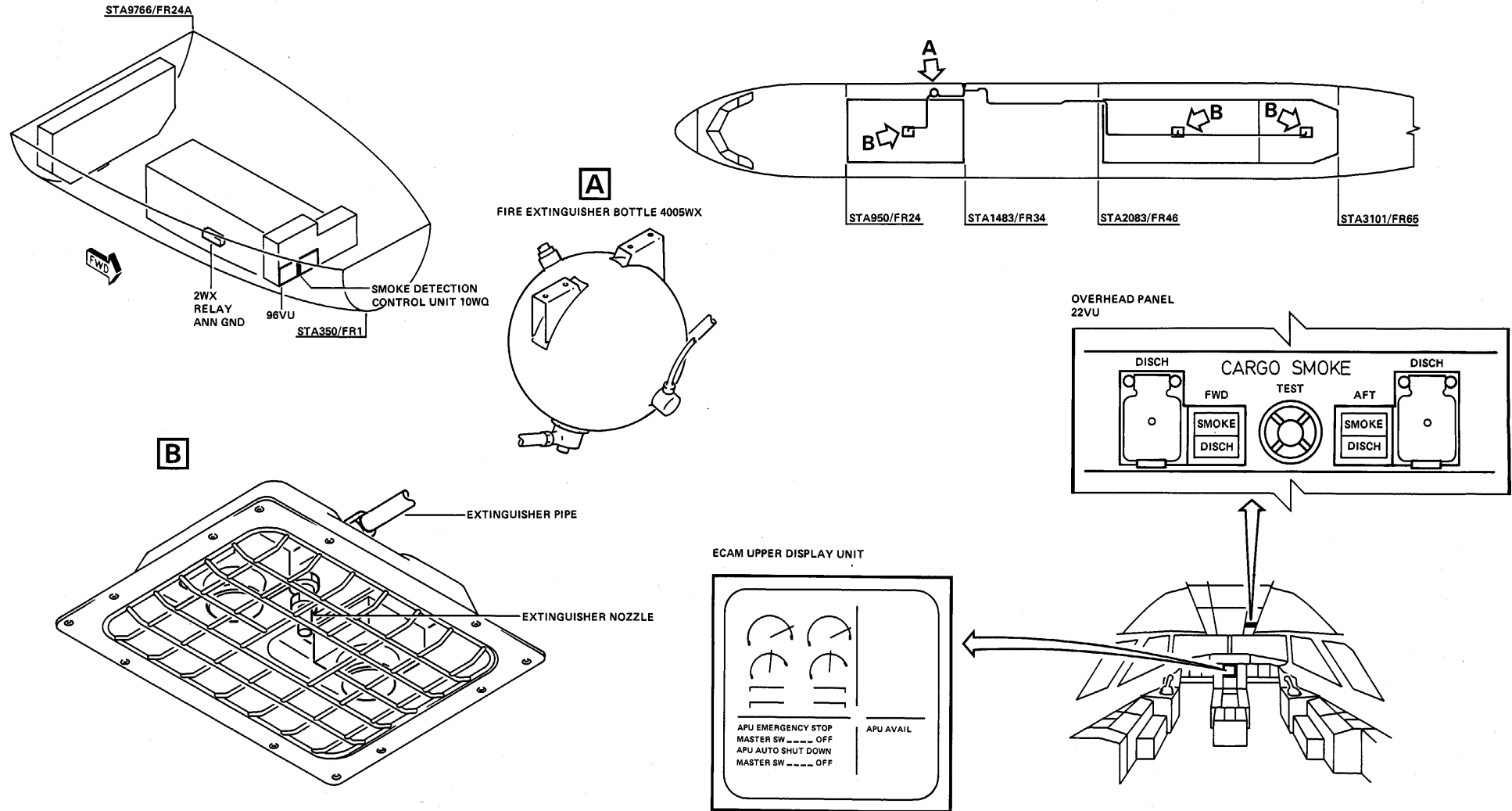


Figure 54 LDDC Fire Exting. Component Location

26-24 PORTABLE FIRE EXTINGUISHING

SYSTEM DESCRIPTION

Description

The portable fire extinguishers are fitted under the forward and aft attendant seats in the passenger compartment.

Quick- release clamps hold the fire extinguishers in their stowed position.

The fire extinguishers have three main components:

- Container
The container is made of steel. The threaded neck in the upper section of the container is for the operating head. The container is coated with red lacquer.
- Operating Head
The operating head consists of:
 - a carrying handle,
 - an operating lever,
 - a safety catch,
 - a nozzle,
 - a pressure gage.
- Extinguishant
The extinguishant is specified on the extinguisher bottle label.

Operation

For the correct operation and data of the portable fire extinguisher, refer to the label. The label on the extinguisher containers the instructions for use, approval number, details of weight and date of last check.

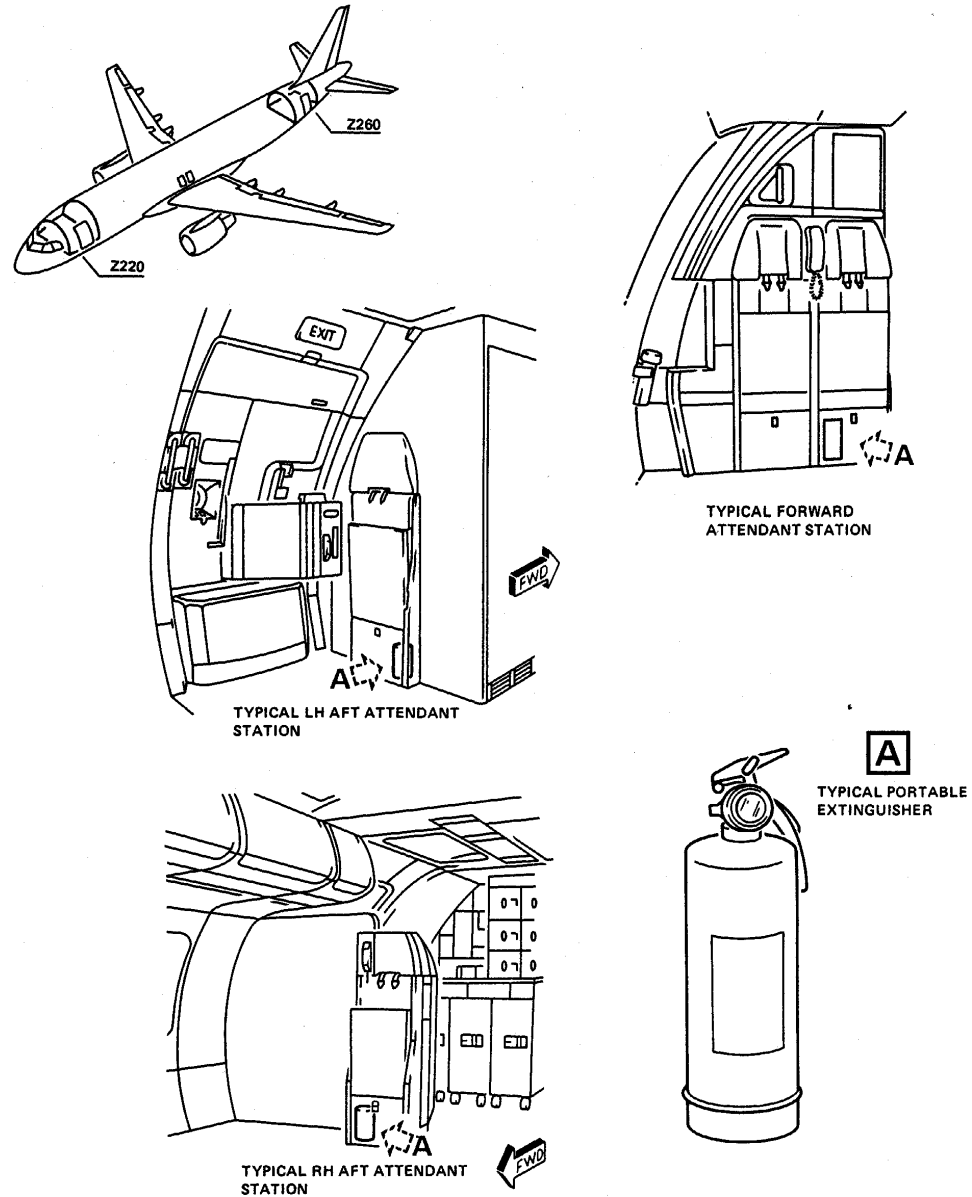


Figure 55 Portable Fire Extinguisher

26-25 LAVATORY EXTINGUISHING

SYSTEM DESCRIPTION

General

The lavatory fire extinguishing system is installed in each lavatory. It puts out fire in the waste container. The system is fully automatic and operates independently of other systems. The system has:

- an extinguisher bottle,
- a temperature indicator.

Operation

When exceeding appr. 80°C the heat fusible tip melts and the bottle will be discharged.

Check

When the temperature indicator strip has changed colour to black you have to replace and weigh the bottle.

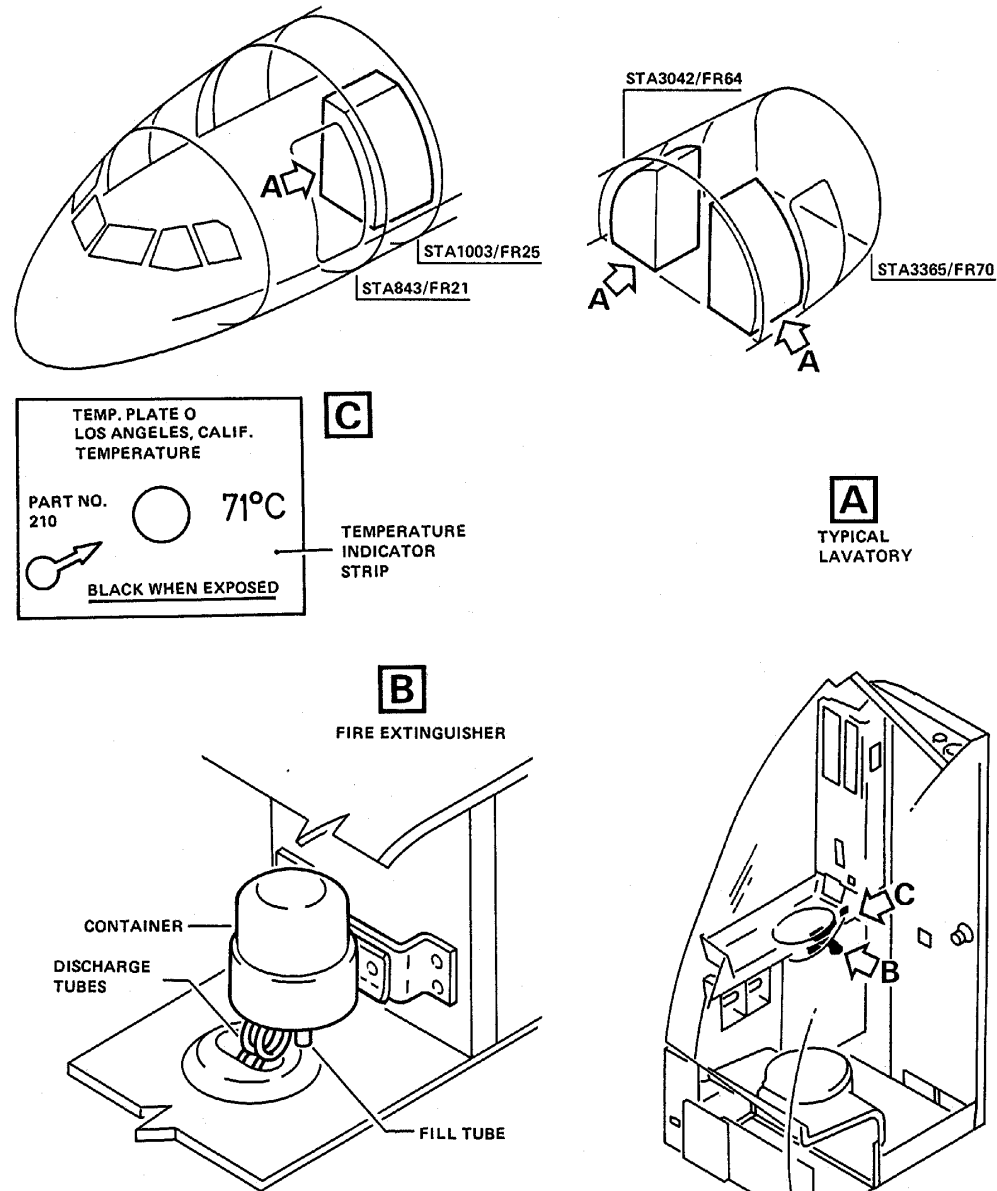


Figure 56 Lavatory Fire Extinguishing

