

# Gulfstream V

## OPERATING MANUAL

### FIRE PROTECTION

#### **2A-26-10: General:**

The Fire Protection System for the Gulfstream V provides a means to detect and indicate fire or smoke, and to store and distribute fire extinguishing agent to all protected areas of the aircraft.

The Fire Protection System is divided into the following subsystems:

- 2A-26-20: Smoke Detection and Evacuation System
- 2A-26-30: Fire Detection and Warning System
- 2A-26-40: Fire Extinguishing System

#### **2A-26-20: Smoke Detection and Evacuation System:**

##### **1. General Description:**

The Smoke Detection and Evacuation system provides a means to detect, indicate and evacuate smoke from protected areas of the aircraft. It is operable and capable of being tested any time aircraft electrical power is available. The following subsystems, units and components together compose this system:

- Smoke Detection System
- Emergency Smoke Evacuation Panel

##### **2. Description of Subsystems, Units and Components:**

###### **A. Smoke Detection System:**

- (1) Smoke Detector: Located in the baggage compartment, the smoke detector receives power from the Left Essential (L ESS) DC bus. It is functional whenever the LEFT and/or RIGHT MAIN BATTERY switch is selected to ON, whenever AC or DC external power is applied to the aircraft or whenever any aircraft generator is operating.
- (2) Smoke Detector Test Switch: A switch is provided to test the Smoke Detection system. It is located on the Cockpit Overhead Panel (COP) in the SYSTEM Test section and is labeled SMOKE DET. When electrical power is available to the L ESS DC bus, the TEST function is operable.

###### **B. Emergency Smoke Evacuation Panel:**

Located on the forward (cabin) side of the secondary pressure bulkhead, this panel contains the following components:

- (1) Emergency Smoke Evacuation Valve Handle: Labeled EMERGENCY SMOKE EVACUATION VLV, rotation to the VENT SMOKE position manually opens the smoke evacuation valve. Rotation to the NORMAL OPS position manually closes the smoke evacuation valve.

Prior to flight, the Emergency Smoke Evacuation Valve Handle is verified to be the NORMAL OPS position by the flight crew. The handle remains in this position through all phases of flight, unless needed otherwise.

# Gulfstream V

## OPERATING MANUAL

- (2) Baggage Compartment Vent Valve Reset Switch: Actuation of this switch to the RESET position energizes a solenoid, restoring airflow into the baggage compartment area.

### 3. Controls and Indications:

(See Figure 1 and Figure 2.)

#### A. Circuit Breakers (CBs):

The Smoke Detection and Evacuation system is protected by the following CBs:

Circuit Breaker Name:	CB Panel:	Location:	Power Source:
AFT BAGG SMOKE DET	LEER	C-8	L ESS DC Bus
AFT BAGG VENT VALVE	LEER	D-6	L ESS DC Bus

#### B. Indications:

- (1) Crew Alerting System (CAS) Messages associated with the Smoke Detection and Evacuation system are:

Area Monitored:	CAS Message:	Message Color:
Aft Baggage Compartment	AFT BAG SMOKE	Red

- (2) Additional annunciations caused by an actual alert, or depressing the SMOKE DET switch:

- The MASTER WARN reset switch illuminates.
- A three-chime aural WARNING tone sounds.

#### NOTE:

If an actual alert occurs, momentarily depressing the MASTER WARN switch silences the WARNING tone and reverts the flashing CAS message to steady display. The CAS message will remain displayed steady until the system senses the level of smoke is below the threshold.

### 4. Limitations:

#### A. Flight Manual Limitations:

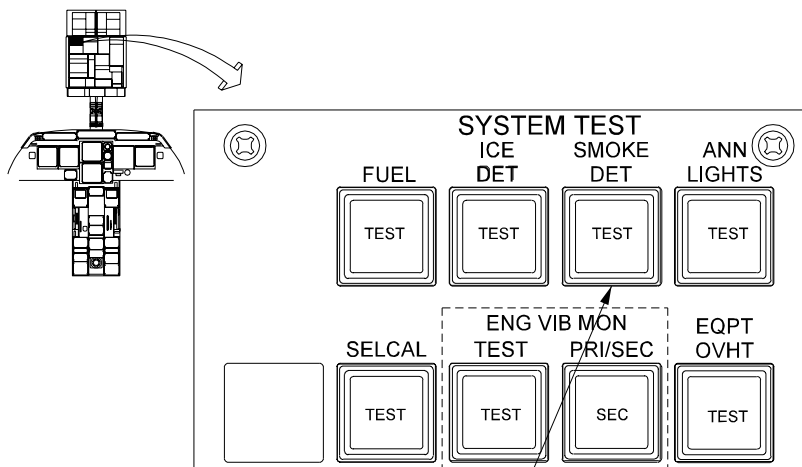
There are no limitations established for this system as of this revision.

#### B. System Notes:

- (1) If the Emergency Smoke Evacuation Valve Handle is positioned to VENT SMOKE, pressurization inflow to the baggage compartment will be inhibited.
- (2) When positioning the Baggage Compartment Vent Valve Reset Switch to the RESET position, hold for a minimum of ten (10) seconds to allow full operation of the solenoid.
- (3) If the baggage compartment has been depressurized, the internal baggage compartment door cannot be opened until the baggage compartment has been repressurized.

# Gulfstream V

## OPERATING MANUAL



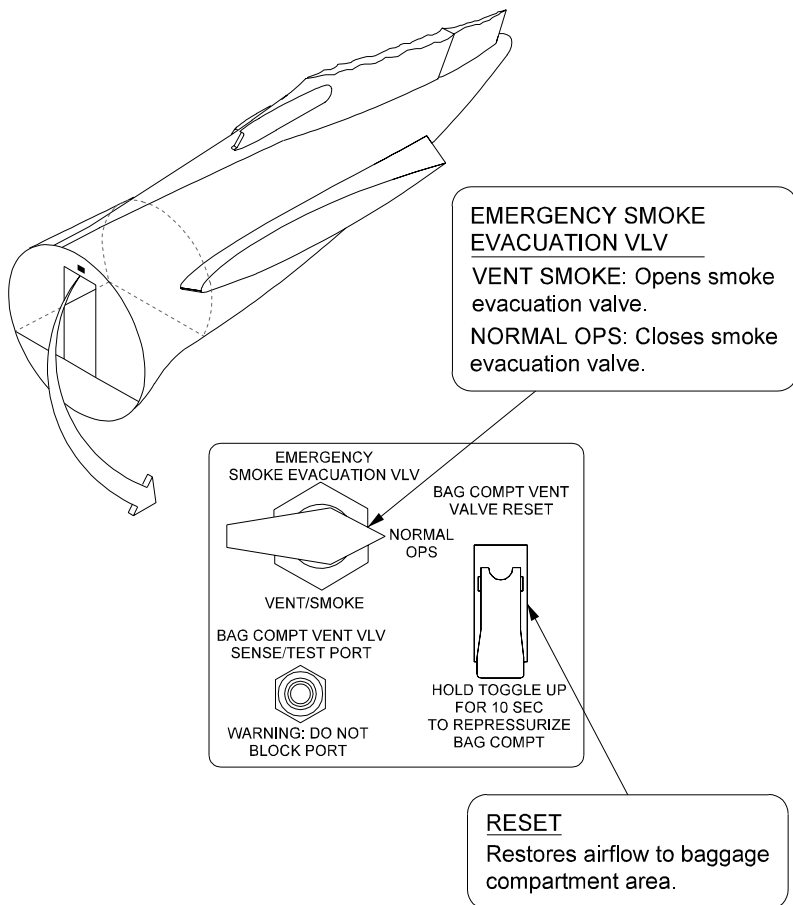
**SMOKE DET**  
TEST legend in switch capsule illuminates.  
AFT BAG SMOKE message on CAS.  
Three-chime aural WARNING tone sounds.

06608B00

Cockpit Overhead Panel: SYSTEM TEST Section  
Figure 1

# Gulfstream V

## OPERATING MANUAL



06609B01

Emergency Smoke Evacuation Panel  
Figure 2

### **2A-26-30: Fire Detection and Warning System:**

#### **1. General Description:**

The Fire Detection and Warning system provides a means to detect and indicate the presence of an overheat or fire condition in protected areas of the aircraft. It is a dual channel system, thus it will still be functional should a single channel fail or one of the two power sources is lost.

The following subsystems, units and components together compose this system:

- Engine Fire Detection System
- Pylon Overheat Detection System
- APU Fire Detection System

# Gulfstream V

## OPERATING MANUAL

- Passenger and Tail Compartment Overheat Detection System

The Fire Detection and Warning system receives power upon selection of the MAIN BATTERIES switches to ON. It will remain operable at all times provided the L ESS DC bus and R ESS DC bus are functional and all associated CBs are closed. Prior to APU start, the APU Fire Detection system is tested by the flight crew. Likewise, prior to engine start, the Engine Fire Detection system is also tested by the flight crew. Any failures or faults during testing are annunciated and/or recorded.

During all phases of flight, the Fire Detection and Warning system remains active in sensing its respective areas. The Engine Fire Detection system continuously monitors self-health. Any failures or faults are annunciated and/or recorded.

During shutdown, the Fire Detection and Warning system remains operable until selection of the MAIN BATTERIES switches to OFF. Any recorded failures or faults are stored for later review and troubleshooting.

## 2. Description of Subsystems, Units and Components:

### A. Engine Fire Detection System:

- (1) Fire Loops: Each engine contains two fire loops, designated LOOP A and LOOP B. Each loop is connected via wiring to the associated engine Fire Detector Control Unit (FDCU). LOOP A and LOOP B each contain five dual-sensor elements. Four of the five elements are located adjacent to the engine, within the nacelle. The fifth element is located within the engine core.
- (2) Dual-Sensor Elements: Each element is designed to sense a rise in ambient temperature above a predetermined value which will cause the FDCU to discriminate between an actual fire condition, or fault, and prompt the associated annunciation. Conversely, if sensed ambient temperature falls below the predetermined value, the FDCU will prompt removal of the associated annunciation.
- (3) Fire Detector Control Unit (FDCU): The fire loop system for each engine is supervised by a dedicated FDCU. It contains a separate, but identical, control circuit for each loop. Operational logic is such that if either fire loop fails, an annunciation is prompted. The flight crew will then select the faulty loop off, leaving the operable fire loop active to function as a single-loop system.

### NOTE:

If available or required prior to departure, maintenance technicians may assist in isolation or resolution of any faults and/or failures by performing Built-In-Test (BIT) checks on the associated FDCU.

- (4) Test Control Panels: Two system test control panels are provided for the flight crew to verify proper system operation. They are located on the Cockpit Overhead Panel (COP) and are labeled FIRE TEST and FIRE DETECTION. When the Left Essential (L ESS) DC bus and Right Essential (R ESS) bus are supplied with power, testing of the system is possible.

### B. Pylon Overheat Detection System:

Each engine pylon area contains three thermal switches installed adjacent to the bleed air ducting. Normally open, a sensed rise in ambient temperature above a predetermined value (250° F) will cause one or more switches to close. Any switch closure prompts display of the associated annunciations.

### C. APU Fire Detection System:

- (1) Fire and Overheat Detector: Fire and overheat detection for the APU is provided by a detector assembly consisting of a stainless steel loop with a permanently attached sensor element. The assembly is filled with helium gas and hermetically sealed.

Detector operation is based upon Boyle's Gas Law, which states that if a volume of gas is held at a constant pressure, an increase in pressure will occur as a result of a rise in temperature. Thus, when heat is applied to the detector assembly, the corresponding rise in pressure will trigger pressure switches in the sensor element. The switches in turn will cause annunciations to be prompted for display as described in the following scenarios:

- High temperature increases above predetermined values occurring within a small section of the detector assembly are considered to be fire scenarios.
- Overall (ambient) temperature increases above predetermined values occurring over large sections of the detector assembly are considered to be overheat scenarios.

The APU Electronic Control Unit (ECU) will automatically initiate an immediate protective shutdown if a fire condition exists, bypassing the cool down mode. Automatic APU shutdown is inhibited, however, during FIRE TEST checks. This allows APU fire detection system testing with the APU operating.

Escape of the helium gas contained within the detector assembly (and thus the proportional decrease in pressure) will trigger a pressure switch causing a fault annunciation to be displayed.

The fire and overheat detection system is self-resetting. Return of normal pressures within the detector assembly will result in cancellation of annunciations.

- (2) Test Switch: An APU FIRE TEST switch is provided for the flight crew to verify proper system operation. It is located on the COP in the FIRE TEST section. When the Left Essential (L ESS) DC bus and Right Essential (R ESS) bus are supplied with power, testing of the system is possible.

#### NOTE:

The APU fire detection system is monitored for failures. Should a failure occur, an amber APU FIRE DET FAIL message will be displayed on the Crew Alerting System (CAS) display. The APU fire detection system will then be inhibited.

# Gulfstream V

## OPERATING MANUAL

### D. Passenger and Tail Compartment Overheat Detection System:

Thermal switches are installed at various locations throughout the passenger and tail compartment to sense overheat conditions. Closure of any switch prompts display of the associated annunciations. The locations of the switches are as follows:

- Left Electronic Equipment Rack (LEER)
- Right Electronic Equipment Rack (REER)
- Baggage Compartment Equipment Rack (BEER)
- Forward Floor
- Left Aft Floor
- Center Aft Floor
- Right Aft Floor
- Aft Equipment Area (Tail Compartment)

### 3. Controls and Indications:

(See Figure 3 and Figure 5.)

#### A. Circuit Breakers (CBs):

The Fire Detection and Warning system is protected by the following CBs:

Circuit Breaker Name:	CB Panel:	Location:	Power Source:
L FIRE DET LOOP A	LEER	B-14	L ESS DC Bus
R FIRE DET LOOP B	LEER	B-13	L ESS DC Bus
L FIRE DET LOOP B	REER	B-10	R ESS DC Bus
R FIRE DET LOOP A	REER	B-11	R ESS DC Bus

#### B. Indications:

- (1) Crew Alerting System (CAS) Messages associated with the Fire Detection and Warning system are:

Area Monitored:	CAS Message:	Message Color:
Left Engine	L ENG FIRE	Red
Right Engine	R ENG FIRE	Red
Left Pylon	L PYLON HOT	Red
Right Pylon	R PYLON HOT	Red
APU	APU FIRE	Red
Fire Loops	ENG FIRE LOOP ALRT	Red
Left Aft Floor	L AFT FLOOR HOT	Red
Center Aft Floor	C AFT FLOOR HOT	Red
Right Aft Floor	R AFT FLOOR HOT	Red
Aft Equipment Area	AFT EQUIP HOT	Red
APU Fire Detection System	APU FIRE DET FAIL	Amber
Fire Loops	FIRE DET LOOP FALT	Amber
LEER	L EER HOT	Amber
REER	R EER HOT	Amber
Baggage EER	BAG EER HOT	Amber
Fwd Floor	FWD FLOOR AREA HOT	Amber

# Gulfstream V

## OPERATING MANUAL

### (2) Summary of Annunciations By Event:

- (a) Selection of the L (or R) ENG FIRE TEST switch:
  - On the L ENG (or R ENG) FIRE TEST switch, the legends LOOP A and LOOP B are illuminated.
  - The MASTER WARN reset switch is illuminated.
  - The L (or R) fire handle is illuminated.
  - The L (or R) FUEL CONTROL switch is illuminated.
  - A three-chime aural WARNING tone sounds.
- (b) Selection of the FIRE DETECTION FAULT TEST switch:
  - The legend TEST illuminates in the FAULT TEST switch.
  - The legend FAULT is displayed on the LEFT / RIGHT LOOP A / LOOP B switches.
  - A two-chime aural CAUTION tone will sound.
- (c) Selection of the APU FIRE TEST switch or a valid APU FIRE signal:
  - A three-chime aural WARNING tone sounds.
  - The MASTER WARN reset switch is illuminated.
  - The exterior fire bell will sound (if aircraft is on the ground).
  - The FIRE light on the APU control panel is illuminated.

#### **NOTE:**

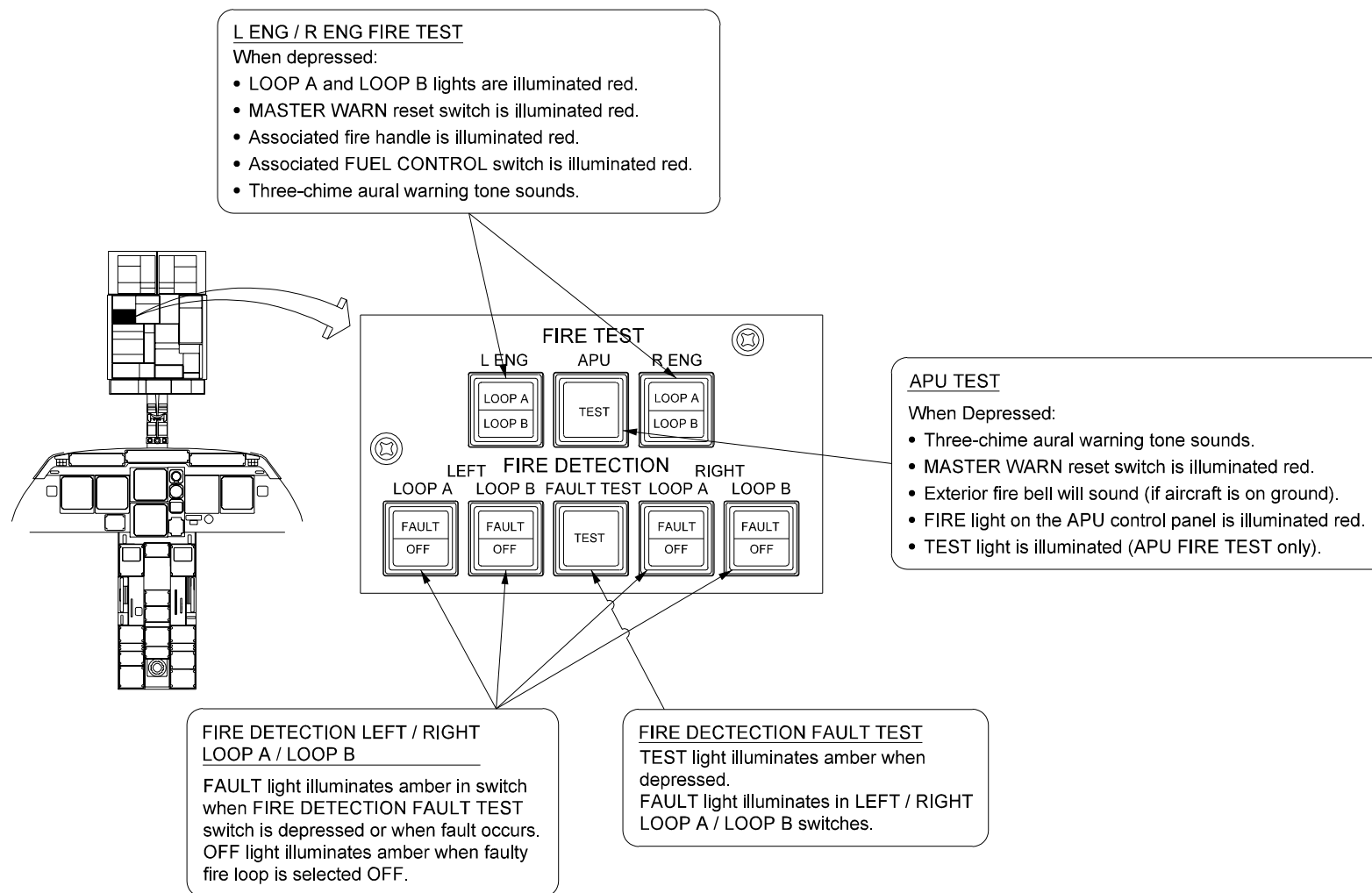
In addition to the above indications, the TEST legend will illuminate in the TEST switch. A red APU FIRE message and amber APU FIRE DET FAIL message will also be displayed on CAS. These annunciations occur during APU FIRE TEST only.

- (d) Detection of a valid ENGINE FIRE signal:
  - The MASTER WARN reset switch is illuminated.
  - The L (or R) fire handle is illuminated.
  - The L (or R) FUEL CONTROL switch is illuminated.
  - A three-chime aural WARNING tone sounds.
- (e) Detection of a valid FIRE LOOP FAULT signal:
  - The affected LEFT / RIGHT LOOP A / LOOP B switch FAULT legend is illuminated. Selection to off causes the OFF legend to be illuminated.
  - A three-chime aural WARNING tone sounds.

#### **4. Limitations:**

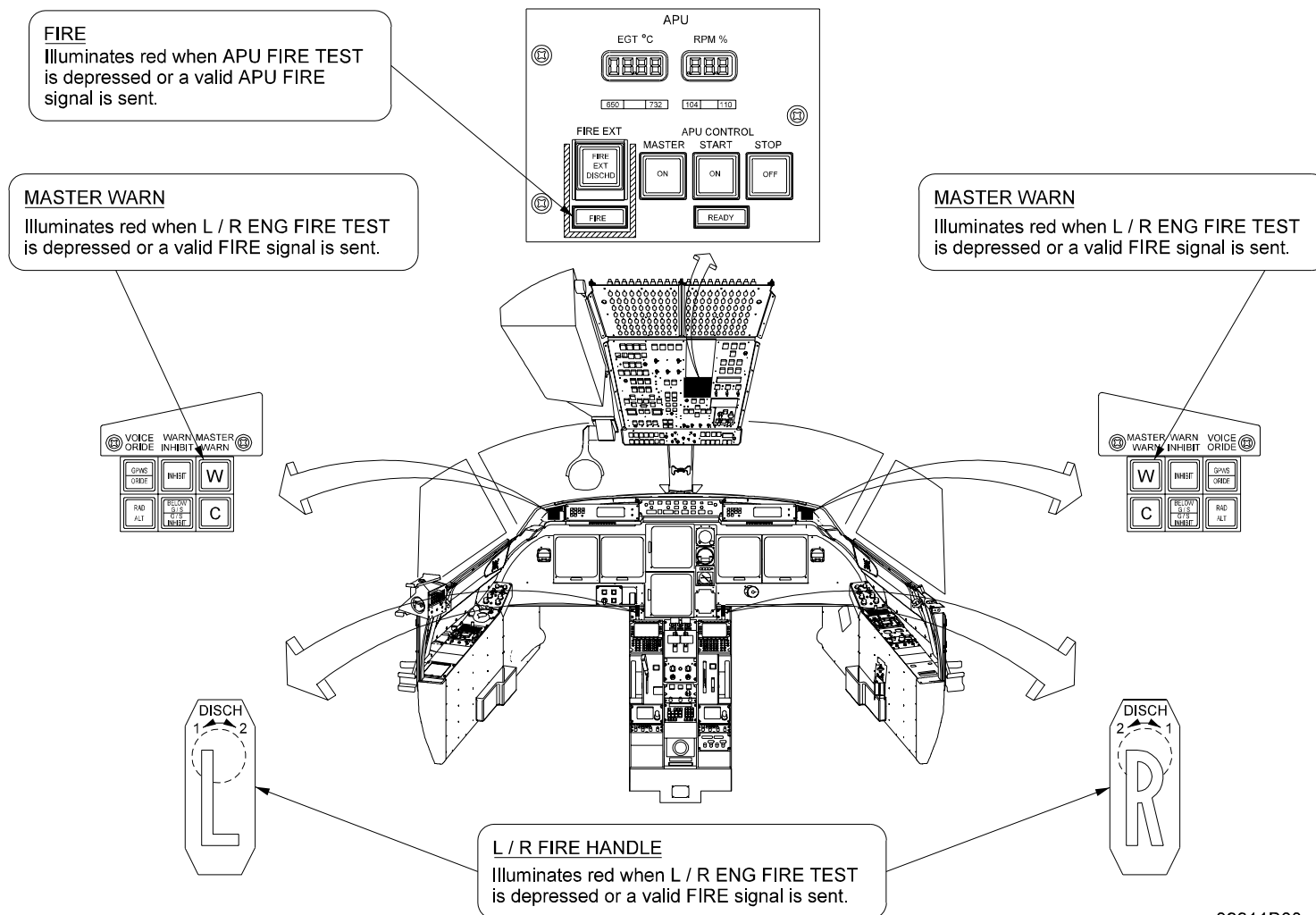
There are no limitations established at the time of this revision.





06610B00

Cockpit Overhead Panel:  
FIRE TEST and  
DETECTION Section  
Figure 3

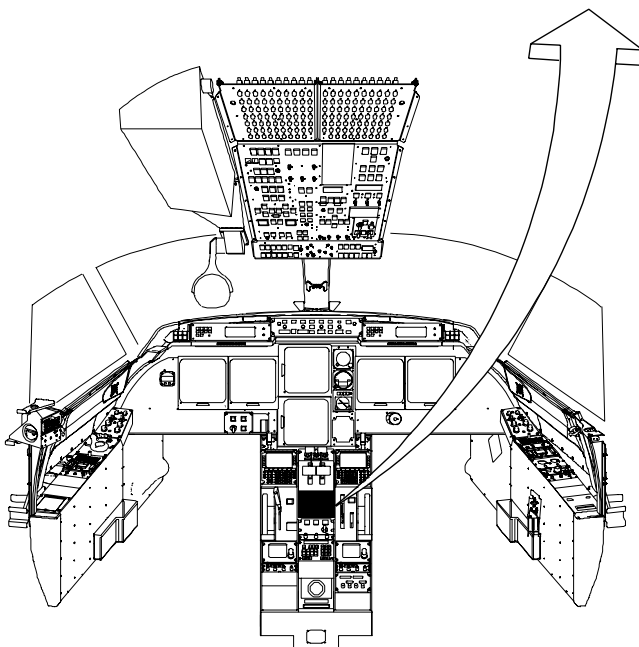
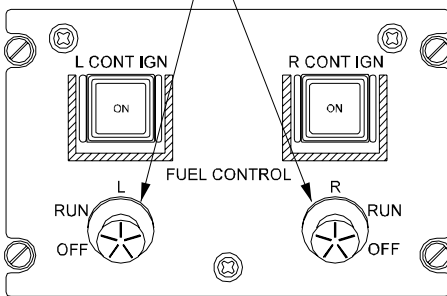


06611B00

Cockpit Fire Detection and Warning Indications  
Figure 4

**L / R FUEL CONTROL**

Illuminates red when L / R ENG FIRE TEST is depressed or a valid FIRE signal is sent.



08670B01

Engine Fuel Control Fire Detection and Warning Indications  
Figure 5

### **2A-26-40: Fire Extinguishing System:**

#### **1. General Description:**

The Fire Extinguishing system provides the flight crew with fixed and portable units and components used to extinguish fire. Engine fire extinguishing is operable any time aircraft electrical power is available. The following subsystems, units and components together compose this system:

- Engine Fire Extinguishing System
- Auxiliary Power Unit (APU) Fire Extinguishing System
- Portable Fire Extinguishing System

The Fire Extinguishing system receives power upon selection of the MAIN BATTERIES switches to ON. The Engine Fire Extinguishing system is available during all phases of flight provided the L ESS DC bus and R ESS DC bus are functional and all associated CBs are closed. If one ESS DC bus fails, both engines retain fire extinguishing capability but only one discharge per engine is available. If the L ESS DC bus fails, APU fire protection is not available.

During shutdown, the Fire Extinguishing system remains operable until selection of the MAIN BATTERIES switches to OFF.

#### **2. Description of Subsystems, Units and Components:**

##### **A. Engine Fire Extinguishing System:**

- (1) Fire Extinguishing Bottles: Two identical, single-shot fire extinguishing bottles, referred to as LEFT and RIGHT, are mounted in the tail compartment. They are electrically discharged by the flight crew from the cockpit. They are identical, each having the following components:
  - Halon® 1301 fire extinguishing agent and propellant.
  - A low pressure switch which provides a signal to display a message on the Crew Alerting System (CAS) if the bottle is discharged for any reason.
  - A thermal discharge device: If excessive temperature and pressure builds up within the bottle, the disc ruptures and the entire contents of the bottle is discharged into the tail compartment.
- (2) Extinguishing Agent Plumbing: Routes the extinguishing agent from each fire bottle to both engine cowling interior areas.
- (3) Fire Handles: Located on the forward portion of the cockpit center pedestal, the fire handles are labeled L (for Left) and R (for Right). They are normally locked in the IN position. When a valid fire signal is provided by the Engine Fire Detection system, an internal lock-release solenoid is automatically energized, allowing the associated fire handle to be pulled to the OUT position. A manual override button is provided underneath each handle to override the lock-release solenoid, allowing the fire handle to be pulled to the OUT position at all times.

Each fire handle is capable of rotation to two positions after placement in the OUT position. The positions are labeled DISCH 1 and DISCH 2. System logic is designed such that rotation of either fire handle to the DISCH 1 position results in extinguishing agent

# Gulfstream V

## OPERATING MANUAL

discharge from the RIGHT fire bottle. This ensures that the LEFT fire bottle is reserved as a secondary measure, due to its dual role as the APU fire bottle. Given this logic, the modes of operation are shown in the following table:

Fire Handle Pulled:	Rotated To:	Discharges:	Into:
L	DISCH 1	RIGHT Fire Bottle	Left Engine Nacelle
	DISCH 2	LEFT Fire Bottle	
R	DISCH 1	RIGHT Fire Bottle	Right Engine Nacelle
	DISCH 2	LEFT Fire Bottle	

### B. APU Fire Extinguishing System:

- (1) System Plumbing: Is provided from the LEFT fire bottle to the APU compartment.
- (2) Agent Discharge Switch: The flight crew may discharge Halon<sup>®</sup> 1301 fire extinguishing agent from the LEFT fire bottle into the APU compartment by means of a guarded switch located on the Cockpit Overhead Panel (COP). The switch is located in the APU controls section and is labeled FIRE EXT.

#### NOTE:

After extinguishing agent is discharged into the APU compartment, the LEFT fire bottle is no longer available for fire protection.

### C. Portable Fire Extinguishing System:

The aircraft is equipped with two portable fire extinguishers to aid the flight crew in combating different types of fires which may occur. One fire extinguisher contains Halon<sup>®</sup> and one contains water.

## 3. Controls and Indications:

(See Figure 6.)

### A. Circuit Breakers (CBs):

Power source and circuit breaker (CB) logic is designed such that if either the Left Essential (L ESS) DC bus or Right Essential (R ESS) DC bus should fail, fire extinguishing agent is still available for both engines. If the L ESS DC bus fails, however, APU fire protection will not be available.

The Fire Extinguishing system is protected by the following CBs:

Circuit Breaker Name:	CB Panel:	Location:	Power Source:	Provides Power To:
FIRE EXT SHOT #1	LEER	B-12	L ESS DC Bus	Left Fire Handle DISCH 1
				Right Fire Handle DISCH 1
FIRE EXT SHOT #2	REER	B-12	R ESS DC Bus	Left Fire Handle DISCH 2
				Right Fire Handle DISCH 2

# Gulfstream V

## OPERATING MANUAL

Circuit Breaker Name:	CB Panel:	Location:	Power Source:	Provides Power To:
APU FIRE EXT	LEER	B-10	L ESS DC Bus	APU FIRE EXT Switch

### B. Indications:

(1) Crew Alerting System (CAS) Messages:

CAS messages associated with the Fire Extinguishing system are:

Area Protected:	CAS Message:	Message Color:
Left Engine	L FIRE BTL DSCHG	Amber
Right Engine	R FIRE BTL DSCHG	Amber
APU	L FIRE BTL DSCHG	Amber

(2) Additional Annunciations:

Depressing the APU FIRE EXT switch causes the FIRE EXT DISCHD legend to be illuminated in the switch capsule.

### 4. Limitations:

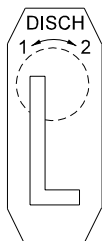
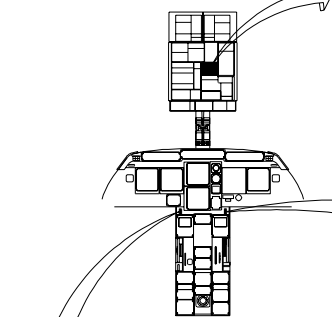
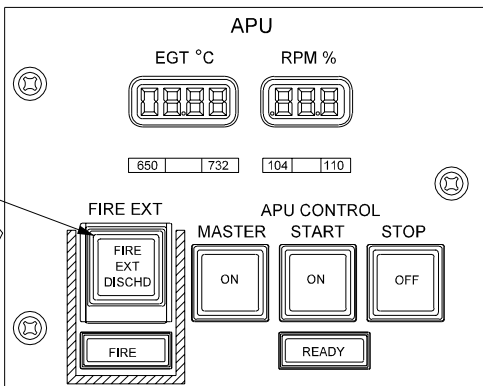
#### A. Flight Manual Limitations:

There are no limitations established at the time of this revision.

# Gulfstream V

## OPERATING MANUAL

**FIRE EXT**  
 When depressed, extinguishing agent is discharged into the APU compartment. The FIRE EXT DISCHD light will illuminate amber.



**L / R FIRE HANDLE**

- When pulled:  
 Generator is shut off.  
 Hydraulic fluid is shut off.  
 Engine fuel is shut off.
- When rotated to DISCH 1:  
 Right fire bottle is discharged.
- When rotated to DISCH 2:  
 Left fire bottle is discharged.



06612B01

Fire Extinguishing System Controls and Indications  
 Figure 6