Chapter 5 FIRE PROTECTION SYSTEM

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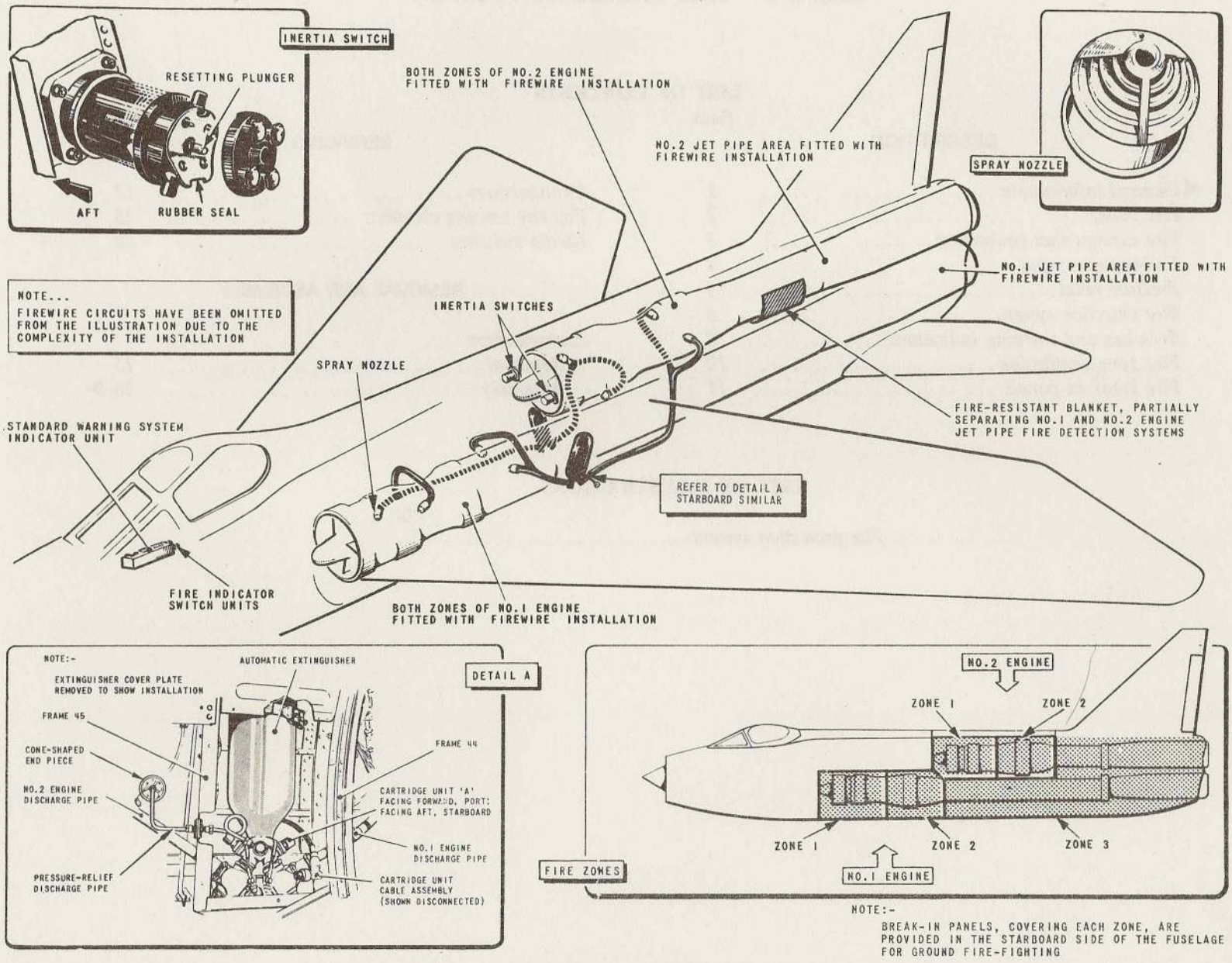

FIG. 1. FIRE PROTECTION SYSTEM

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DESCRIPTION

General information

1 The fuselage surrounding the engines and jet pipes is divided into fire zones which contain sensing elements associated with electrical fire-warning circuits. An extinguisher system, giving protection to engine-bay fire zones only, is normally controllable by cockpit switches but is operated automatically in a crash landing by inertia switches *(para.10).*

Fire zones *(fig.1)*

2. Each engine bay is divided into two fire zones, No.1 and No.2, separated from each other by a firewall between the engine compressor section and the turbine and exhaust section. The aft frame of both zones 2, and the floor of No.2 engine bay, constitute firewalls separating both zones 2 from a common zone 3; this latter zone comprises the space between the jet pipes and the fuselage sides. Each fire zone has a separate ventilation system.

Fire extinguisher equipment

◀**3.** Two extinguishers are mounted in compartments on each side of the fuselage, immediately aft of No.1 engine bay. The extinguishers were originally charged with Methyl Bromide which is now obsolescent, and replacement extinguishers will be charged with Bromochlorodifluro-Methane (B.C.F.) *(fig.1).* The extinguisher bodies are secured to the structure by metal straps, and their dual operating heads are secured to the supporting saddle brackets by retaining cables. The two operating heads of the port extinguisher serve both zones 2, and the starboard extinguisher similarly serves both zones 1. The extinguishant delivery pipe to each fire zone branches, and terminates in two spray nozzles which discharge gas in a cone of spray. Provision is made for venting the extinguishant overboard in case of excessive pressure in the extinguisher, due to rises in temperature above the safe maximum. Two Type A.984 fusible indicators, visible through windows in access panel 61P, show a reddish brown discolouration if the extinguishers have been discharged by firing. A nylon indicator disc is dislodged if its associated extinguisher has vented its contents overboard. An additional check for normal discharge is to examine the firing head for a protruding indicator pin; a thumb-type panel fastener in the fuselage skin, near the extinguisher, is depressed to expose the pin.

Extinguisher types

◀**4.** The aircraft may be fitted with Type 141A, Ref.No.27N/346 extinguishers (M.B.) or with Graviner Type 57545-004 Ref.No.27N/– containing Bromochlorodifluro-Methane (B.C.F.) extinguishers. ▶

Pressure relief

5. From each extinguisher a pressure discharge relief pipe terminates between frame 45 and 46, port and starboard, in a cone-shaped end-piece. A press-fit plug is fitted in the end of the pipe and a nylon indicator disc in the outer periphery of the end-piece. In the event of pressure in the extinguisher becoming excessive, the extinguishant will be vented overboard via the pressure discharge pipe, and the plug and disc will be dislodged. As it is possible for the plug and disc to be dislodged during normal discharge by firing, an inspection must be made whenever an extinguisher has been discharged. If the plug and disc have been dislodged, new parts Graviner Part No.515 must be fitted.

Fire detection system

6. The medium-temperature-range, Firewire sensing elements of the fire detection system consist of lengths of flexible stainless steel capillary which contains a central core separated from the inner walls of the capillary by a temperature-sensitive filling material. The filling material is semi-conductive when cold, but conducts readily when heated. The sensing elements are connected, through bulkhead fittings and electrical cable assemblies, to relay units; these utilize the a.c. impedance of the sensing elements and their ability to store an electrostatic charge under fire warning conditions to illuminate the cockpit warning lamps. The detector system is self-resetting when the sensing-element temperature returns to normal.

7. The Triple FD detection system utilizes Type 162D control units *(Sect.6, Chap.12)* and sensing elements coupled in various set lengths to form separate circuits. There is one circuit in each engine bay, coupled to the engine exhaust units to give warning of hot gas leaks, and serving zones 1 and 2. Two circuits, one to each jet pipe, serve zone 3 and are extended by cable assemblies to the reheat jet pipes, where sensing elements are fitted around the nozzles. The two ends of each sensing-element circuit are intercon-

nected electrically at the relay units, ensuring that the detection system will remain operative should the sensing elements be severed, providing the centre core is not earthed to fuselage or capillary due to the break.

Switches and warning indicators

8. Warning of fire in any zone is given by the standard warning system *(Sect.6, Chap.12).* Indicators FIRE 1 or FIRE 2, as appropriate, are illuminated if a fire occurs in No.1 or No.2 engine bay, and indicators RHT 1 or RHT 2 are illuminated if a fire or excessive temperature occurs in zone 3. Appearance of an engine bay fire warning is accompanied by illumination of the integral lamp in one of the F1 and F2 indicator switch units mounted on the aft end of the warning system indicator unit. When either switch is operated the contents of both extinguishers are discharged into zones 1 and 2 of the appropriate engine bay.

9. Two Mk.2, Type 10C, inertia switches Ref.No.27N/94 are mounted, one port and one starboard, on the forward face of frame 43 above the horizontal firewall. The switches, which are accessible when the No.2 engine hatch is removed, operate to discharge both extinguishers into both zones of each engine bay when subjected to a deceleration of 4½g.

Fire zone ventilation

10. Zones 1 and 2 of each engine bay are primarily ventilated by air which enters through port and starboard intakes at the forward end of each zone and, induced by hot air from the engines, leaves through discharge vents at the aft end. Ram air from the intake in the fin ventilates zone 3 after being utilized for cooling the alternator, generator, and oil in the accessory drive unit gearbox; this supply is supplemented by air from an intake in the spine and one in the port side of the fuselage, which exhausts into zone 3, through the firewall, after cooling equipment in the spine. Additional auxiliary vents in zones 1 and 2 assist the ventilation of both engine bays.

Fire break-in panels

11. Six red-painted fire break-in panels (access panels 50A, B, C, D, E and F) are fitted in the skin along the starboard side of the fuselage. Panels A and B give access to zones 1 and 2 of No.1 engine bay, C and D give access to zones 1 and 2 of No.2 engine bay and E and F give access to zone 3.

SERVICING

Extinguishers

12. Apart from checking the electrical continuity of the cartridge unit fuses in the operating heads *(Sect.6, Chap.12),* the only extinguisher servicing necessary is checking for leakage by weighing, and examining for corrosion, dents, and scoring. Replacement extinguishers must always be check-weighed prior to installation; the weight of a fully-charged extinguisher (with cartridge units fitted) is stamped on the extinguisher.

Firewire sensing elements

13. Care must be taken to prevent ingress of moisture during assembly or reassembly of a Firewire element; this can occur if connections are not properly fitted and may result in a resistance low enough to operate the relay circuit. The transportation sealing caps, supplied with new parts, should not be removed until it is necessary to install the particular part concerned. Each time a connection is made new copper 'S' washers must be fitted and the gland nuts tightened to a torque loading of 90 ± 10 lb in; the exception being the connection of the high temperature Firewire on No.1 and No.2 jet pipes which have no copper 'S' washers fitted and the gland nuts are torque loaded to 150 ± 10 lb in. The bend radius of the element must not be less than 1 in., and when replacing an element it must be securely clipped using the original clipping points and clips, Type D3004, bushes D3893.

Inertia switches

14. It is possible to inspect the inside of the inertia switches through their transparent cases; should examination reveal damage or the presence of moisture, a new switch must be fitted. To reset a switch, provided no damage has occurred or is suspected:-

(1) Slacken the four finger-nuts securing the terminal block cover, and remove the cover and the rubber seal.

(2) Depress the resetting plunger until the contact bow springs back into the unoperated position.

(3) Reset the rubber seal and the terminal block cover, and tighten the nuts.

REMOVAL AND ASSEMBLY

Extinguishers *(fig.1)*

Removal

15. To remove either extinguisher:-

(1) Remove the ventral tank *(Sect.4, Chap.2).*

(2) Remove No.1 engine hatch *(Sect.3, Chap.1).*

(3) Remove the twenty-six 2 B.A. bolts and eight 4 B.A. nuts securing the access panel on the forward face of frame 44, noting the positions of the Firewire clips.

(4) Remove the seven 2 B.A. bolts securing the extinguisher cover plate, and remove the plate.

(5) Disconnect the electrical sockets from the plugs on the cartridge firing units.

(6) Remove the locking wire and, using spanner Ref.No.26DK/95249, unscrew the unions securing the extinguishant delivery pipes to the operating heads.

(7) Remove the locking wire and disconnect the pressure-relief discharge pipe.

Note . . .

In no circumstances may the banjo bolt be removed from the extinguisher.

(8) Disconnect the quick-release clamp on the forward pipe and remove the pipe extension.

(9) Slacken the 2 B.A. captive nuts which tension the operating head retaining cable, until both ends of the cable are released.

(10) Supporting the extinguisher, remove the securing-strap safety pin, release the strap, and withdraw the extinguisher through the aperture in frame 44.

Assembly

16. Assembly of either extinguisher is the reverse of operations (3) to (10) of the removal procedure with special attention to the following points during assembly:-

(1) Ensure that the banjo bolt is facing inboard on both extinguishers.

(2) Check that a minimum gap of 0.10 in. exists between the saddle bracket and the rectangular portion of each cable end-fitting.

(3) Tighten the banjo bolt to a torque loading of 20 lb ft.

(4) When refitting the access panel check that the Firewire clips are secured at the correct positions.