SECTION 10

FIRE PROTECTION SYSTEM

INTRODUCTION

Fire protection on the Vulcan aircraft is provided by five systems. They protect the engine compartments, fuel tank bays, wing leading edges, bomb bay stones and the A.A.P.P. Five hand operated B. C. F. 1 extinguishers are provided for use in the pressure cabin and one hand operated B. C. F. extinguisher, for external use, is located with emergency equipment in the fuselage nose section.

Inertia switches on the lower forward face of the rear pressure bulkhead are provided to break the circuits to the generators, isolate the batteries to prevent the outbreak of fire in crash conditions, and also to discharge the containers automatically when deceleration exceeds 3G.

ENGINE SYSTEM

To ensure adequate protection against fire risk, each engine compartment is divided into zones, by bulkheads integral with the engine which seal on to the aircraft structure, the compartment thus formed being line with 28 s.w.g. titanium sheet. The forward zone, designated Zone 1, is not covered by the extinguisher system spray pipes. The rear zone is sub-divided by an intermediate bulkhead immediately forward of the combustion chambers, the two positions being known as Zones 2A and 2B respectively. Refrasil blankets are fitted to each side of the centre engine rib in Zone 2B, the heat insulators protect the rib from high temperature which is produced at this point. Automatic warning of fire is given by a thermo-electric resetting fire detector system, consisting of two control units mounted port and starboard in the nose-wheel bay, a set of detectors containing thermo-couples in engine zones 2A and 2B and combined warning indicator/operating switches, one to each engine on the pilots coaming panel.

The indicator/operating switches are painted red and are identified by the letter F in their centres. An automatic warning only is given and normally the extinguishant is released by manual operation of the indicator/operating switch. In crash conditions, where the deceleration exceeds the given value of 'G' the extinguishers are discharged automatically.

INSTALLATION

Two Gravenor fire extinguishers Mk 13A (12 lb capacity) using methyl-bromide, are installed on each side of the bomb bay. From the forward extinguishers, light alloy pipes lead to the inboard engine compartment and the rear extinguishers to the outboard engine compartment. These pipes feed fore and aft sprays on the sides of the engine bays, the sprays passing through the intermediate bulkhead to cover Zones 2A and 2B. Small diameter holes are provided in the spray pipes positioned so as to give adequate protection for each fire risk.

OPERATION

This system of fire detection work on the thermo-electric principle of voltage generation when heat is applied to the junction of the two dissimilar metals which form the thermo-couples. Each of the detector heads consist of two thermo-couples in series and of opposite polarity, one of which is shrouded from the flame and rapid temperature variations, whilst the other being exposed is more rapidly affected by temperature change. When the combined temperature of

/the exposed thermo-couples

the exposed thermo-couples exceed that of the shrouded couples by 185°C sufficient output is generated (7.5 millivolts) to illuminate the corresponding cockpit warning indicator. It is necessary to depress the warning indicator/switch to fire the electrically operated fuses which discharge the extinguishers.

When a cockpit indicator switch is depressed, an explosive charge in the extinguisher is ignited, electrically, to rupture the container diaphragm and create an outlet through which liquid methly-bromide can flow into the pipe system.

FUEL TANK SYSTEM

A methyl-bromide system protects the fuselage and wing fuel tanks, the extinguishers being automatically discharged by the firewire detectors or the inertia switches. An indicator lamp, positioned alongside the bomb bay warning lamp on the second pilot's instrument panel, lights when any fuel tank extinguishers have operated. It should be noted that when the inertia switches operate, both heads of the dual headed wing tanks extinguishers are fired to supply extinguishant to the inboard and outboard banks of tanks simultaneously; the extinguishers for fuselage tanks and wing leading edge also operate.

INSTALLATION - FUSELAGE TANKS

The air space around the front (No.1) tanks is covered by two Mk.13A fire extinguishers. The extinguishers, mounted in brackets secured to the aft face of the rear pressure bulkhead, supply three horizontal spray pipes clipped, together with firewire elements, along the length of the tanks and one vertical spray pipe at the front face of the tank.

Air space around the rear (No.2) tanks in the nose wheel bay is covered by two Mk.13A extinguishers, mounted in brackets on the bulkhead between the forward and rear tanks, which feed three horizontal spray pipes passing rearwards along the length of the tanks and one vertical spray pipe at the forward face of the tanks. Firewire elements run adjacent to the pipe lines.

INSTALLATION - WING TANKS

The five wing tanks on each side of the aircraft are divided into two bays by double skinned rib, from the front to the rear spar, between the three inboard tanks and the two outboard tanks. The inner tanks are contained on their inboard face by the undercarriage outboard rib, and on their front and rear faces by the front and rear spars respectively. The outer tanks are bounded by the outboard hinge rib and by the front and rear spars.

Six methyl-bromide extinguishers, mounted in brackets on the transport rib are provided for either the inboard or the outboard bank of tanks. The extinguishers are filled with dual heads and the methyl-bromide flow is automatically directed to the tank bay affected by the electrical signal from the firewire element. It should be noted that the firing of any one head discharges the whole contents of the container. Outlet pipes from the extinguishers pass along the transport rib and rear spar to connect to further pipe, disposing centrally between the tank groups, which supplies spray pipes on the forward and rear face tanks. Firewire elements are located adjacent to the pipe lines.

LEADING EDGE SYSTEM

Three Mk.13A methyl-bromide extinguishers are provided in the bays forward of the main-wheel units to feed a spray pipe fitted along the leading edge of the

/wing, inside the

wing, inside the anti-icing ducting, to prevent a fire due to strike ahead. The extinguishers are actuated from the firewire detectors around the wing fuel tanks.

BOMB BAY SYSTEM

A methyl-bromide system is provided for protection of fuel tanks and special stores carried in the bomb bay. The system is operated automatically by firewire detectors or by inertia switches; an indicator on the 2nd pilot's panel lights up when the extinguishers have been discharged.

Four Mk 13A methyl-bromide bottles are grouped each side of the bomb bay, the outlet pipes from the bottles of each group are connected to a gallery pipe.

The gallery pipes direct the methyl-bromide to stainless steel spray pipes, which run along the port and starboard sides of the bomb bay, and have two rows of small diameter holes to distribute the extinguishant throughout the length of the bay.

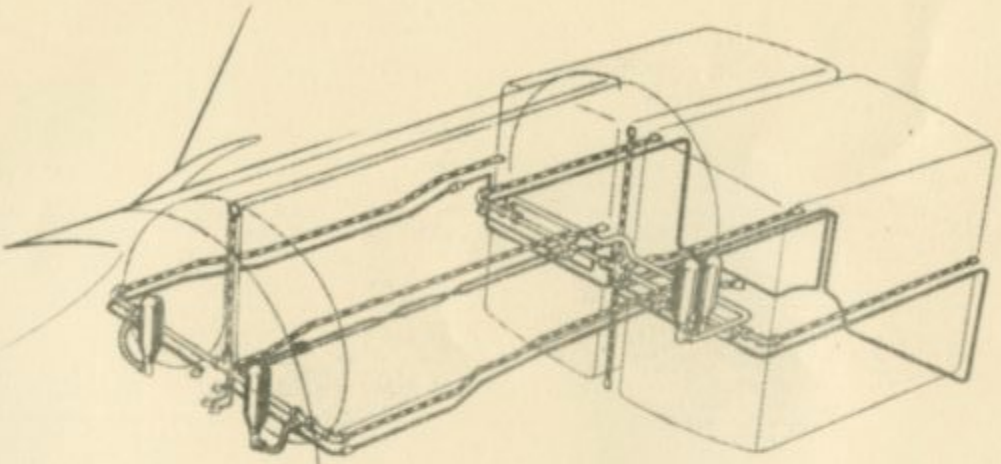
A.A.P.P. SYSTEM

A 10 lb methyl-bromide extinguisher, mounted externally on the front end panel of the power plant casing is controlled by a button on the A.A.P.P. control panel in the crews compartment. In the event of a fire in the power plant compartment a series of detector heads mounted around the inside of the casing energise a warning light contained within the push button which when depressed will discharge the extinguisher into the power plant through a nozzle mounted on the interior of the front panel and automatically close the L.P. cock.

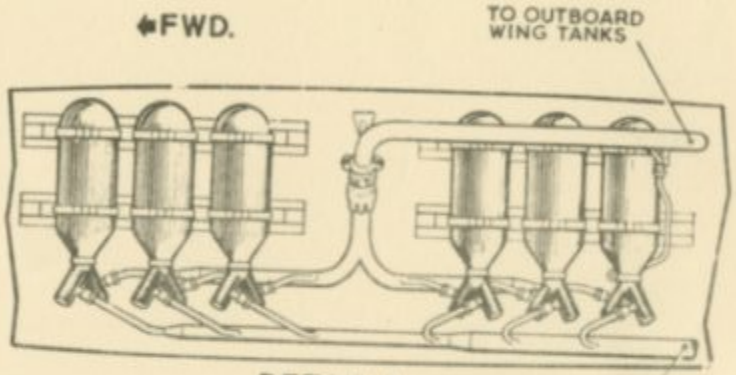
EMERGENCY EQUIPMENT

Hand operated C. B. C. F. extinguishers are mounted at convenient positions in the crews compartment. One more extinguisher is provided for external use. Their locations are as follows:-

a.	Behind each pilots seat -	2	Gravinor Type 34H (B. C. F.)
b.	Below pilots floor (secured to floor support) -	1	
c.	Crews seat port side -	1	
d.	Crews seat starboard side -	1	
e.	External Fuselage nose stowage -	1	



FUSELAGE TANKS



DETAIL A

NOTE..
THE THREE FORWARD BOTTLES TO BE MOUNTED WITH 3-PIN SOCKET (HEAD 'A') FWD. THREE AFT BOTTLES TO BE MOUNTED WITH 3-PIN SOCKET AFT.

KEY

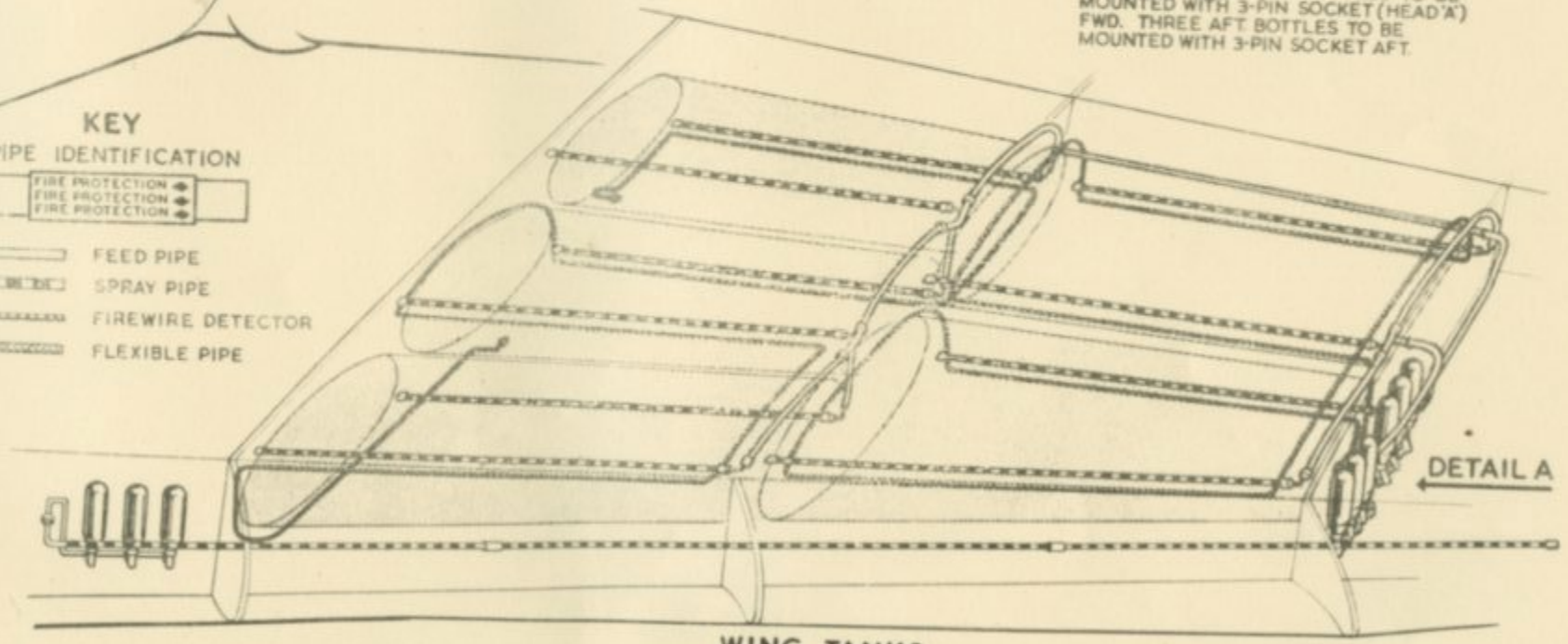
PIPE IDENTIFICATION

FEED PIPE

SPRAY PIPE

FIREWIRE DETECTOR

FLEXIBLE PIPE



WING TANKS