

Chapter 8C AIR SYSTEMS - DE-MISTING, ANTI-ICING, RAIN DISPERSAL,  
ARMAMENT SERVICES AND CANOPY SEAL SYSTEM

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## DESCRIPTION

## General information

1. Hot air for de-misting, anti-icing, rain dispersal and gun purging is obtained from the main air-supply pipe (Chap. 8A), and passes through a constant-flow valve (Chap. 8E), to a gun purging valve (Chap. 8E). From the gun-purging valve, the air flow is directed to the de-misting, anti-icing and rain dispersal systems, or to the gun breeches, depending upon the valve position. The guided weapon pack is heated by 8th-stage compressor air drawn directly from No. 1 engine. Condensation in the canopy side panel interspaces is prevented by circulation of chemically-dried air. The canopy seal is inflated with hot air tapped from the hot-air pipe upstream of the gun-purging valve.

## DE-MISTING

## Description (fig. 2)

2. The windscreen side panels and the canopy top panel are de-misted by hot-air sprays. A tapping from the hot-air pipe, at frame 12 on the port side, directs an air supply through two separate pipes, one passing forward to the windscreen sprays and one aft of the canopy spray. The windscreen supply passes through a stop valve and a non-return valve before being routed, via branch pipes, to enter the sprays located along the windscreen sills. The canopy spray pipe conducts air through a stop valve, inboard through a non-return valve to a pressure-reducing valve on the starboard side of the aft pressure bulkhead, and thence to the female portion of a break

connection; the male portion and the spray pipes are assembled to the canopy.

## Control handle (fig. 3)

3. The control handle is mounted on a spindle passing through the port console, the spindle carrying a lever and linkage connected independently to each stop valve. Three selective handle positions are available as follows:-

OFF - both cocks closed.

TOP ON - canopy cock fully open and windscreen cock partly open.

ALL ON - both cocks open.

## Canopy interspace de-misting (fig. 2 and 4)

4. Air to the side panel interspaces ▶

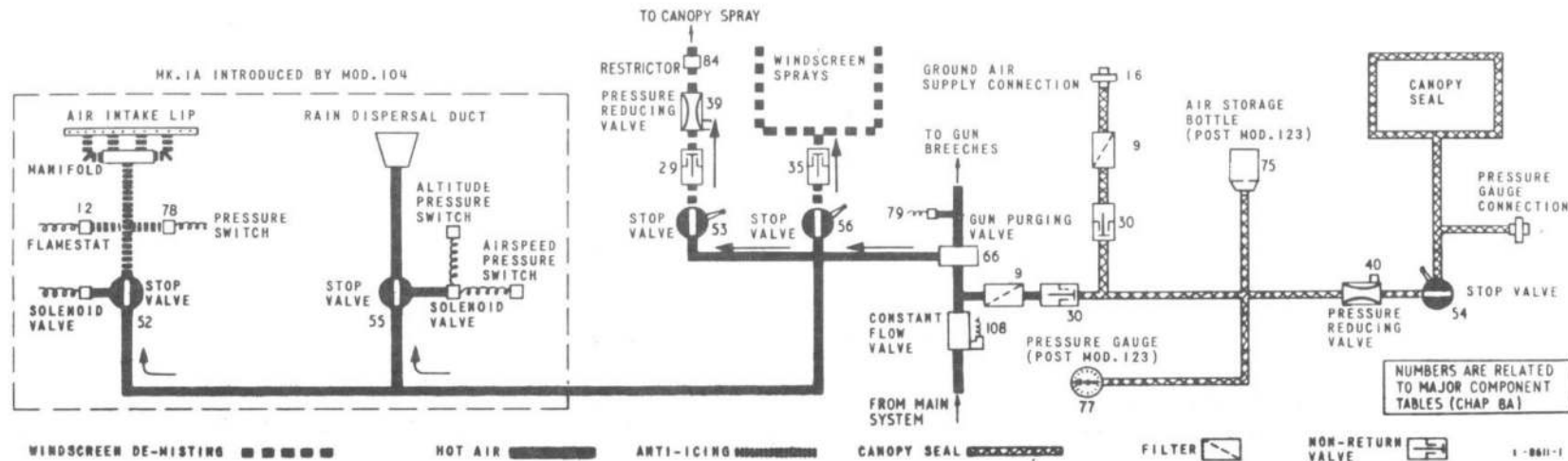


Fig. 1. Theoretical diagram

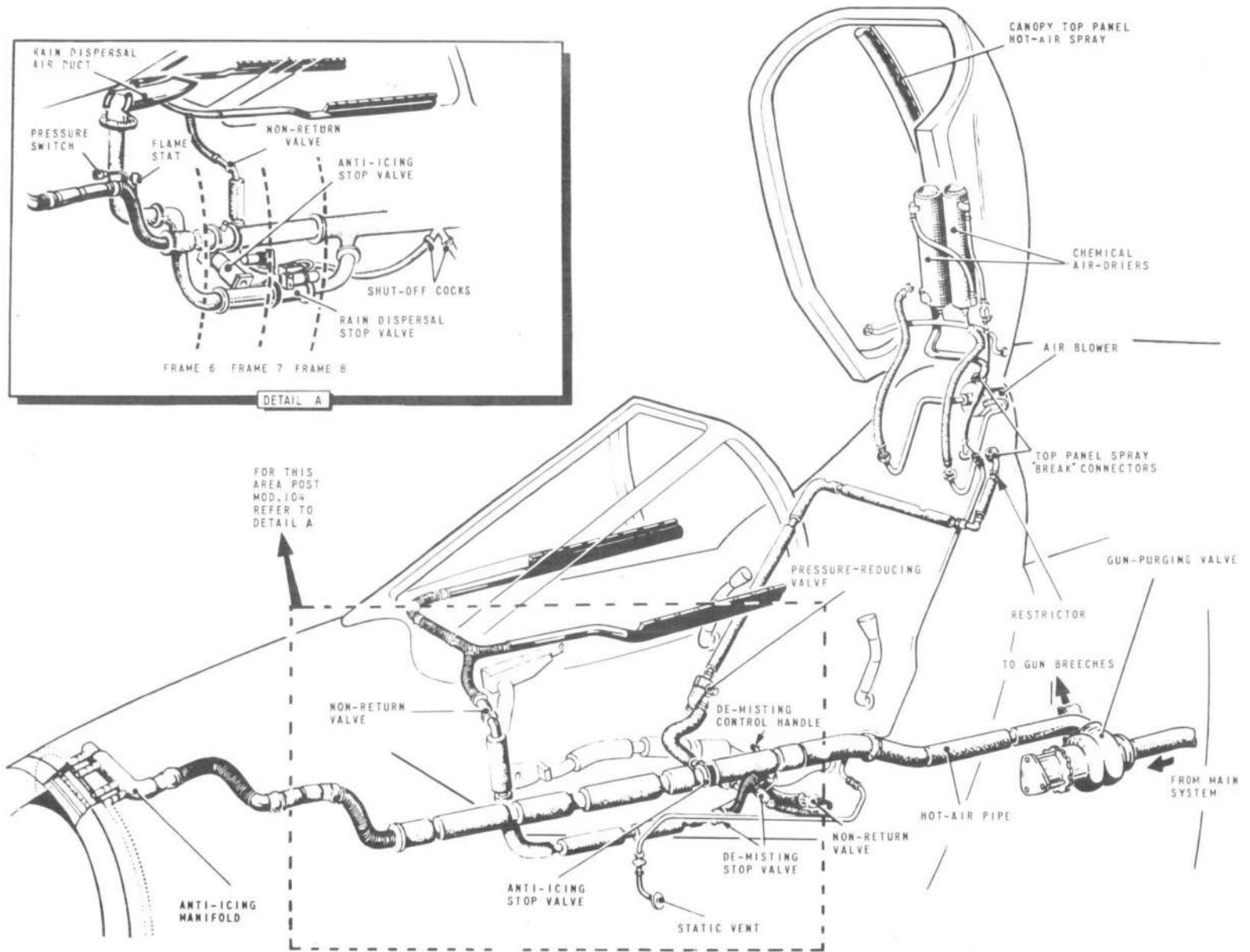


FIG.2. DE-MISTING, ANTI-ICING AND RAIN DISPERSAL

is dried by its passage through two chemical air-driers (*fig.6*), mounted on the canopy top member. The air is circulated by an electrically-driven blower mounted, between the canopy hinge brackets, aft of the cockpit; air pressure build-up is relieved by a static bleed pipe, connected between the port air-drier and a vent in the fuselage skin. The blower is controlled by the WIND-SCREEN-SIDE switch on the starboard console.

#### ANTI-ICING AND RAIN DISPERSAL

##### General information

*Pre Mod.104 (F Mk.1 aircraft)*

5. Only the engine anti-icing system of F Mk.1 aircraft is operative, this being controlled from the DE-ICE switch on the cockpit starboard console panel Sect.1, Chap.1, *fig.11*. A green indicator lamp, forward of the switch, is illuminated whenever the switch is set to DE-ICE and indicates that the electrical circuit is functioning correctly but gives no indication of anti-icing valve failure. For details of the engine anti-icing system refer to A.P.102C-1509-10/11. ▶

*Post Mod.104 (F Mk.1A aircraft)*

6. With the embodiment of this modification, air-intake lip anti-icing (*para.9*) and windscreen rain dispersal (*para.12*) systems are incorporated in addition to engine anti-icing. All three systems are electrically controlled from the DE-ICE/RAIN DISP. switch on the cockpit starboard console panel (*Sect.1, fig.12*) DE-ICE controls air intake lip and

engine anti-icing; RAIN DISP. controls the rain dispersal system.

7. An amber ICE WARNING lamp, inboard of the switch, is illuminated by the combined operation of a moisture content sensing head and a thermal switch when the aircraft is flying in icing conditions. A second indicator lamp, coloured green, is illuminated when DE-ICE is selected, if the air-intake lip anti-icing control valve (*para.9*) is open. For details of the electrical circuits refer to Sect.6, Chap.6 of A.P.101B-1001-1B or 1C, as appropriate. ▶

8. Hot air for rain dispersal and air intake lip anti-icing is supplied through a common pipe, from the gun purging valve, which is divided at frame 10 to supply each system separately.

##### Air intake lip anti-icing

9. The air-intake lip (*fig.2*) is a circular, wedge-section, stainless steel structure which constitutes the leading edge of the intake and is divided, by horizontal blanking plates, into two (*top and bottom*) semi-circles. The complete structure is also divided, by an annular partition, into forward and aft compartments.

10. Heated air, flow-governed by an electrically-controlled, pressure operated, butterfly-type stop valve (*para.13*), is piped from the main air supply (*Chap.8A*) to a manifold situated behind the top edge of the air-intake lip. Four outlet stubs extend forward from the manifold, the inner pair being connected, by rubber pipes, directly to the upper

half of the aft compartment and the outer pair, through pipes led around the upper half of the intake and attached to the lower half of the aft compartment. Communication between forward and aft compartments is through holes drilled at equidistant intervals in the annular partition. To ensure a continuous flow of heated air through the compartments, bleed holes have been drilled through the inner skin of the forward one.

11. Possible damage to the intake structure due to overheating or excessive pressure in the lip is prevented by an automatic system comprising a pressure switch and a flamestat. These are tapped into the anti-icing pipe downstream of the butterfly valve and operate at 40-45 lb/in<sup>2</sup> gauge pressure and 350 deg C respectively; if either figure is exceeded the associated switch will override the manual selection to close the valve and extinguish the DE-ICE indicator lamp (*para.7*). The pressure switch incorporates a manual reset button; once the switch has operated it can only be reset manually on the ground. For details of the switch refer to A.P.112G-1107-1. ▶

##### Rain dispersal

12. Hot-air flow for rain dispersal is delivered through an electrically-controlled pressure-operated butterfly valve (*para.13*) mounted between frames 8 and 9 beneath the port console (*access panel 8P*). When the valve is open, air is directed to a spray nozzle, mounted forward of the windscreen. Above 350 knots I.A.S. or 10,000 ft altitude rain dispersal is not required and if either

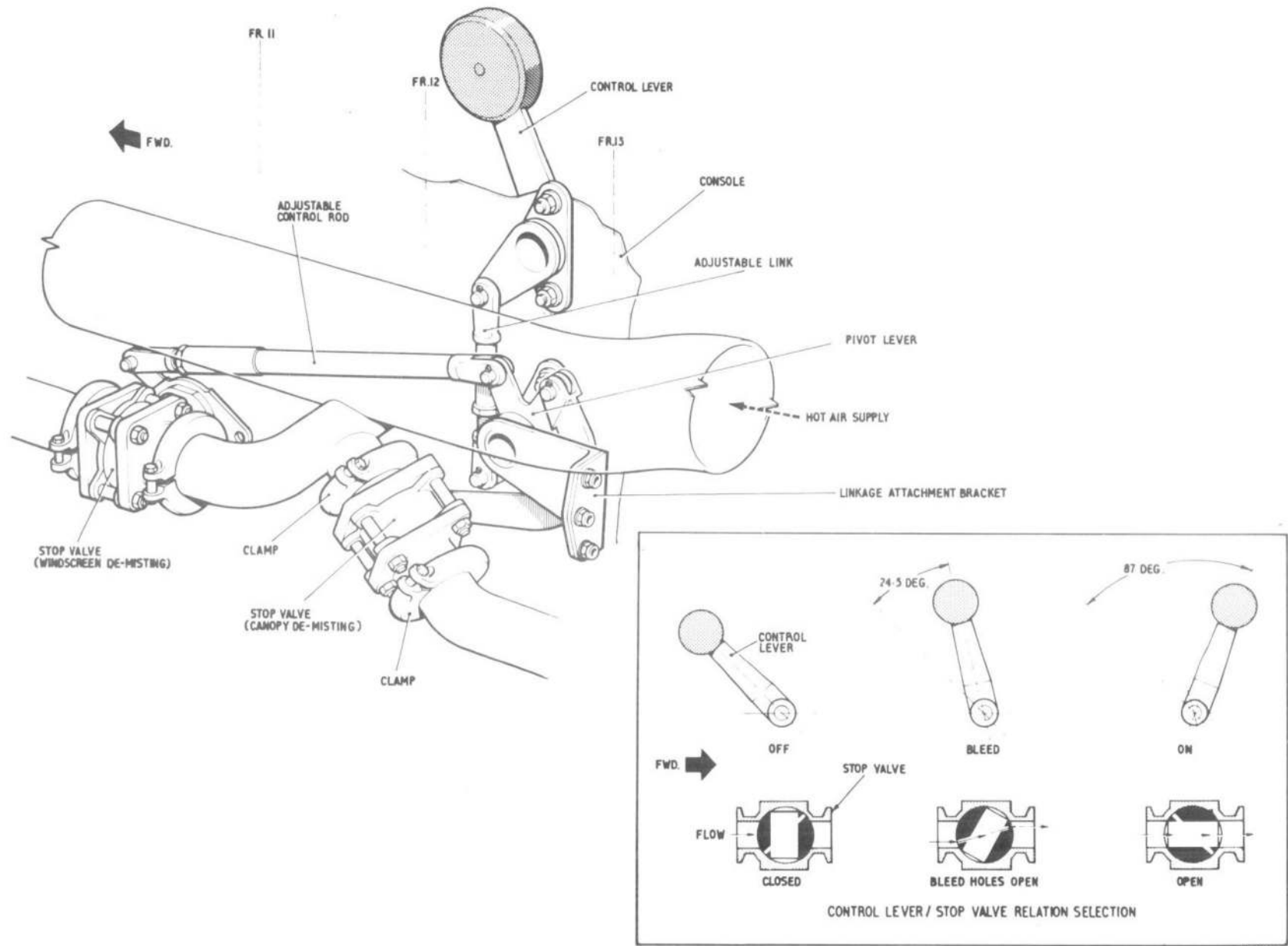


FIG.3. DE-MISTING CONTROLS (POST MOD.104)

of these figures is exceeded an air speed or an altitude switch respectively overrides or prevents manual selection of the valve.

#### Stop valves

- ◀ 13. The stop valves in the anti-icing and rain dispersal system differ only in the fact that the anti-icing valve incorporates a switch which signals the DE-ICE ON indicator when the valve is open. They are operated by the air pressure in the main pipe, upstream of the valve, under the control of remote solenoid valves which are in circuit with the associated selections of the RAIN DISP/DE-ICE switch. When no air flows in the main pipe both valves are inoperative. For a detailed description of the valves refer to A.P.4303E, Vol.1, Sect.2.

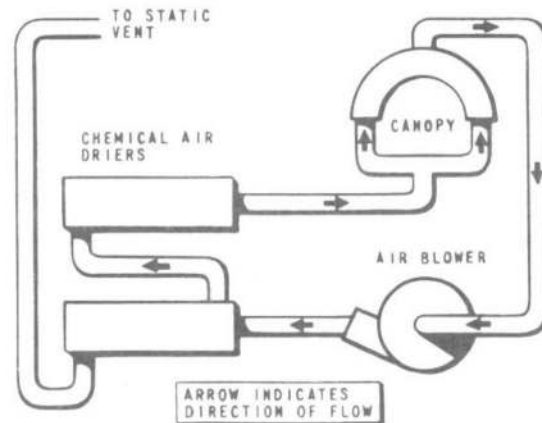
### ARMAMENT SERVICES

#### Gun purging

14. The inflammable gases released into the gun breeches during firing, are expelled by hot air diverted from the hot-air supply pipe by the gun purging valve (Chap.8E). The valve operates electrically when the gun firing trigger is depressed. A capillary tapping, in the pipe leading to the gun breeches, transmits purging air pressure to a pressure-switch which controls a lamp on the starboard coaming instrument panel. The lamp is illuminated when the gun purging valve is open. The gun firing circuit is routed through the pressure switch so that if the gun-purging valve fails in the closed position, the guns will not fire.

#### Guided weapon pack heating.

15. Hot-air from No.1 engine 8th compressor stage flows through a pipe passing forward along the starboard side of the fuselage and across the bottom of frame 21, to terminate in a union connection; the connection is blanked off when the guided weapon pack is not fitted.



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Fig.4 Canopy interspace de-misting diagram

### CANOPY SEAL SYSTEM

#### General information (fig.5)

- ◀ 16. A hollow rubber seal of rectangular cross-section is bolted to the windscreen arch, canopy sills and the aft pressure bulkhead; it is automatically inflated when the canopy is locked to seal the gap between cockpit and canopy. Air for inflation is supplied from the aircraft air system. For ground servicing, an external charging point (para.19) is provided. ▶

#### ◀ Air supplies (fig.5) ▶

##### Pre Mod.123

17. The aircraft supply is tapped from the main hot-air pipe, upstream of the gun purging valve, and passes through a filter and a non-return valve, both located between frames 16 and 17 on the port side (access panel 21P), to a T-connection adjacent to the cabin air-inlet pipe at frame 15. A pipe from the T-connection passes through the pressure bulkhead to an 8 lb/in<sup>2</sup> pressure reducing valve on the side of the port console and thence to a stop valve on the bracket of the canopy internal handle (Chap.1A). When the canopy is locked the handle opens the stop valve to admit air to the canopy seal through a pipe connected between the seal and the valve outlet; unlocking the canopy closes the air supply and vents the air in the canopy seal into the cockpit through the stop valve body. A tapping from the seal inlet pipe terminates, on the pressure bulkhead with an attachment point for the test gauge used during ground servicing.

##### Post Mod.123

18. This modification introduces an air storage bottle which provides a reserve of pressure to maintain canopy seal inflation against leakage or supply failure or to allow opening and closing the canopy up to five times when the engines are stationary. The air bottle outlet is tapped into a 4-way connector inserted in the air pipe to the stop valve downstream of the T-connection (para.17); the remaining union of the 4-way connector communicates with a pressure

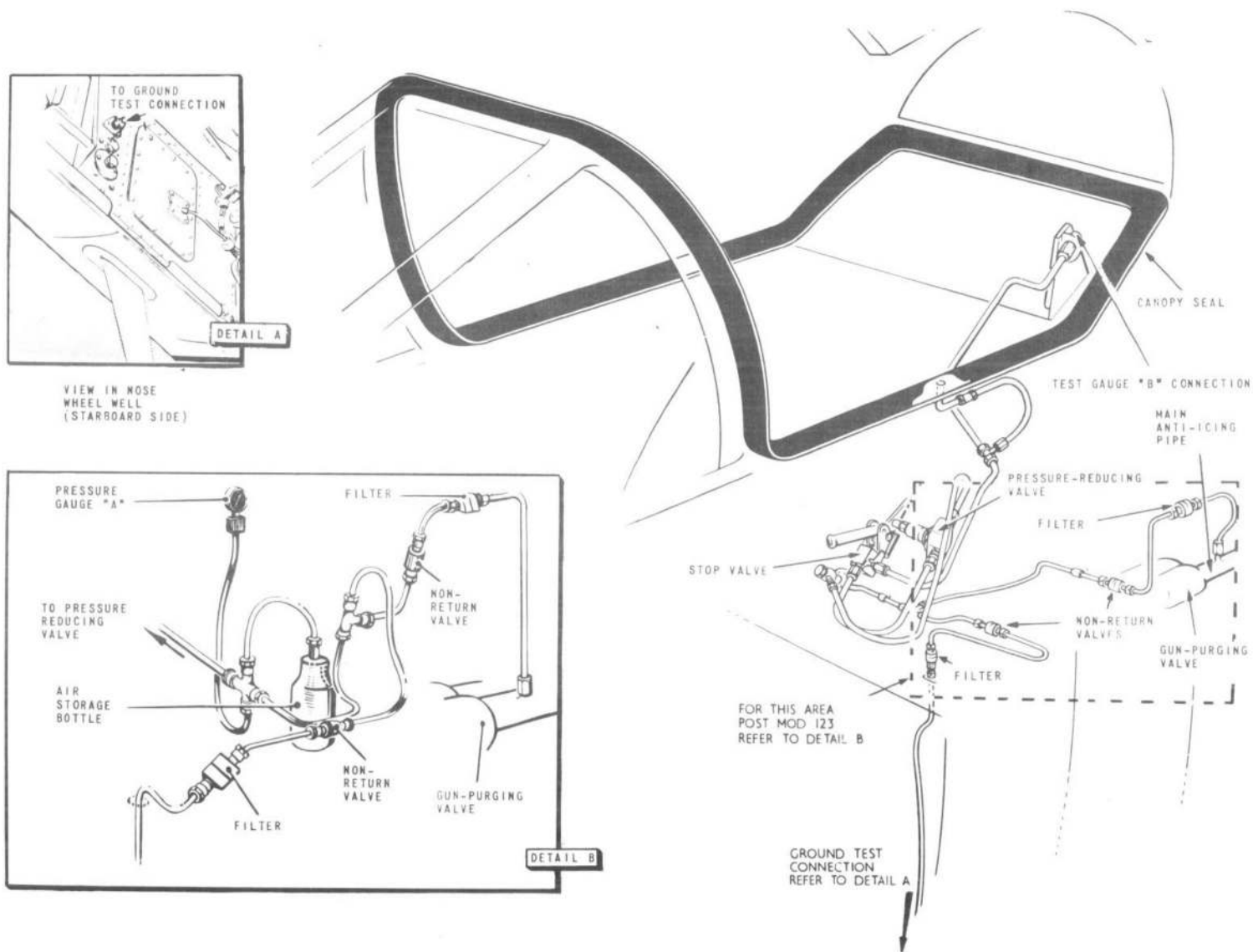


FIG. 5. CANOPY SEAL INFLATION

◀ MINOR AMENDMENT ▶

RESTRICTED

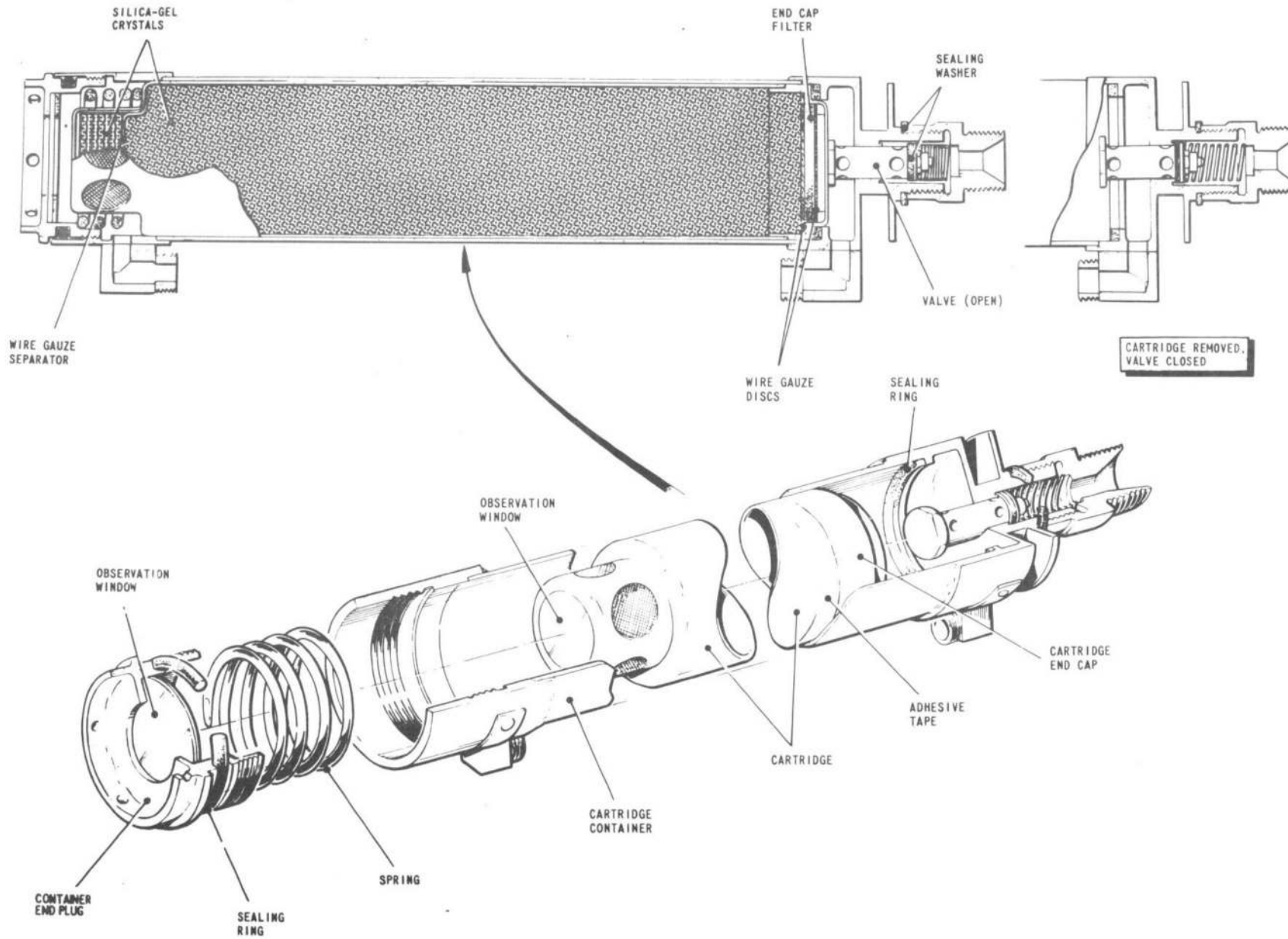


FIG.6. CHEMICAL AIR-DRIER

RESTRICTED

gauge mounted on the rear face of the aft pressure bulkhead. The bottle stores air at engine delivery pressure (170-190 lb/in<sup>2</sup>) during engine running and can also be charged from the ground connection (para. 19) using the equipment listed in Table 1.

#### Ground supply

19. An inflation connection, for ground testing purposes, which is blanked off when not in use, is located on the nose-wheel starboard beam (fig. 5). A ¼ in. dia. pipe is routed from the connection through a filter, to a non-return valve on frame 15, whence it is joined to the T-connection, (para. 17).

### SERVICING

#### WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cockpit or performing any operations upon the aircraft.

#### Tools and equipment

20. Refer to Table 1 for details of the tools and equipment used in servicing and removal and assembly operations.

#### Chemical air-driers (fig. 6)

21. The desiccant crystals, visible through the observation window, are normally coloured blue and change to pink when saturated. In the latter condition the contents are to be changed, as follows:-

(1) Unscrew the container end plug

using a tommy bar; remove the spring and the drying agent cartridge. ►

(2) Remove the adhesive tape securing the lower end cap of the cartridge. Remove the end cap and pour out the contents of the cartridge, i.e. desiccant crystals and stainless steel gauze separator.

(3) Pour in Silica gel crystals Ref. No. 33C/790 to cover the observation window to a depth sufficient only to allow the separator to be assembled. Refit the separator and fill the remainder of the cartridge with Silica gel crystals.

#### Note...

*Be careful not to shatter the crystals.*

(4) Clean the cartridge end cap filter; refit the filter and end cap. Secure them with adhesive tape not exceeding 5.80 in. in length, to avoid overlapping

(5) Refit the cartridge in the tube, refit the spring, and screw in the container end plug, tightening it with the tommy bar.

#### Canopy seal leakage test

*Pre Mod. 123*

◀ 22. To test the seal for leakage:-

(1) Remove the blank from the test gauge 'B' connection (fig. 5) and fit a test connector complete with a pressure gauge.

(2) Remove the blank from the ground supply point on the nose undercarriage

starboard beam (fig. 5) and fit an inflation adapter.

(3) Open the ram-air valve and close and lock the canopy.

(4) Connect a tyre inflation pump to the inflation adapter and inflate the seal until the pressure gauge reads between 7.75 lb/in<sup>2</sup> and 8.25 lb/in<sup>2</sup>. Continue inflating slowly and check that the gauge reading does not exceed the higher figure. If it does, the reducing valve is suspect.

(5) Check all the unions between the seal and the ground inflation point for leakage.

(6) Unlock the canopy and check that the seal deflates as soon as the locking handle moves.

(7) Lock the canopy and re-inflate the seal to between 7.75 lb/in<sup>2</sup> and 8.25 lb/in<sup>2</sup>. Note the exact reading.

(8) Disconnect the inflation pump and leave the seal inflated for a period of 3 to 24 hours, during which the pressure drop should not exceed the figure given by the graph (fig. 7) for the period under consideration.

(9) Remove all ground equipment and fit and wire-lock the blanks on the test connections.

*Post Mod. 123*

23. To test for leakage:-

(1) Remove the blank from the test ►

◀ gauge connection (*fig.5*) and fit a test connector complete with a pressure gauge 'B'.

(2) Remove the blank from the ground supply point on the nose undercarriage starboard beam (*fig.5*).

(3) Connect a ground air supply, which will produce 0-80 lb/in<sup>2</sup>, to the ground supply point.

(4) Open the ram-air valve and close and lock the canopy.

(5) Turn on the ground supply and slowly increase the pressure until pressure gauge 'A' (access panel 21P on the rear face of the pressure bulkhead) reads 20 lb/in<sup>2</sup>. Check that the pressure recorded by gauge 'B' reads between 7.75 lb/in<sup>2</sup> and 8.25 lb/in<sup>2</sup>.

(6) Check all the valves and pipe joints between the canopy seal and the non-return valves in the high-pressure system for leakage. (The non-return valve in the engine air supply line is behind frame 16 and that in the ground supply line between frames 15 and 16).

(7) Slowly increase the supply pressure until gauge 'A' reads 50 lb/in<sup>2</sup>; check that gauge 'B' continues to read between 7.75 lb/in<sup>2</sup> and 8.25 lb/in<sup>2</sup>.

(8) Slowly increase the supply pressure until gauge 'A' reads 80 lb/in<sup>2</sup> and again check that the pressure indicated by gauge 'B' remains between 7.75 lb/in<sup>2</sup> and 8.25 lb/in<sup>2</sup>.

(9) With a gauge 'A' pressure of 80 lb/in<sup>2</sup> unlock the canopy and check that gauge 'B' pressure falls to zero.

(10) Unlock and lock the canopy several times to reduce the pressure in the system and then, with the canopy locked, re-adjust the supply until gauge 'A' reads 20 lb/in<sup>2</sup>.

(11) Leave the canopy locked down and check that, during a test period of three hours, the pressure indicated by gauge 'A' does not fall by more than 1.5 lb/in<sup>2</sup>.

(12) Remove all ground equipment and fit and wire-lock blanks on the test connections.

#### Setting the de-misting control

24. To set the control:-

(1) Disconnect the connecting rod from the lever assembly.

(2) Set the control lever to OFF.

(3) Close the windscreen and canopy stop valves against their respective stops. ▶

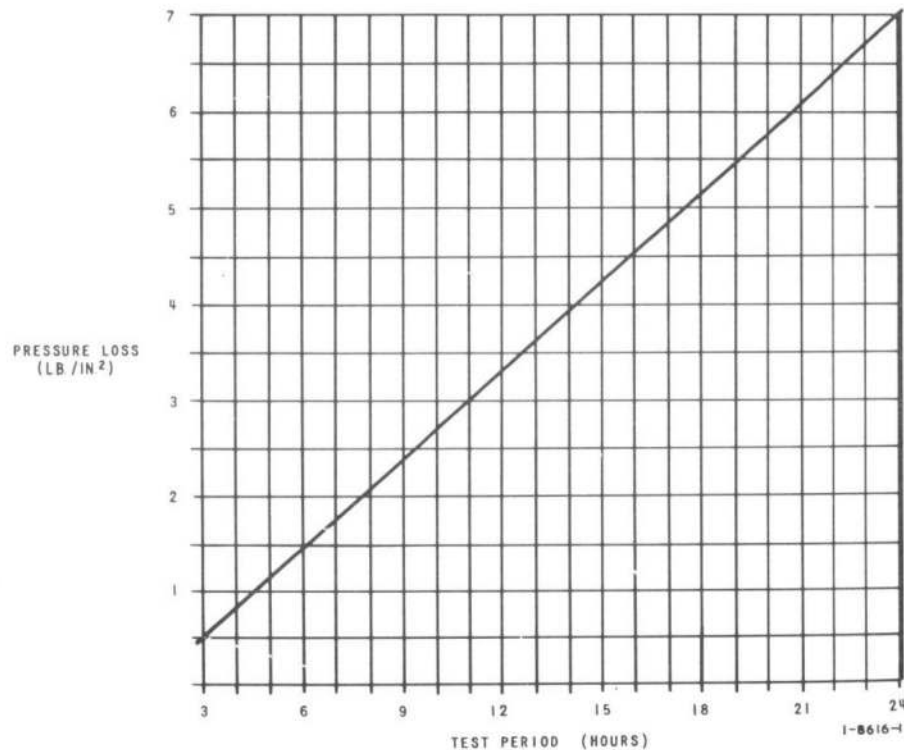


Fig. 7. Canopy seal leakage diagram  
(pre Mod. 123)

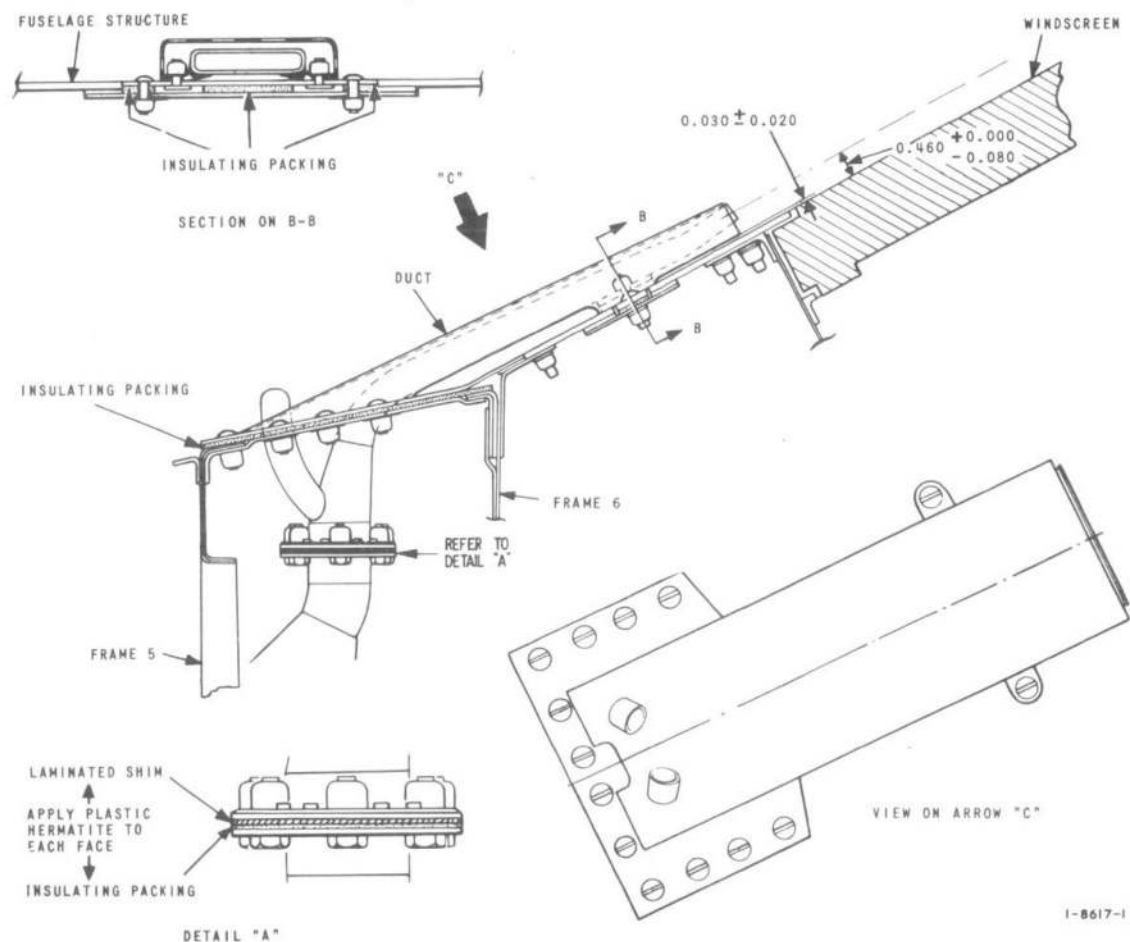


Fig. 8. Rain dispersal air duct

◀ MINOR AMENDMENT ▶

◀ (4) Refit the connecting rod and adjust its length as required so as not to disturb the settings made in (3).

(5) Move the control lever through its range of travel and ensure that the three selected positions, given in para. 3 are satisfactorily attained.

**Note...**

*Undue pressure must not be applied to the lever when closing the stop valves.*

(6) On satisfactory completion of adjustment, relock the connecting rod.

**REMOVAL AND ASSEMBLY****Rain dispersal air duct (fig. 8)**

25. Prior to assembly, lightly coat each face of the insulating packing and laminated shim (detail A) with plastic Hermatite 1250 ensuring that no surplus enters the duct. The dimensions given in the illustration must be obtained when fitting the duct. It is permissible, if necessary to achieve correct positioning of the duct, to file the insulating packing located at the top of frames 5 and 6. ▶

TABLE 1

## Tools and equipment

Ref.No.	Part No.	Description	System	Application
26DK/95181	EB2.88.3769	Bar, tommy	Canopy interspaces de-misting	Air-drier container end plug
26DK/95228	EB2.88.5921	Connector, test	] Canopy seal inflation	Leakage test
4F/2191	-	Gauge, pressure 0-15 lb/in <sup>2</sup>		Leakage test
26DK/95369	EB2.88.5853	Adapter	] Canopy seal	System pressurizing
4G/3743	-	Pump, inflation, Type B		

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