AERO ENGINE SCHOOL
COURSE NOTE
No. TAv.354.
Printed in England

AVON 200 SERIES - FLAP BLOWING SYSTEM

SEQUENCE HEADING CHART.

1. Basic Presentation.

2. Required function of system:-

   To conduct compressed air from the engine and eject it over the wing flap when 10^{o} of flap is selected.

3. Air Flow of System.

   (a) Air Supply produced by:- — COMBUSTION AIR CASING.

   (b) Air Control Valve by:- — BLEED VALVES AND FUEL OPERATED SERVO.

   (c) Supply to Flaps.

   (d) Micro-Switch controlled by:- — FLAP POSITION AND MANUAL SELECTION.

4. Effect of flap blowing on the engine fuel system A.C.U. operation.

5. A.C.U. Reset System.

   (a) Control of P_2 exhausted to P_1 by:- — A.C.U. RESET giving

   (b) Resetting of acceleration by split P_2 increase in:- — AIR METERING SECTION OF A.C.U.

6. Interaction of Flap Blowing System.

7. Servicing. Ground Running Checks.

8. Study of Components.

9. Consolidation Period.

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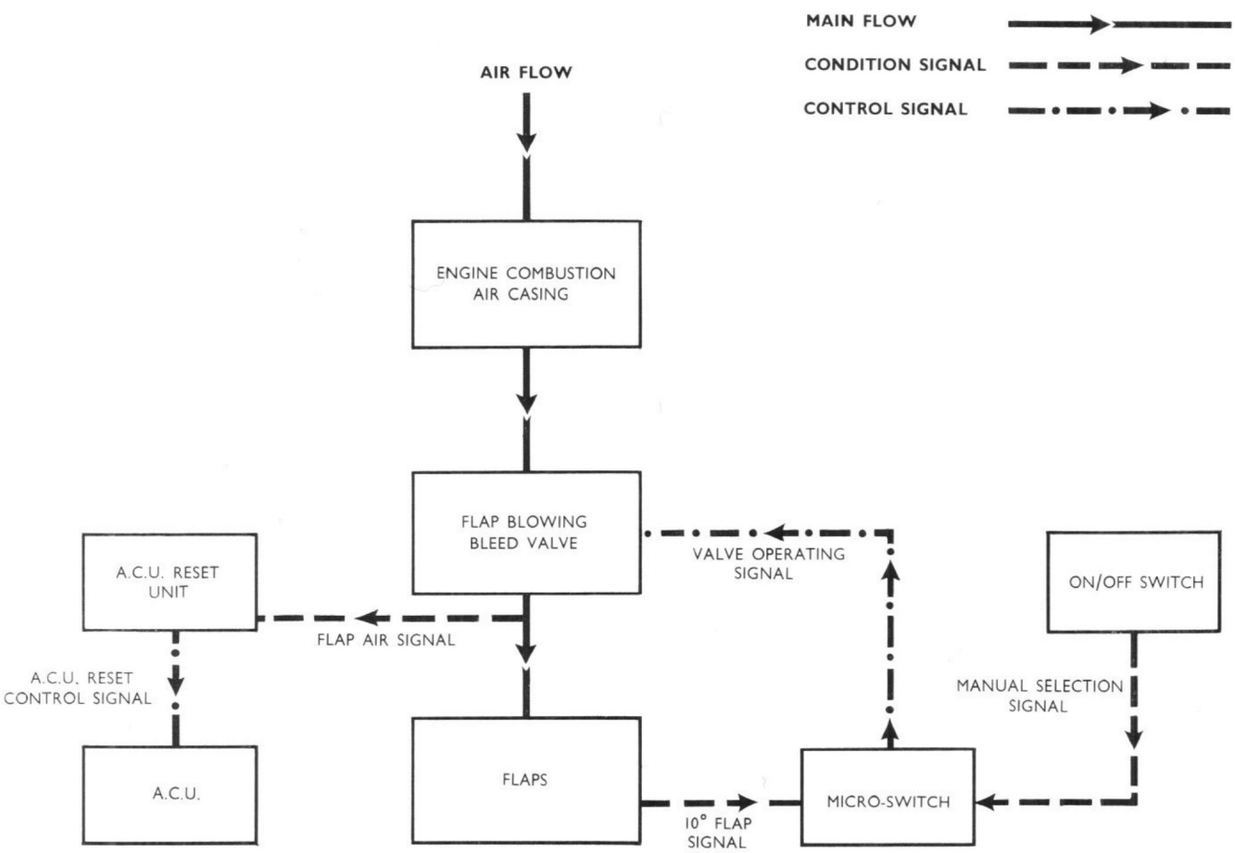
AVON 200 SERIES

FLAP BLOWING SYSTEM

Basic Presentation

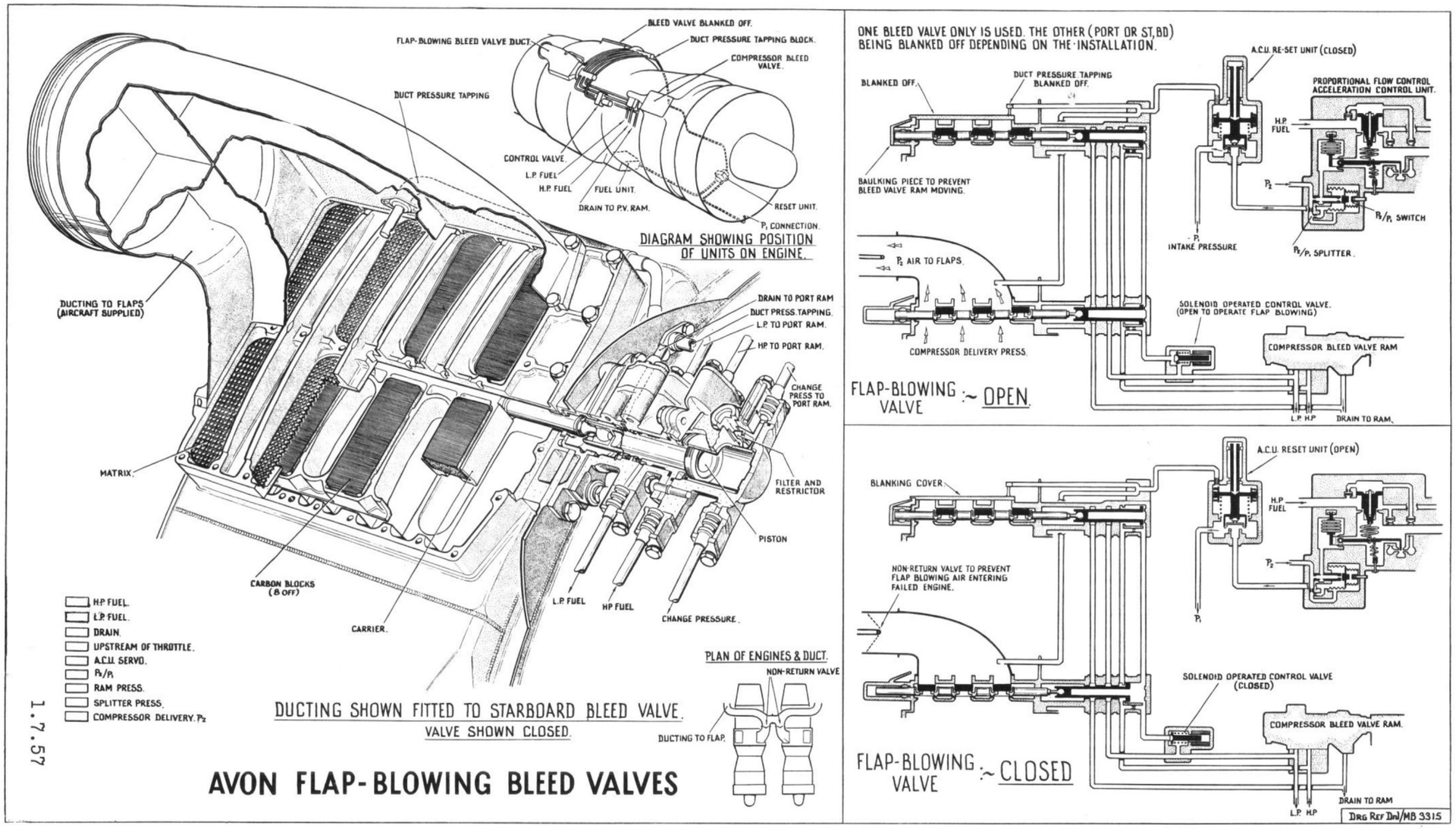


(1) This system augments aircraft lift at low aircraft speeds to facilitate take-off and landing on short runways or aircraft carriers.

(2) The extra lift is obtained by blowing air through tubes over the trailing edge of the aircraft flaps

(3) The air is tapped off the combustion air casing when the aircraft flaps are lowered at least 10°.

(4) Due to the change in airflow through the engine compressor it is necessary, automatically to reset the A.C.U. to ensure correct acceleration conditions.



AVON 200 SERIES.

FLAP BLOWING SYSTEM.

2. FUNCTION OF SYSTEM.

To augment aircraft lift at low aircraft speeds to facilitate take-off and landing on short runways or aircraft carriers.

The lift is augmented by ducting compressed air from the engine and ejecting it over the wing flaps. This increases the airflow velocity over the wing and encourages it to follow the line of curvature near the trailing edge where a sudden change in angle occurs with the flaps down.

3. AIR FLOW SYSTEM.

(a) Air supply.

A proportion of the air from around the combustion chambers is fed to the underside of two slide control valves, only one of which is used, depending upon whether the engine is port or starboard.

(b) Air control valve.

An aluminium body houses a slide member.

This carries eight carbon sealing pads in recesses.

It is positioned on the underside of a ported outlet plate.

Air pressure holds the pads in contact with the plate.

The slide extension is housed in a cylinder attached to the rear side of the unit.

The other end is located by a differential area piston housed within a ported cylinder.

Fuel pressure supplied to this cylinder provides the force to operate the slide member.

(c) Supply to flaps.

The flow is:-

Compressed air from air casing.

Through control valves.

Through non-return valves.

Via associated ducting to

Titanium tubes in trailing edge of wings directing air over flaps.

(d) Micro-Switch control.

When flap blowing is selected by cockpit switch:-

A circuit is made to the flap operated micro-switch.

This switch closes on selection of 10° of flap.

This completes a circuit to energise the solenoid valve.

/continued.

The valve opens to allow fuel to flow from the restricted side of the servo pistons to return to L.P.

Thus a pressure drop is created on this side of the piston which moves to open the air valve.

4. EFFECT OF FLAP BLOWING ON A.C.U. OPERATION.

With the system in operation, the air flow through the engine turbine is reduced.

Acceleration time to Maximum R.P.M. is increased. An acceleration control reset unit is therefore embodied to restore acceleration times to normal.

5. A.C.U. RESET UNIT.

It comprises an aluminium body housing a spring loaded piston carrying a universally mounted plate valve. The piston is spring loaded to open the valve.

Air from the flap blowing duct closes the valve.

A calibrated drilling in the side of the valve seat permits a restricted air flow from the A.C.U. to the intake when the valve is in the closed position.

The unit is connected into the air line from the A.C.U. air metering section to the engine intake.

6. INTERACTION OF FLAP BLOWING SYSTEM.

The following summarises the action taking place:-

H.P. fuel is delivered to the air control valve servo cylinder and fed to both sides of the piston.

The feed to the largest area is via a restrictor.

With solenoid valve closed, pressures either side of piston are equal, but due to the differential area the piston is held in a position to close the air valve.

With solenoid valve energised and opened, fuel flows from restricted side of servo piston back to L.P.

A pressure drop is created and the piston moves to open the air valve.

The rate of fuel flow is consequently increased to restore the acceleration time.

To reset the A.C.U., air pressure, now present in the flap blowing duct, is fed to the A.C.U. reset unit to close the reset unit valve.

This restricts the air flow from the A.C.U. air metering section and increases the proportion of pressure felt by the A.C.U. P_2 capsule.

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7. SERVICING. GROUND RUNNING CHECKS.

Servicing.

Apart from periodic checks for security no routine servicing is necessary.

Should a unit become unserviceable it should be removed and replaced by a serviceable unit.

Replacement of an actuator is straight forward but care must be taken to ensure equal overlap of the outlet ports by the carbon pads when the valve is in the closed position.

Adjusting shims are available for setting the overlap in steps of 0.005" from 0.020" to 0.125".

Replacement carbon pads must have 0.002" to 0.006" end and side clearance in their housings.

NOTE. If a valve slide has to be removed it should be noted that no blank can be fitted to the manifold while this work is in hand and special care must be taken to ensure that no foreign matter is allowed to enter the combustion chamber.

Ground Running Checks.

(1) Select 93.8% R.P.M. and when conditions have stabilized switch on flap blowing. R.P.M. should fall and J.P.T. rise within 3 secs. Repeat this check three times.

(2) Select 65% R.P.M. (J.P.T. approx. 410°C). Switch on flap blowing and observe change in conditions. R.P.M. should fall below 59% and J.P.T. should not rise above 525°C.

(3) Re-select 65% R.P.M. with flap blowing in operation. Carry out a slam acceleration to T.O. R.P.M. Acceleration time should be 5 - 6 seconds. Repeat three times. J.P.T. will rise sharply during these checks.

NOTE. Whenever ground testing the engine with flap blowing in operation, the Top Temperature Controller must be switched 'ON'.
Maximum permissible J.P.T. on slam accelerations with flap blowing in operation is 850°C. for 3 secs.

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