

SECTION 2E.C.U. DESCRIPTION1. Nose Fairing

The nose fairing is formed from light alloy sheet, is of double skin construction, the space between the skins allowing passage of air for engine anti-icing, and open at the front to ram air. The fairing is attached to the front face of the centre adaptor by studs and nuts, the fitting of a dowel being such that the fairing will be located in one position only, so lining up the ram air outlet and water drain outlet.

Slots around the mating faces line up to allow the anti-icing air to exhaust from the nose fairing to the centre passages through the twelve hollow vanes of the intake casing.

2. Air Intake Casing

The casing is an alloy casting and is located on the front face of the low pressure compressor extension.

The twelve hollow vanes, each with two passage ways link the outer casing with the centre section. Passages between these vanes duct the air from the aircraft intake to the L.P. compressor.

The rear diaphragm supports the L.P. compressor front bearing housing and the stationary member of the bearing seal. Housed in the centre adaptor is the oil separator and its front seal.

At the rear of the intake casing 30 hollow entry guide blades are fitted in recesses in the outer casing and are secured by set bolts which are screwed into the threaded base of each blade. At their inner ends the blades locate in the centre section.

A circumferential manifold located around the outer casing distributes hot air through the entry guide blades.

The aircraft intake duct is fitted by means of a manacle ring to the front flange of the casing, this facilitating speedy removal for inspection and engine changing.

All vanes vent anti-icing air through their rear ducts whilst anti-icing air to the nose fairing flows through the front ducts.

For reference purposes the twelve hollow vanes are numbered one to twelve in a clockwise direction viewed from the rear of the engine, No. 1 Vane being at 12 o'clock position and are used for the following purposes:-

No. 1 Vane - Joined by duct to No. 12 vane to vent engine anti-icing air and also breather air from oil separator, to the rear of the engine. External fittings are the front one for the front hoist, during installation, or the engine sling, and the second one for the adjustable bracket to which is fitted the fixed length aircraft link.

/No. 2 Vane

SECTION 2E.C.H. DESCRIPTION

No. 2 Vane - External elbow venting anti-icing air from Nos. 2 and 3 Vanes.

No. 3 Vane -

No. 4 Vane - Shielded perforated plate through which vents anti-icing air into the engine bay.

No. 5 Vane -

No. 6 Vane -

No. 7 Vane - Oil scavenge from L.P. compressor front bearing and oil separation. Engine anti-icing air from vanes 5, 6, 7, 8 and 9 vertically downwards to atmosphere.

No. 8 Vane - Nose fairing water drain. External elbow for ram air pressure to fuel system.

No. 9 Vane - Ram air pressure to the elbow on Vane 8. Pressure oil to L.P. compressor front bearing.

No. 10 Vane - Shielded perforated plate through which engine anti-icing air vents into the engine bay.

No. 11 Vane - External elbow venting engine anti-icing air to join with that from Vane 2 and 3.

No. 12 Vane - Joined by duct to No. 1 and 12 vanes to vent breather air to rear of engine External connections at the vane accepts vent air from the constant speed drive unit oil tank.

3. Low Pressure Compressor Rotor

A six stage compressor rotor, axial flow type, is driven by the second stage turbine wheel.

The main assembly consists of the front rotor shaft, the six rotor discs with the five spacer rings, the rotor driving shaft and rotor tail shaft.

Each stage of the compressor rotor blades is mounted in an aluminium alloy rotor disc, the fitting being of fir tree root form. The fifth and first stage blades are designed with a front and rear key respectively to the fir tree roots to provide end location, spacer rings bolted between each stage provide a positive location for stages two, three and four.

The zero stage disc complete with blades having rear keys, is located by two dowels to the first stage discs.

The spacer ring and the front shaft retaining bolts complete the assembly of the zero stage to No. 1 stage disc.

The compressor driving shaft is secured by its integral flange to the rear of the rotor by bolts passing through discs number four and five. A bearing seal is located to the rear of the flange followed by a single thrust bearing which locates the rear end of the compressor rotor within the intermediate casing.

SECTION 2E.C.U. DESCRIPTION

The compressor driving gear, located on the driving shaft by serrations, the bearings and bearing seal, are all secured by tabwasher and ring nut. An adjusting washer locates the rotor assembly in relation to the intermediate and L.P. compressor casings.

Splined into the rear of the driving shaft is the rotor tail shaft, on to the rear of which is splined the L.P. compressor driven coupling. Located inside the rear of the tail shaft, by three retaining pins, is a threaded steel ball into which is screwed the forward end of the centre tube unit, the other end being locked to the rear of the L.P. turbine disc.

4. Low pressure compressor casing

The alloy casing is in two sections, the extension unit and compressor casing and secured by bolts along the centre lines.

Grooves of dove-tailed section house the five rows of steel stator blades. Retaining plates, secured by countersunk head screws to the casing joint faces at the ends of each half row of blades, retain the blades of stages 1, 2 and 4 in position when the casings are separated.

A mounting bracket on the starboard side lower half casing, is the location for the Constant Speed Drive Unit and Alternator, whilst the port side mounting accepts the engine oil tank.

The front bulkhead is bolted to the flange on the casing, the Elliot fuel flowmeter is mounted on the rear lower portion.

A banjo standard, to which bolts a two way connection, is tapped into the rear of the L.P. lower half casing. L.P. delivery air from No. 1 Vane intermediate casing is piped to the C.S.D.U. oil tank and also to the banjo connection to pressurise the front and rear bulkhead seals.

A transportation and test bed attachment point is located on the lower half casing.

The first four rows of starter blades, the '0', 1, 2 and 3 stages are bolted, with two bolts to each blade, to the compressor casing, so providing positive location.

5. The Front Bulkhead and Seal

Comprises top and bottom units, attached to the L.P. Compressor Casing, forming the dividing wall between Zone 1 and 2A of the engine installation. A seal, located around the bulkhead, is kept to a value of 5 p.s.i. by a valve. Two covers are provided for the Flow meter and the Constant Speed Drive Unit. Passing through the bulkhead are Air, Fuel and oil and hydraulic pipelines, the throttle control rod and various breeze plug connections.

6. Intermediate Casing

The intermediate casing is situated between the two compressors and contains both the L.P. exit guide blades, and H.P. entry guide blades.

The central section of the casing is connected to the outer portion by eight cambered hollow vanes, the area between which is used to convey the L.P. delivery pressure air to the H.P. compressor inlet.

SECTION 2E.C.U. DESCRIPTION

The rear L.P. compressor and front H.P. compressor bearings are accommodated within the front and rear walls of the casing.

Spur gears mounted on the compressor shafts initiate drives which are conveyed through three of the hollow vanes to the outside of the casing.

Mounting faces for the auxiliaries are arranged around the outer casing, forming two groups, namely L.P. and H.P. driven. The former comprises the compressor tachometer generator and L.P. driven fuel pump. The latter comprises the following:-

H.P. Driven fuel pump
Main Oil Pump and four Scavenge Pumps
Constant Speed Drive Unit
Hydraulic Pump
H.P. Tachometer Generator (When fitted)

In addition it transmits the drive from the starter to the H.P. compressor when the starter is in operation.

Vanes of the casing are used as follows:-

No. 1 Vane - Two connections, piping L.P. delivery air to pressurise:-

- (a) Constant speed drive unit oil tank.
- (b) Front and rear bulkhead seals.

No. 2 Vane -

No. 3 Vane -

No. 4 Vane - Drive to the constant speed unit and starter.

No. 5 Vane - The oil pumps and auxiliary drives. Oil drain to the sump.

No. 6 Vane - Front - L.P. Driven fuel pump drive. Rear H.P. driven fuel pump drive. (L.P. R.P.M. Tachometer generator, L.P. & H.P. Hand turning gears.)

No. 7 Vane - Vents engine oil tank via spring loaded valve to gear chamber.

No. 8 Vane -

7. High Pressure Compressor Rotor

The seven stage high pressure compressor is made of heat resisting steel.

The rotor blades are mounted, by fir tree root form, in the seven steel discs between which are bolted six spacer rings, the whole assembly being contained between the front rotor shaft and the rear rotor centre.

The front rotor shaft, which carries the compressor front bearing, bearing seal and driving gear, is bolted to stages one and two.

The rear rotor centre, which carries the double thrust bearing, bearing seal, compressor rear air seals and compressor driving coupling, is bolted to number six spacer ring and number seven rotor disc.

SECTION 2E.C.U. DESCRIPTION

Inside the compressor are assembled concentrically an inner oil tube and an outer air transfer tube, both made of light alloy.

8. High Pressure Casing

The cast steel casing is split on the horizontal centre line and has seven dove-tailed grooves machined in its inner diameter to accept the seven stages of compressor stator blades.

Retaining plates secured by screws to the casing joint faces at the ends of each half row of blades, retaining the blades in position when the casings are separated.

Air via an outlet from the third stage of the compressor casing upper half is used for cooling the rear face and pressurising the bearing seal of the L.P. turbine.

9. Delivery Casing

The stainless steel delivery casing is situated between the rear face of the H.P. compressor casing and the combustion chamber outer casing. The inner and outer casings are linked together by eight hollow vanes.

Two mounting trunnions are bolted to the outer casing at the 3 o'clock and 9 o'clock positions, and are two of the three attachment points for the engine sling. (The third point being on the air intake casing 12 o'clock position.)

The H.P. Compressor rear bearing support and coupling chamber unit is located on the front of the inner casing flange, the access hole to the eight locating bolts of the H.P. coupling being blanked by a cover plate with special seals. Mounted on the rear of the inner casing flange is the H.P. turbine rear bearing support unit.

Delivery casing external locations are Pl/P3 switch tapping, Oil cooler and fuel filter attachments, Unit fuel system brackets and eight duplex burners.

The inner faces of the burner locations receive the heads of the eight flame tubes.

The hollow vanes are utilised in the following manner:-

No. 1 Vane - Blanked

No. 2 Vane - A/C Hot air services and air starting duct

No. 3 Vane - Fuel tank pressurising and inducer valve.

No. 4 Vane - Oil feed pipe and oil drain pipes

No. 5 Vane - Vent to atmosphere.

No. 6 Vane - Fuel heater pipe.

No. 7 Vane - Engine anti-icing air outlet.

No. 8 Vane - Blanked

OLYMPUS 301 SERIESSECTION 2E.C.U. DESCRIPTION

10. Compressor Turbine Couplings. The compressor turbine coupling assembly is housed within the chamber in the delivery casing and connects the H.P. & L.P. compressors with the 1st and 2nd stage turbines respectively.

The inner coupling which drives the L.P. compressor is situated within the H.P. coupling and rotates independently on the inter-shaft roller bearing. The external teeth of the compressor coupling engaged with internal teeth of the L.P. turbine coupling and is secured by the fitting of the centre tube unit through the L.P. turbine shaft. This centre tube is located in the threaded steel ball in the compressor tail shaft, the swivelling of the ball allowing for any malalignment.

The outer driven coupling is fitted to the H.P. compressor rear shaft by the same means as the inner driven coupling i.e. splined and retained by a locked ring nut, and receives the drive from the outer turbine coupling internal teeth. The outer track of inter shaft bearing is located between two circlips inside the H.P. compressor shaft coupling.

Eight lugs extend forward from the outer turbine coupling. Each carry a locating bolt and nut which secures a thrust ring housing to the coupling. The head of each bolt is drilled to engage with one of two spring loaded plungers fitted to each coupling lug.

This device and the special nuts ensures the security of the locating bolt assemblies. The thrust ring housing, being positioned by bolts of a smaller diameter than their locating holes in the coupling, permits a flexing of the H.P. rotating assembly.

An external labyrinth is carried on this coupling to form a seal with the coupling chamber housing.

11. Rear Bulkhead.

This bulkhead forms the dividing wall between zone 2a and 2b, air seal inflated to 5 p.s.i. by the L.P. Compressor, completes the efficient sealing between the zones. Attached to the front face is the starter exhaust pipe and the throttle rod rear bearing while on the rear face are the two Breeze plug connections for the zone 2a fire detectors. Pipelines for the following services pass through this bulkhead.

- (i) H.P. 3rd stage air.
- (ii) Pressure oil to L.P. Turbine bearing.
- (iii) Scavenge oil from L.P. Turbine bearing.
- (iv) Drain and dump valve fuel.
- (v) Zone 2b inducer.

12. Bearings.

There are seven main bearings located in the following positions.

- No. 1 - L.P. Compressor front bearing (ROLLER) positioned at the rear of the air intake casing.
- No. 2 - L.P. Compressor rear bearing (SINGLE BALL) positioned in the front wall of the intermediate casing.
- No. 3 - H.P. Compressor front bearing (ROLLER) positioned in the intermediate casing rear diaphragm.

SECTION 2E.C.U. DESCRIPTION

- 4 - H.P. Compressor rear bearing (DOUBLE BALL) positioned in the front of the coupling chamber.
- No. 5 - Intershaft bearing (ROLLER) positioned between the L.P. and H.P. Couplings.
- No. 6 - H.P. Turbine rear bearing (ROLLER) positioned at the rear of the turbine inner drum.
- No. 7 - L.P. Turbine rear bearing (ROLLER) positioned in the exhaust annulus diaphragm.
13. Combustion Chamber Outer Casing.

This outer casing of steel, is fitted between the delivery casing rear flange and the front flange of the L.P. turbine casing, this rear joint has located between the flanges the turbine stator support ring.

The casing comprises the top and bottom halves, joined along the horizontal flanges by bolts, spring washers and flanged nuts.

The bottom half casing has three mountings two for the ignition plugs and the other for the turbine drain connection, also brackets for the two drain bosses for dump valve and fuel system seal drains.

When assembled, the outer casing encloses the flame tubes, turbine entry duct, H.P. turbine stators and H.P. turbine casing in which rotates the H.P. turbine.

14. Flame Tubes.

Eight flame tubes are situated in the annulus formed between the combustion chamber outer casing and turbine inner drum. Each combustion chamber comprises two main units, i.e. the flame tube head and the flame tube unit, Nos. four and six tubes are fitted with steel inserts for the igniter plugs.

The flame tube head is of "streamline" form and has a flanged connection by which it is secured to the inner surface of the delivery casing, also a retaining strap which is bolted to a threaded boss on the flame tube.

Each flame tube unit comprises four sections welded together to make a rigid assembly. The front section carries an outer joint ring at its forward end which locates on the inner ring of the flame tube head.

A flare of conical form is spot welded to the bore of the front section which carries a swirler at its apex, faces towards the front of the assembly, and in the bore of the swirler the "Duplex" burner is located. Two inter-connecting flanges positioned part way along the tube are fitted to link with the adjacent flame tubes. The rear end of the tube accommodates a locating ring which fits into the turbine entry duct.

15. Turbine Entry Duct Unit.

The turbine entry duct, housed in the rear of the combustion chamber outer casing is bolted to the H.P. turbine stator support cone. The entry duct is made of sheet steel and supports the downstream ends of the eight flame tubes. Seventeen H.P. turbine stator segments are inserted into the rear of the entry duct, each segment being located by the H.P. turbine casing.

16. Turbine Assembly.

The main units of the turbine section are:-

SECTION 2E C.U. DESCRIPTION

- (a) H.P. Turbine bearing support housing.
- (b) H.P. Turbine rotor.
- (c) L.P. Turbine rotor.

H.P. Turbine support housing

The H.P. turbine support housing is carried in the combustion chamber unit casing which is secured at its front end to the rear face of the delivery casing.

The rear end of the casing accommodates the turbine bearing and housing, the stationary portion of the turbine bearing seal, the stator support cone and H.P. turbine stators.

An oil jet and filter assembly located in the housing provides bearing lubrication.

H.P. Turbine Rotor.

The turbine disc is bolted to the large flange at the rear end of the hollow turbine shaft. Forward of this flange are the bearing and front and rear seals, all three components being secured to the shaft by a retaining nut.

At the front end of the shaft is the compressor driving coupling assembly.

The turbine blades are of aerofoil section and are shrouded at the tips. Each has a root of "fir tree" form which is located axially by a projection at the forward end of the root and a locking tab at the rear.

L.P. Turbine Rotor.

The hollow L.P. turbine shaft passes through the bore of the H.P. turbine shaft. A seal at its forward end prevents hot air from the turbine passing between the shafts to the coupling chamber. Splines at the front end of the shaft carry the turbine coupling.

The turbine blades are shrouded at the tips and are fitted and secured in a similar to the H.P. turbine blades.

The L.P. turbine bearing, together with the bearing seal fitted between the bearing and disc, is secured to the wheel hub by a retaining nut. The centre tube passes through the bore of the shaft, and a connection piece at its forward end locates in the L.P. compressor shaft. The tube provides positive location between the L.P. turbine and compressor.

17. Exhaust Annulus.

The exhaust annulus is located on the rear face of the L.P. turbine casing. It consists of an inner and outer ring which are separated by eight radially disposed hollow vanes. A flange at the rear of the inner ring accommodates the exhaust inner cone, whilst a diaphragm at the front end supports the L.P. turbine bearing and housing.

Upper and lower connections on the rear of the bearing housing connect with the air and oil drain pipes respectively.

Three of the eight hollow vanes are utilised in the following manner:-

SECTION 2

E.C.U. DESCRIPTION

No. 1 Vane - Conveys 3rd stage H.P. compressor air for L.P. turbine cooling and bearing seal pressurising.

No. 4 Vane - Houses the oil feed pipe to oil jet assemblies in the rear bearing housing cover.

No. 5 Vane - Accommodates an oil drain pipe from the bearing housing.

A hole at the bottom of the annulus forms a drain which connects with the turbine drain system.

Upper and lower heat shields, attached by brackets, encase both combustion chamber outer casing and exhaust annulus.

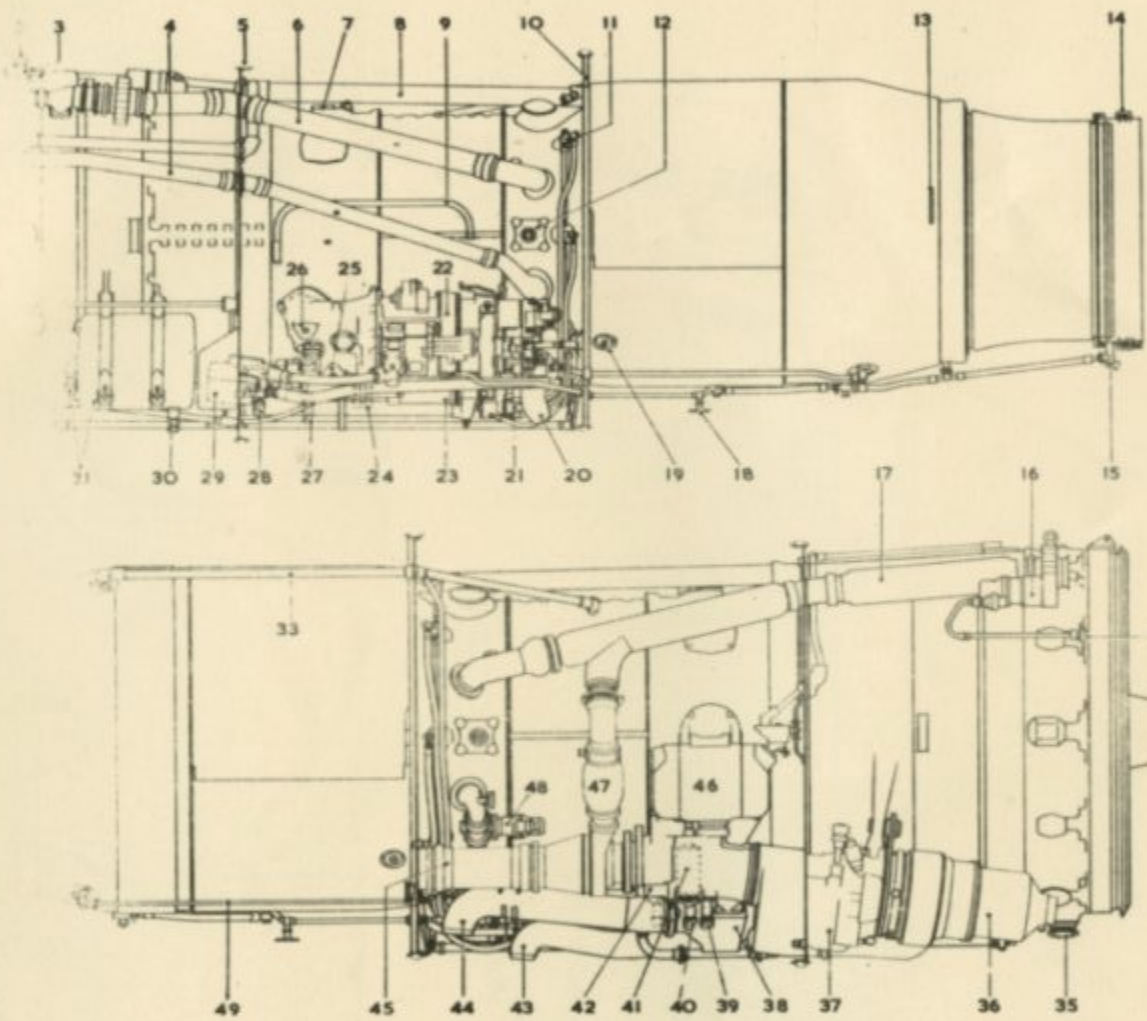
18. Exhaust Cone Unit.

The exhaust outer cone, bolted to the turbine exhaust annulus rear flange, has front and rear flanged bellows units designed to permit a limited articulation which allow for malalignment between jet pipe and engine.

The jet pipe is attached to the exhaust cone by two half clamps which are retained in position by the rear bellows unit surrounding them. This unit is located by the front manacle clamp to the exhaust cone and by the rear seating strap to the jet pipe.

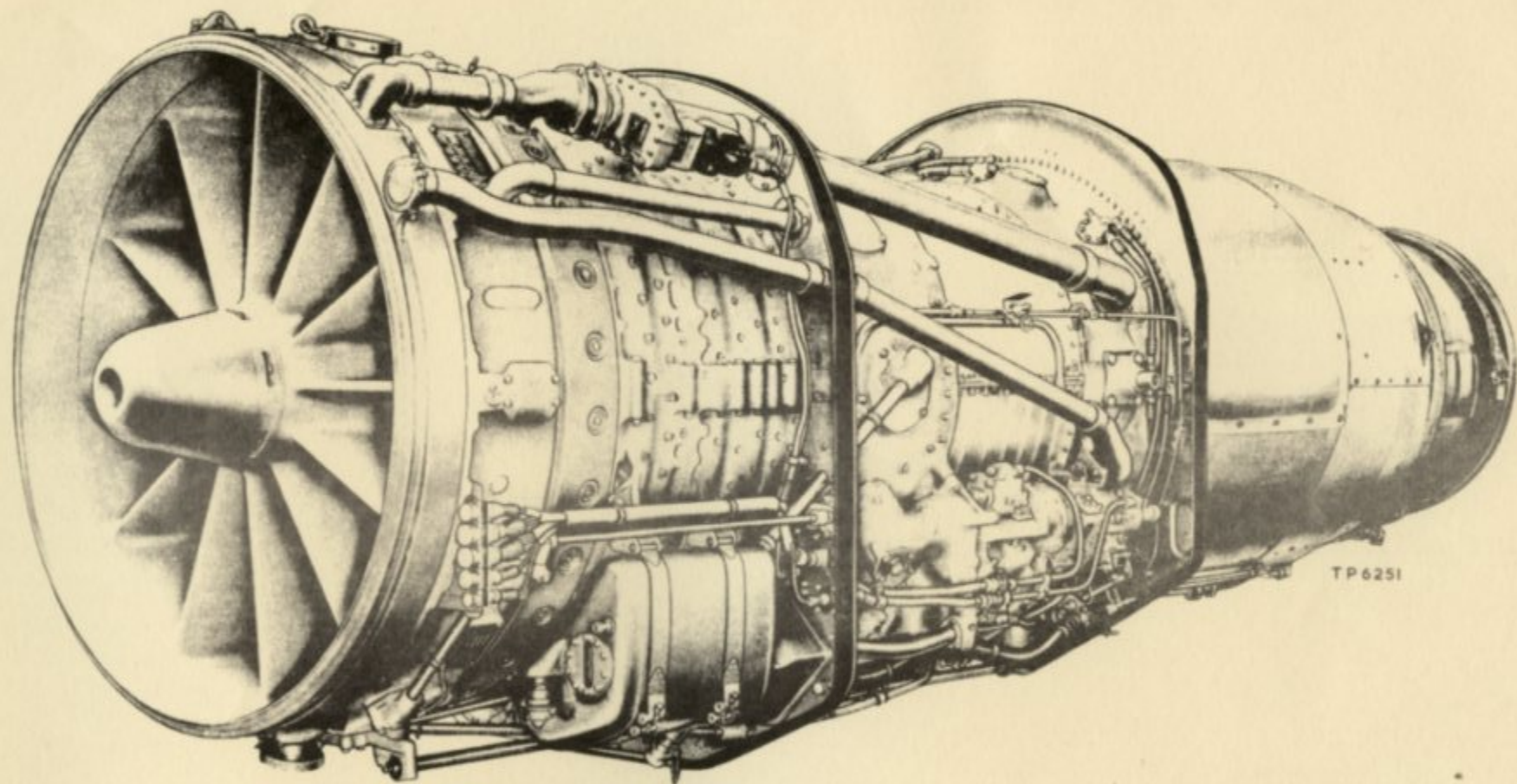
Drainage collectors are provided at the bottom of the bellows seals and are designed to drain away any fuel that may seep through the attachment joints.

Between the front and rear bellows units, the external surface of the exhaust cone is covered with heat insulating blanket, located by springs on the port and starboard sides.

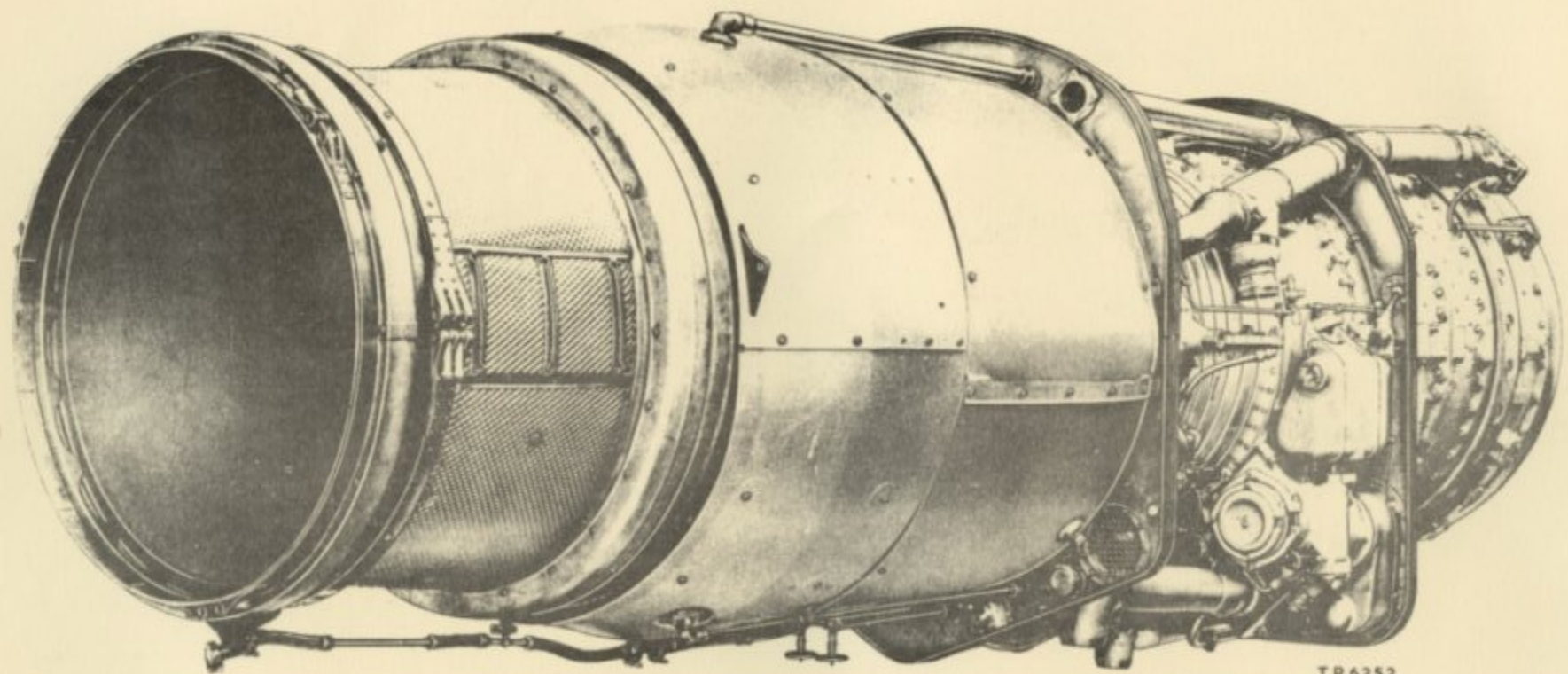


- 1 FRONT LIFTING EYE.
- 2 FRONT MOUNTING BRACKET
- 3 OIL SEPARATOR AIR OUTLET
- 4 FUEL HEATER AIR SUPPLY.
- 5 FRONT BULKHEAD.
- 6 ANTI-ICING AIR SUPPLY TO AIR INTAKE CASING AND ENTRY GUIDE VANES.
- 7 AIR TO PRESS. CSU OIL TANK & BULKHEAD SEALS.
- 8 ANTI-ICING AIR RETURN TO ZONE 2B
- 9 FUEL SYSTEM HOIST FARLEAD.
- 10 REAR BULKHEAD.
- 11 FUEL BURNER.
- 12 MOUNTING AND THRUST TRUNNION.
- 13 REAR LIFTING EYE.
- 14 JET PIPE ATTACHMENT RING.
- 15 COMBUSTION CHAMBER AND EXHAUST CONE DRAIN.
- 16 AIR SUPPLY CONTROL VALVE.
- 17 AIRCRAFT AIR SUPPLY PIPE.
- 18 FUEL DRAIN.
- 19 IGNITER PLUG.
- 20 ENGINE BREATHER.
- 21 FUEL FLOW DISTRIBUTOR AND DRIFT VALVE.
- 22 UNIT FUEL SYSTEM.
- 23 FUEL FILTER.
- 24 SCAVENGE FILTERS.
- 25 H. P. COMPRESSOR HAND TURNING GEAR LOCATION.
- 26 L. P. COMPRESSOR HAND TURNING GEAR LOCATION.
- 27 OIL SUMP DRAIN.
- 28 OIL TANK FILLER.
- 29 FUEL FLOWMETER.
- 30 OIL TANK DRAIN.
- 31 OIL TANK AND OVERFLOW.
- 32 ELECTRICAL CONNECTIONS.
- 33 PRESSURIZING AIR TO REAR BEARING SEAL.
- 34 ELECTRICAL CONNECTIONS TO CONTROL VALVE.
- 35 AIR INTAKE ANTI-ICING OUTLET.
- 36 A.C. GENERATOR.
- 37 CONSTANT SPEED DRIVE UNIT.
- 38 C.S.U. OIL COOLER.
- 39 C.S.U. OIL TANK DRAIN.
- 40 C.S.U. OIL TANK FILLER.
- 41 C.S.U. OIL FILTER.
- 42 OIL PRESSURE TRANSMITTER.
- 43 GENERATOR COOLING AIR DUCT OUTLET.
- 44 C.S.U. OIL COOLER AIR DUCT OUTLET.
- 45 AIR STARTER EXHAUST.
- 46 C.S.U. OIL TANK.
- 47 AIR REGULATING CONTROL VALVE.
- 48 COOLING AIR INDUCER CONTROL VALVE.
- 49 OIL SUPPLY TO REAR BEARING.

GENERAL INFORMATION



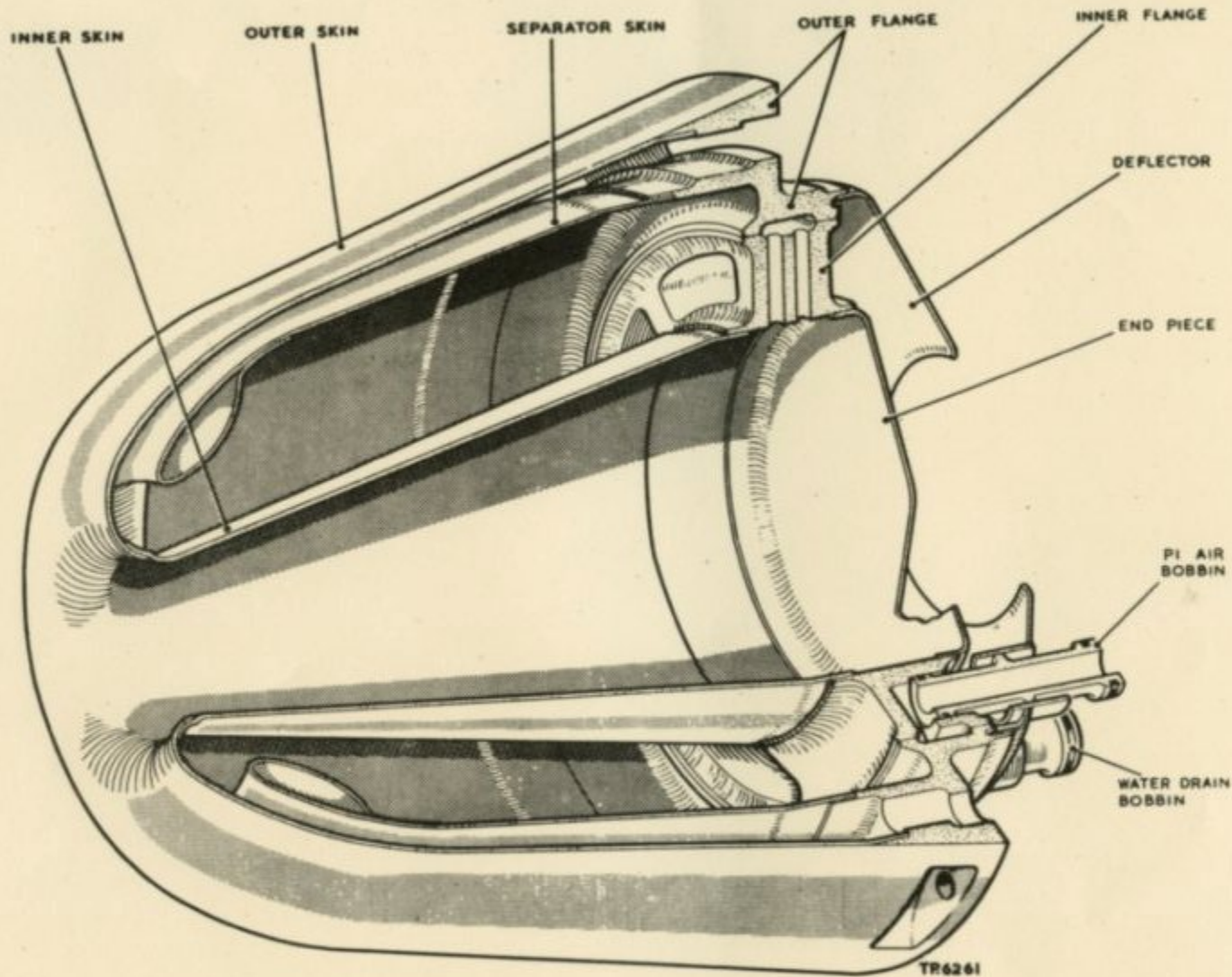
OLYMPUS 301 ENGINE - $\frac{3}{4}$ PORT VIEW



TP6252

OLYMPUS 301 ENGINE - $\frac{3}{4}$ STARBOARD VIEW

RESTRICTED.



NOSE CONE.

L.P. COMPRESSOR ROTOR
FRONT SEAL HOUSING AND NOSE
BULLET MOUNTING FACE

RESTRICTED

FRONT LIFTING EYE

ENGINE MOUNTING BRACKET

OIL SEPARATOR AIR OUTLET

SEALED ADAPTOR RING

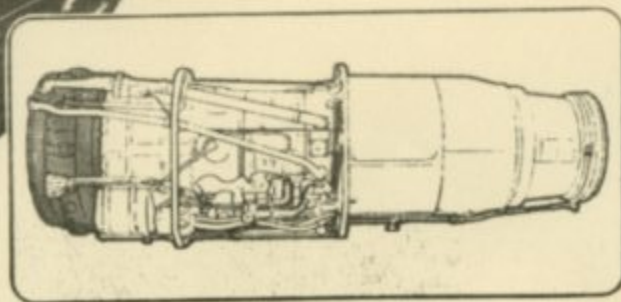
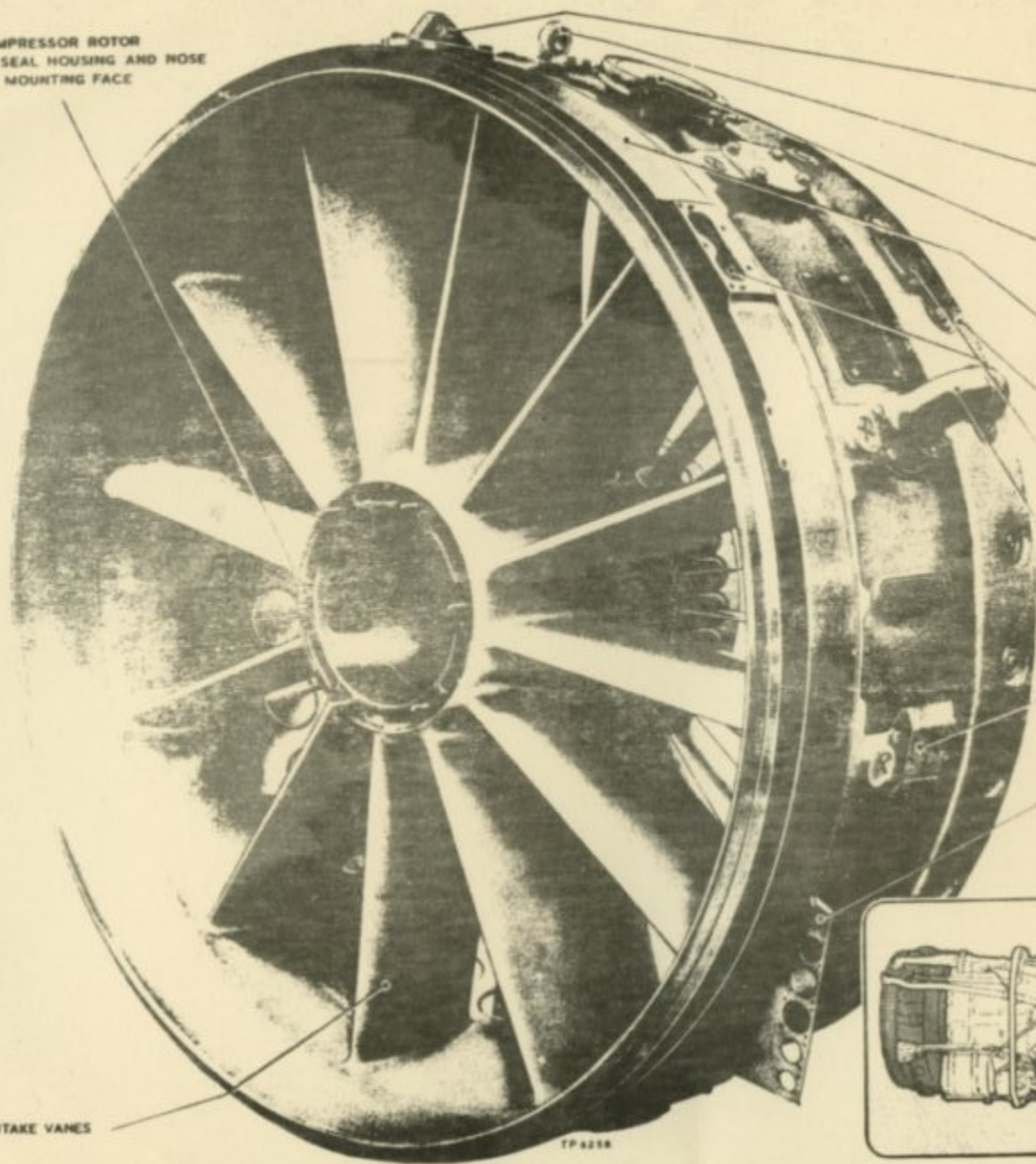
ANTI-ICING AIR DUCT

ANTI-ICING AIR INLETS

ANTI-ICING AIR OUTLETS

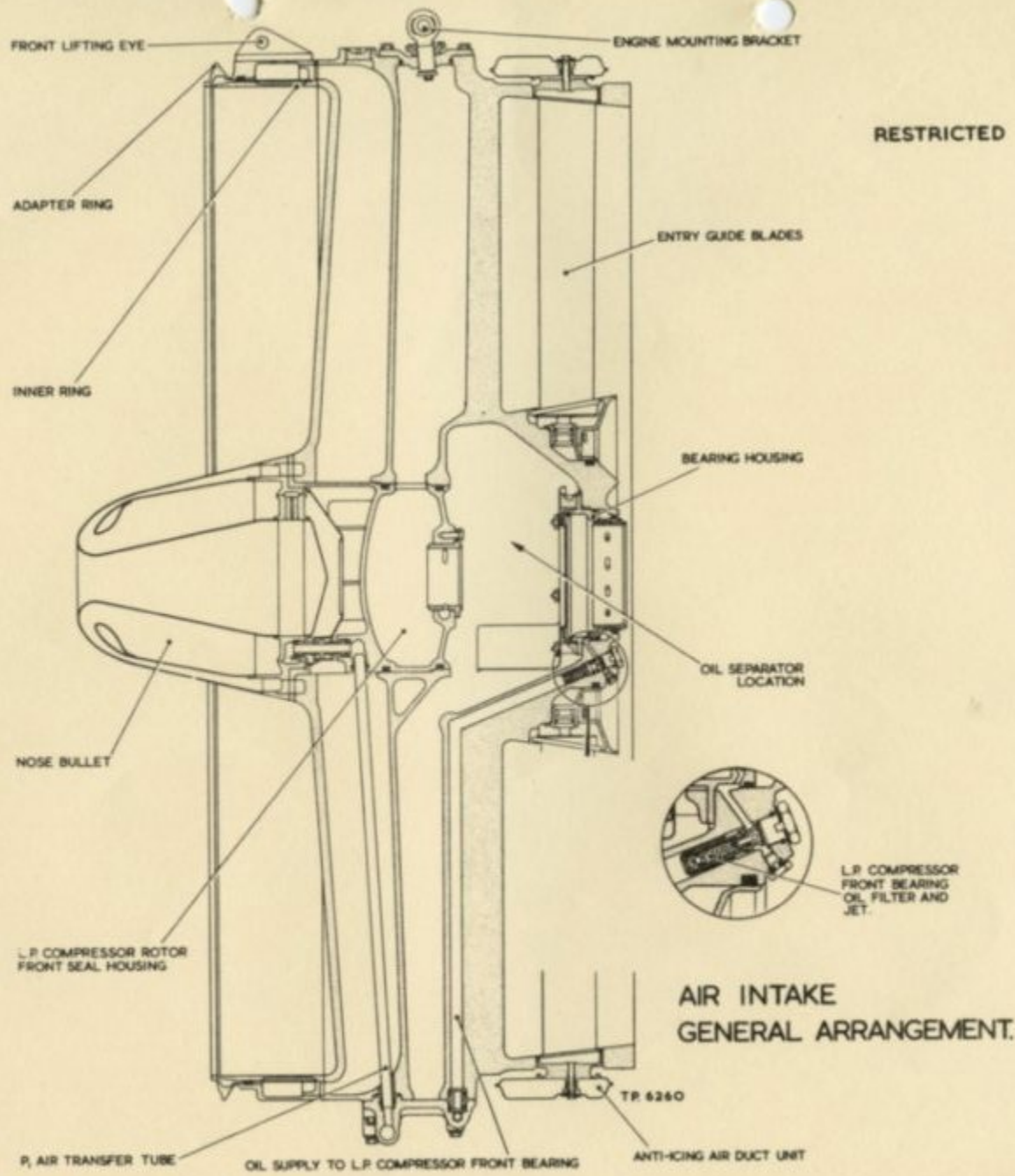
PLUG MOUNTING BRACKET

AIR INTAKE VANES



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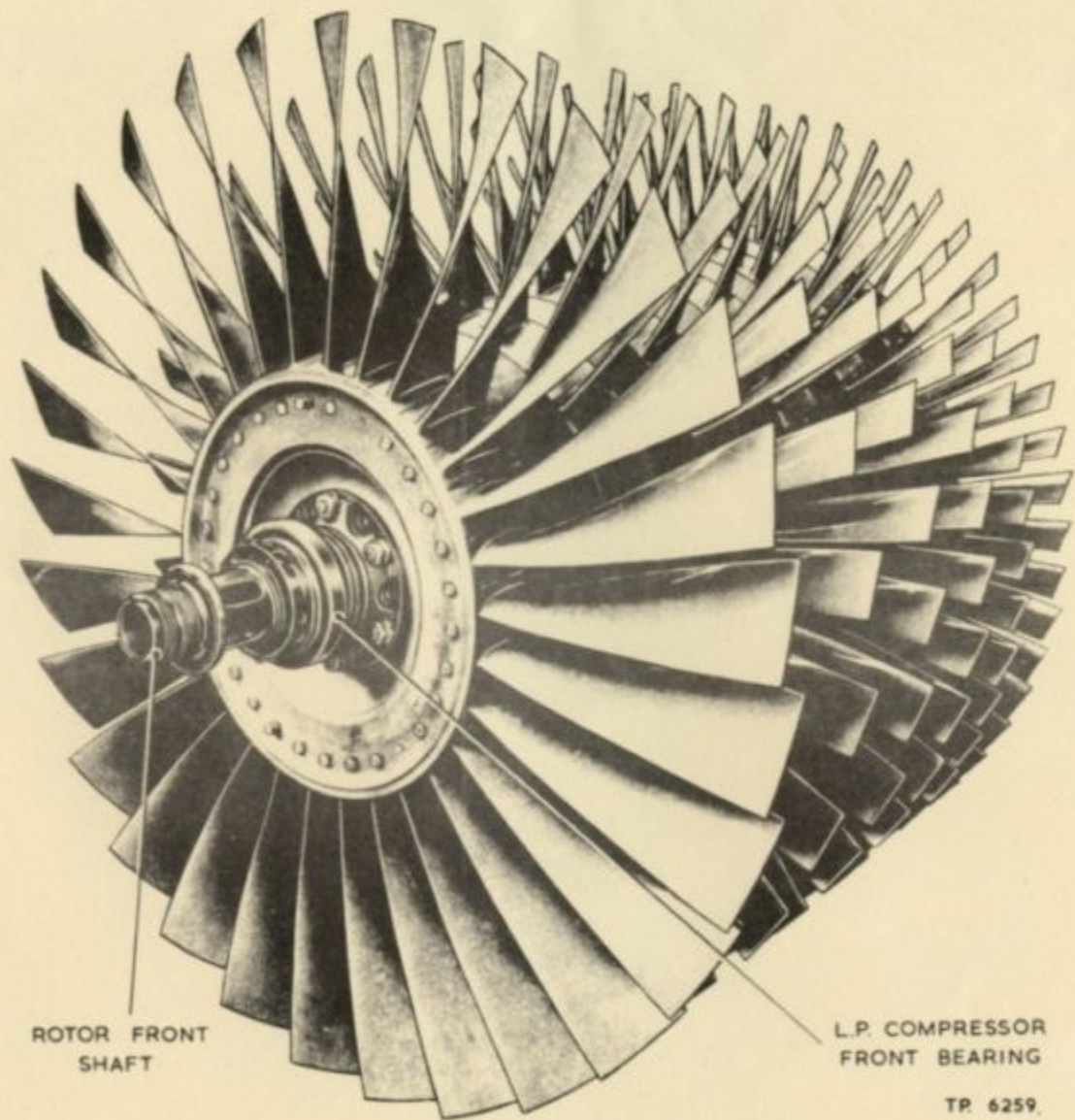
AIR INTAKE CASING (FRONT VIEW)



RESTRICTED

AIR INTAKE
GENERAL ARRANGEMENT.

RESTRICTED.



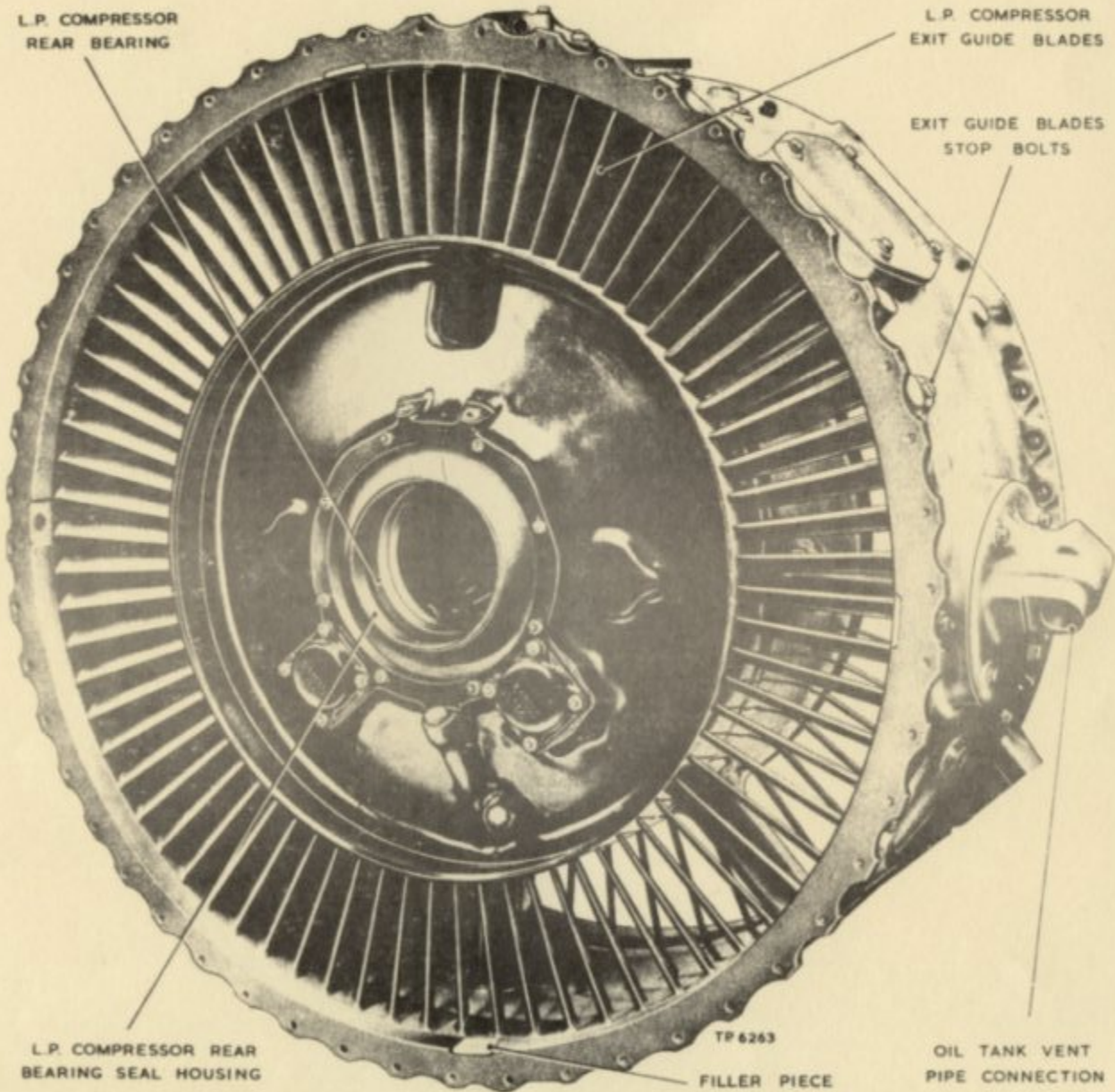
ROTOR FRONT
SHAFT

L.P. COMPRESSOR
FRONT BEARING

TP. 6259.

L.P. COMPRESSOR ROTOR.

RESTRICTED.



INTERMEDIATE CASING-FRONT VIEW.

Section 5Oil Systems

The engine embodies the complete oil system, including the oil tank and oil cooled oil cooler.

1. Oil Tank. The stainless steel oil tank is mounted on the port lower side of the engine, forward of the front bulkhead. A sight glass for oil contents is situated on the front wall of the oil tank.

Capacity

Total capacity of tank	-	5 galls.
Oil content	-	3 galls. 7 pints
Air space	-	1 gall. 1 pint
Usable oil	-	2 galls. 2 pints

The tank is pressure filled through an Avery quick release and self sealing coupling located on the suction filter casing which is positioned at the lower port side of the engine behind the front bulkhead.

The tank is vented to the intermediate casing gear chamber, and incorporated in the vent is a spring loaded non-return valve, lightly loaded which ensures pressurisation of the tank, thus ensuring a flow of oil to the pump suction under all operating conditions.

2. Oil Circulation (Pressure). Oil from the tank is conveyed by external pipe through the front bulkhead to the suction filter and pressure pump.

From the pump, via the pressure filter, the oil is directed to various sections of the engine through thread type filters and jets.

An external pipe from the pressure filter housing directs oil to No. 9 vane of the air intake casing to provide lubrication for the L.P. compressor front bearing. Internal passages in the intermediate casing front and rear diaphragms accommodate oil jets to lubricate the L.P. compressor rear and H.P. compressor front bearings.

An external pipe from the intermediate casing connects to a two way union on No. 4 vane of the delivery casing. One way through the vane to lubricate by jets the H.P. Compressor rear and H.P. turbine bearings, the other way rearward to No. 4 vane of the exhaust annulus and through the vane to the centre jet.

This centre jet comprises two discharges, one radial to lubricate the L.P. turbine bearing, the other an axial jet directing the oil through the centre tube to lubricate the inter-shaft bearing.

3. Oil Circulation (Scavenge). Four auxiliary scavenge pumps, on the rear face of the oil sump, drain oil from the following:-

- (a) L.P. Compressor front bearing.
- (b) L.P. turbine rear bearing.
- (c) The coupling chamber, which includes the inter-shaft bearing and the H.P. compressor rear bearing.
- (d) H.P. turbine bearing.

/Each pump

Section 5Oil System

Each pump accommodates a filter. The oil from these four scavenge pumps together with oil from the fifth scavenge pump, situated in the pressure pump is returned by common pipe, via the fuel cooled oil cooler to the oil tank.

4. Fuel Cooled Oil Cooler. A fuel cooled oil cooler is mounted below the H.P. compressor casing and comprises a cylinder with a series of internal baffles around which the engine oil circulates. Continuous tube units run through the baffles conveying engine fuel as the coolant, the oil and fuel are contra-circulating in the cooler.

A spring loaded by-pass valve is embodied in the cooler to prevent damage to it when starting the engine under cold conditions. The valve operated by the initial high pressure in the scavenge system permits the oil to flow across the end of the cooler direct to the tank until the oil temperature rises and the pressure falls.

The temperature of the inlet oil may be checked by the connection of a slave gauge to a fitting on the front of the front bulkhead lower half. This fitting has three internal passages:-

- (a) Passes oil from the tank to the suction filter.
- (b) Receives scavenge return oil from the cooler, and leads this oil back to the oil tank.
- (c) Receives pressure oil from the pressure filter, and passes this oil into the pipes leading to No. 9 vane of the intake casing.

5. Main Oil Pump. The oil pump is secured to the front face of the oil sump, it is of the spur gear type, and comprises the pressure pump and intermediate casing scavenge pumps. The latter, which is of greater capacity, is inserted within the oil sump casing, and the pressure pump projects from it.

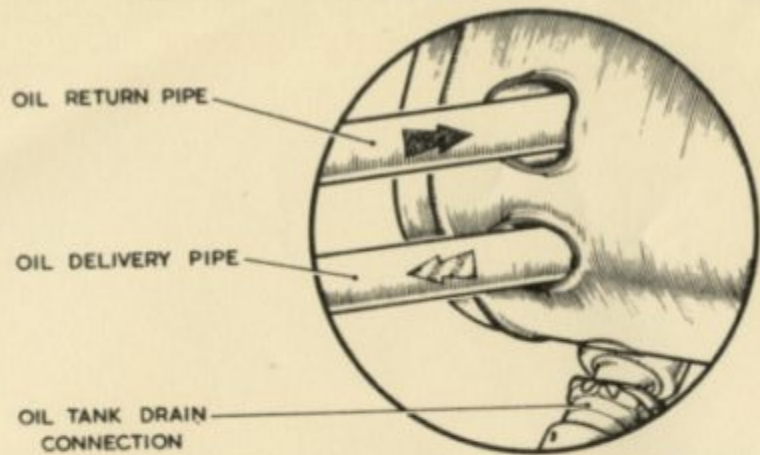
The pumps are driven by spur and bevel gears from the front end of the H.P. compressor rotor.

Between the pressure pump gears and filter a pressure chamber is formed, which accommodates the pressure relief valve and the check valve. The relief valve which is adjustable controls the system operating pressure, the excess pressure being returned to the inlet side of the pressure pump. The check valve, which is lightly spring loaded, prevents oil from the tank flowing into and flooding the engine when stationary.

The scavenge pump inlet port is fed via the sump scavenge oil filter and the outlet port returns the oil through an internal passage in the sump, and through an external connection via the oil cooler to the tank.

6. Auxiliary Scavenge Pumps. The four auxiliary scavenge pumps are mounted on a common driving shaft and driven through gearing from the front end of the H.P. compressor. Each pump having a driving and driven gear enclosed within a separate casing.

The pumps are provided with individual filters which are located in the pump casing and retained by separate filter caps.






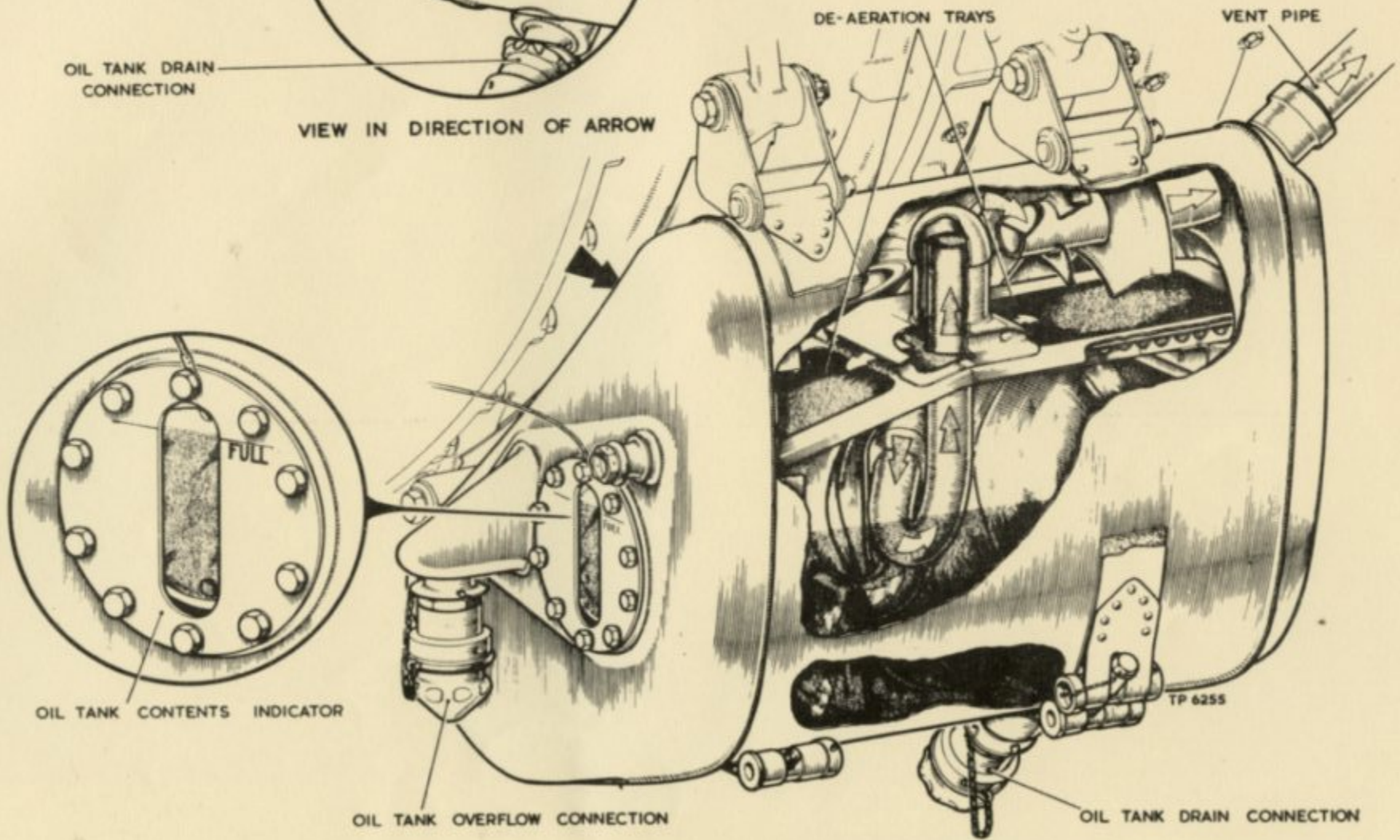
OIL RETURN PIPE

OIL DELIVERY PIPE

OIL TANK DRAIN CONNECTION

VIEW IN DIRECTION OF ARROW

	SUPPLY TO PRESSURE PUMP
	SCAVENGE AND DRAIN
	OIL VENTING



OIL TANK CONTENTS INDICATOR

OIL TANK OVERFLOW CONNECTION

OIL TANK DRAIN CONNECTION

OIL TANK

Section 6Oil System Servicing1. Scavenge Oil Filters.

(a) Remove the filter:-

- (i) Release the filter cap nut lockspring.
- (ii) Position a container beneath the filter cover.
- (iii) Remove the filter capnut followed by the filter and spring.

(b) Examine and clean the filter:-

(i) If foreign material is found, reject the engine. In this case do not clean the filter but re-install it "as found" to minimise time taken by the repair organisation in investigation.

(ii) If the filter is satisfactory clean the parts with clean kerosene; using a soft bristle brush, then dry thoroughly with an air blast. Rag is not to be used.

(iii) Examine the filter for damage and check the security of the gauze..

(iv) Discard the filter capnut O ring.

(c) Refit the filter:-

(i) Fit a new O ring to capnut.

(ii) Refit the spring followed by the filter and capnut.

(iii) Tighten the filter capnut until it is just nipped then loosen it about $\frac{1}{2}$ turn. Secure it with the lockspring.

2. Filling or Replenishing Engine Oil System.Newly installed E.C.U.

(a) Drain the sump.

(b) Fill the oil tank as follows:-

(i) Remove the filler connection blanking cap and fit oil replenishment equipment.

(ii) Charge with oil until oil reaches the 'FULL' mark on the sight glass.

(iii) Remove the replenishment equipment and fit blanking cap.

(c) Should the tank be overfilled drain excess as follows:-

(i) Remove the blanking cap from the oil tank overflow connection, position a container to receive drain oil and connect the drain equipment.

(ii) When drainage has completely ceased from the overflow connection note the quantity drained.

Section 6Oil System Servicing

- (iii) Remove the drain equipment and fit the blanking cap.

NOTE: If oil tank has been overfilled calculate the exact amount of oil pumped into the engine by deducting the quantity of oil drained from the overflow from the amount pumped into the tank.

During initial engine run the oil contents will fall by approx. 4 pints.

- (d) Replenish the oil tank immediately after initial engine run as in 2 (b) above.

3. Oil Replenishment after Flight. Oil tank replenishment should be carried out as soon after flight as possible. Use the oil tank sight glass as a guide to determine whether or not replenishment is required and fill the oil tank as in para. 2 (b).

4. Oil Replenishment after Prolonged Engine Standby.

(a) If there is no reliable record of the oil state prior to the standby, or the oil system has been disconnected (e.g. filters removed), the complete procedure detailed for newly-installed E.C.U.'s should be followed irrespective of oil tank contents.

(b) If all three of the following conditions are met a full engine run may be commenced:-

(i) The oil level was checked and found satisfactory prior to the standby.

(ii) The oil system has not been disconnected in any way (e.g. filters removed).

(iii) The oil tank contents are more than 2.5 gallons.

During the engine run, keep a strict watch on the oil tank contents gradually increase as the oil is scavenged back from the oil sump. WARNING: Stop the engine immediately if the oil level falls below 2.5 gallons. When the engine run is completed replenish the oil tank as in 2 (b).

5. Draining engine oil tank.

(a) Remove the blanking cap from the DRAIN connection on the oil tank.

(b) Position a container to receive drain oil.

(c) Plug the drain self-sealing equipment into drain connection.

(d) At the conclusion of the draining operation, remove the draining equipment and fit a blanking cap.

6. Oil Pressure Adjustment.

(a) Remove relief valve capnut. The capnut is wire locked.

(b) Release the adjuster locknut, hold the relief valve adjuster with a screwdriver during this operation.

(c) Adjust the relief valve to give the oil pressure required; one turn of the adjuster equals approx. 5 p.s.i.

(d) Secure adjuster locknut. Hold the relief valve adjuster firmly with a screwdriver while securing the locknut.

(e) Check that oil pressure is now correct, then fit the relief valve capnut. Torque tighten the capnut to 15 lbs. ft. and secure it with locking wire.

OLYMPUS 301 SERIESSECTION 7ENGINE AIR SYSTEMINTRODUCTION

The engine air system fulfils the following purposes:-

Pressurisation of constant speed unit oil tank and bulkhead seals.
Pressurisation of fuel tanks and fuel recuperators
Hot air supply to aircraft services
Hot air supply to fuel heater.
Engine cooling system
Inducer cooling air to the alternator, constant speed unit oil cooler and zone 2B
Engine breathing system.
Engine bay ventilation
Engine anti-icing.

1. Pressurisation of Constant Speed Unit Oil Tank and Bulkhead Seals

L.R. compressor delivery air enters on aperture in the front face of the intermediate casing diaphragm and flows through No. 1 vane to an air supply connection which located two external pipes.

One pipe supplies air to pressurise the constant speed drive unit oil tank, the air entering the tank through a banjo union on the valve housing. The other pipe supplies air to a connection on the bottom of the L.P. compressor casing from which it is piped to the front and rear bulkhead seals.

2. Pressurisation of Fuel Tanks and Fuel Recuperators

H.P. compressor delivery air enters the apertures in the delivery casing diaphragm and flows through No. 3 vane into the inducer elbow of the alternator, and constant speed drive unit cooling ducts. The fuel tanks and recuperators are pressurised from a tapping on the inducer elbow.

3. Hot Air Supply to Aircraft Services

H.P. compressor delivery air passes through apertures in the delivery casing diaphragm, into No. 2 vane and then into the duct elbow from which it is ducted forward through a non-return valve to the hot air valve fitted on the starboard side of the intake casing. When the valve is open it allows hot air to flow to the aircraft for the following services:-

Cabin pressurizing and air conditioning
Wing and fin anti-icing
Bomb Bay heating

Portions of this ducting are also used for conveying air to the engine starter unit.

4. Hot Air supply to the Fuel Heater

H.P. compressor delivery air passes through apertures in the delivery casing diaphragm and through No. 6 vane to the elbow on the casing. Air then flows through the fuel heater supply pipe to the front of the engine where it is directed to the aircraft fuel heater.

5. Engine Cooling System

(i) Turbine Discs

Cont/The front and rear

Section 7

The front and rear faces of the 1st stage turbine disc and the front face of the 2nd stage turbine disc are cooled by H.P. delivery air. The air enters apertures in the seal housing support of the delivery casing and flows through three turbine air feed pipes to the bearing diaphragm; it is then piped through the turbine bearing support drum to discharge, through three apertures, on the front face of the 1st stage turbine disc.

The outer portion of the 1st stage turbine disc rear face is cooled by air from the annulus in front of the disc, flowing through ports in the disc into the chamber enclosed by the disc rear face and the inter-stage diaphragm. This air flows outwards across the disc face and exhausts into the turbine.

To cool the inner portion of the 1st stage turbine disc rear face and the 2nd stage turbine disc front face, air passes through ports in the 1st stage turbine shaft hub and into the space between the turbine shafts to pass into the annular chamber between the faces of the turbine discs. The air flows outwards across the 2nd stage disc front face and exhausts into the turbines.

The supply of air used to pressurize the 2nd stage turbine rear bearing seal is also used to cool the rear face of the 2nd stage turbine disc and the front face of the bearing housing. The air flows through the bearing housing and the wheel hub air cover on to the rear face of the 2nd stage turbine rotor disc and exhausts into the jet stream immediately after the 2nd stage turbine. A smaller supply of air from the same source is directed between the rear face of the bearing housing and the diaphragm cone, passes through ports in the rear face of the diaphragm cone into the vanes of the exhaust annulus and is then exhausted through holes in the trailing edge of the vanes into the jet stream.

(ii) Combustion chambers, casings and turbine casings.

Compressor delivery air flowing through the annulus of the combustion system cools the skins of the combustion chambers and casings, flows rearwards through ports in the turbine casing and exhausts into the jet stream at the rear of the 2nd stage turbine wheel.

6. Inducer Cooling Air to the Alternator, Constant Speed Unit Oil Cooler and Zone 2B

H.P. compressor delivery air enters apertures in the delivery casing diaphragm and passes through No. 3 vane and the inducer elbow to the inducer control valve. The valve, when opened, causes an inducer to operate, in the constant speed drive unit oil cooler ducting, in the alternator outlet cooling duct and also in zone 2B. A pipe from the control valve carries air to the inducer in the oil cooler outlet duct and a tapping from this inducer conveys air to the inducer in the alternator cooling outlet duct. Zone 2B is cooled by air piped from a tapping below the control valve, passing through the rear bulkhead to discharge from the inducer into zone 2B.

7. Engine Breathing System

Pressurised oil and air mixture from the engine oil tank is vented to No. 7 vane of the intermediate casing. At the outer end of the vane is the tank pressurising valve; when the pressure in the tank exceeds 2 p.s.i. the valve opens and allows the mixture to flow through the vane to the gear chamber.

The air is then vented to atmosphere via the main engine breather outlet. The mixture of oil and air from the intermediate casing gear chamber, delivery casing coupling chamber, compressors and intershaft bearings, flows through port into the hollow L.P. compressor shaft and passes to the front of the engine into the oil separator; it then flows through Nos. 1 and 12 vanes of the intake casing and is ducted rearwards to be discharged to atmosphere through the main engine breather outlet at the propelling nozzle. The oil and air mixture from the 2nd stage turbine bearing passes into the hollow 2nd stage turbine shaft and flows forward to the end of the shaft in the delivery casing where it is ducted via the coupling to the intershaft bearing and through the L.P. compressor shaft to be vented to atmosphere with the other mixtures.

OLYMPUS 301 SERIES

Section 7

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(ii) Combustion chambers, casings and turbine casings.

Compressor delivery air flowing through the annulus of the combustion system cools the skins of the combustion chambers and casings, flows rearwards through ports in the turbine casing and exhausts into the jet stream at the rear of the 2nd stage turbine wheel.

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The air is then vented to atmosphere via the main engine breather outlet. The mixture of oil and air from the intermediate casing gear chamber, delivery casing coupling chamber, compressors and intershaft bearings, flows through port into the hollow L.P. compressor shaft and passes to the front of the engine into the oil separator; it then flows through Nos. 1 and 12 vanes of the intake casing and is ducted rearwards to be discharged to atmosphere through the main engine breather

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Air from the seals of the 1st stage turbine bearing, the 2nd stage turbine air seal and the 1st stage turbine shaft coupling seal discharges into the turbine bearing support drum; the air then passes through the apertures of the delivery casing diaphragm to augment the air from the H.P. compressor rear seals and the H.P. compressor rear bearing seal; the whole volume of air from these seals then passes through No. 5 vane of the delivery casing to a vent pipe on the casing which directs the air to atmosphere.

8. Engine Anti-icing

H.P. compressor delivery air is used to prevent icing of the air intake, the intake vanes, the nose fairing and entry guide blades.

Hot air passes through No. 7 vane of the delivery casing and is piped to a hot air valve mounted on the L.P. compressor casing. The valve is operated by an electrically operated actuator controlled from the cockpit. When the valve is open, hot air passes to the anti-icing air duct inlet and the adaptor ring inlet. The anti-icing air in the duct passes into the entry guide blades then through internal passages to the air intake vanes, while the air in the adaptor circulates around the ring and then into the leading edge of the intake vanes. Air is ducted from the leading edge of the vanes, to the multi-skinned nose fairing from which it is exhausted via the passages in the centre of vanes No. 2 to 11 inclusive. (The passages in the centre of vanes Nos. 1 and 12 are used to duct air away from the oil separator.

The anti-icing air is ducted away from the air intake through five outlets as follows:-

- (i) No. 3 vane is connected to No. 2 vane by a duct in the periphery of the intake casing. The air passing through these two vanes is exhausted through an outlet at the outer end of No. 2 vane from which it is piped to the rear bulkhead to exhaust into zone 2B.
- (ii) Air passing through No. 11 vane is piped from an outlet at the outer end of the vane to zone 2B as described in (i).
- (iii) No. 5 and 6 vanes and Nos. 8 and 9 vanes are connected to No. 9 by a duct in the periphery of the intake casing. Air passing through these vanes is exhausted through an outlet at the outer end of No. 7 vane. The outlet mates with a connection in the engine bay doors from which air is exhausted.
- (iv) The air passing through No. 4 vane is exhausted from the vane outlet into the engine bay. A perforated plate and a deflector plate is fitted over the outlet to prevent hot air impinging directly upon the engine bay walls.
- (v) The fifth outlet is on No. 4 vane and is identical to the outlet on No. 4 vane.

9. Engine Bay Ventilation

Zone 1 forward of the front bulkhead contains the intake casing and L.P. compressor casing. The cooling air inlet ducts of the alternator and constant speed drive unit oil cooler pass through the bottom of this zone. Air from the separator is ducted from the outlet on the top starboard side of the intake casing through the aircraft to the trailing edge of the main plane where it is discharged to atmosphere.

Zone 2A is the compartment between the two bulkheads which contains the fuel system. This zone is ventilated by ram air, ducted from an intake fitted beneath the zone 2A engine bay door, being directed to the top of the zone and discharged to atmosphere by the inducer action of the main engine breather through an aperture in the rear of the door. Ventilation is assisted by ram effect in flight.

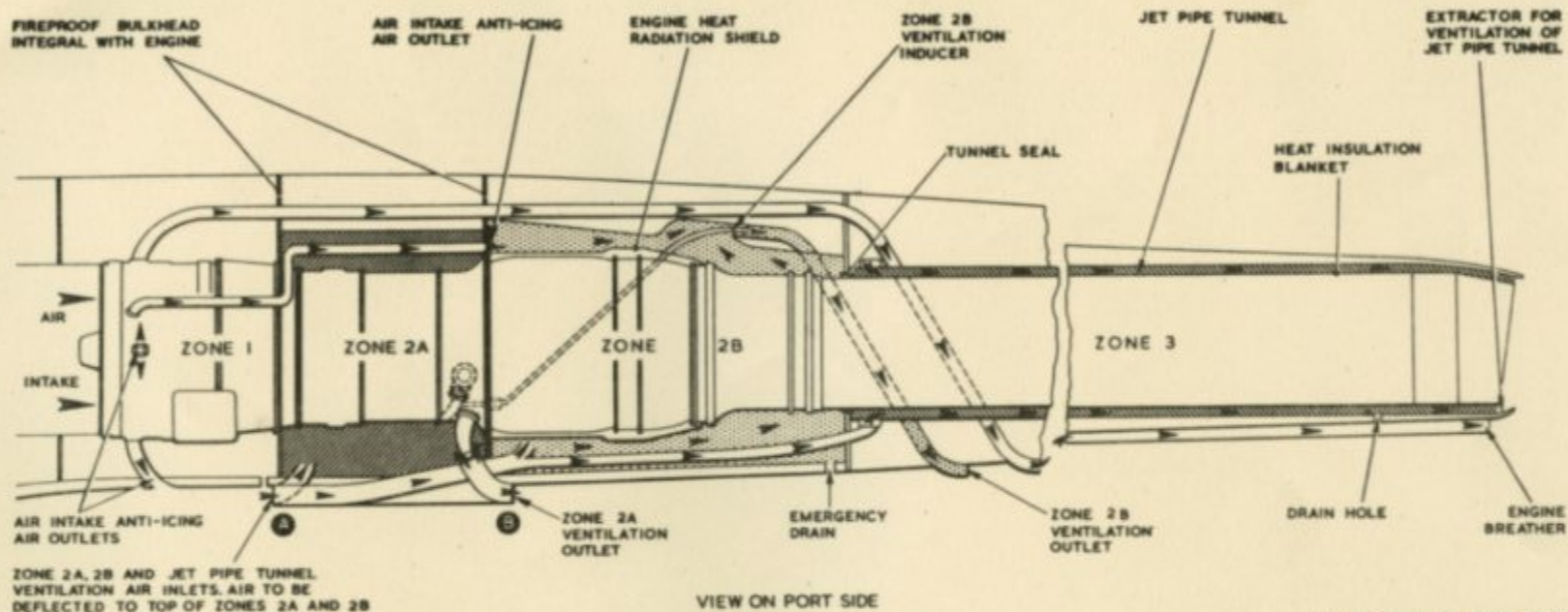
OLYMPUS 301 SERIES

SECTION 7

Aft of the rear bulkhead, zone 2B contains the combustion chambers, turbines and exhaust annulus. Ventilation of this zone is by ram air, ducted from an intake fitted beneath zone 2A engine bay door, entering the base of the compartment and is directed to the top where it enters a duct which carries it to the outlet aperture beneath zone 3. An inducer fitted in the outlet duct ensure efficient ventilation of zone 2B during ground running and taxiing.

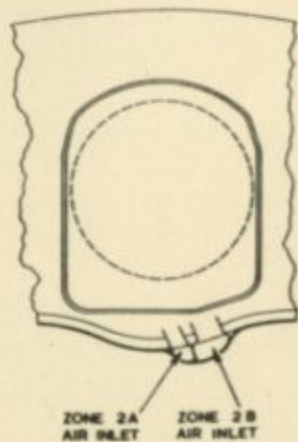
Zone 3 is the zone containing the jet pipe tunnel. It is ventialed by ram air, ducted from an intake fitted beneath zone 2A engine bay door, directed around the circumference of the jet pipe and exhausted at its rear end. To ensure a flow of air during ground running or taxiing the outlet end of the jet pipe is shaped to give extractor action.

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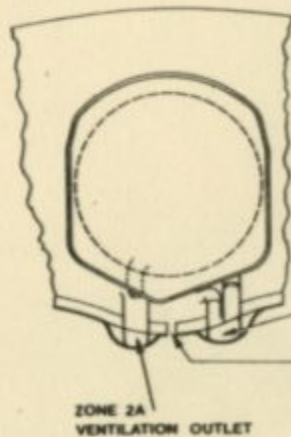


ZONE 2A, 2B AND JET PIPE TUNNEL VENTILATION AIR INLETS. AIR TO BE DEFLECTED TO TOP OF ZONES 2A AND 2B

VIEW ON PORT SIDE



AIR INLETS AT A



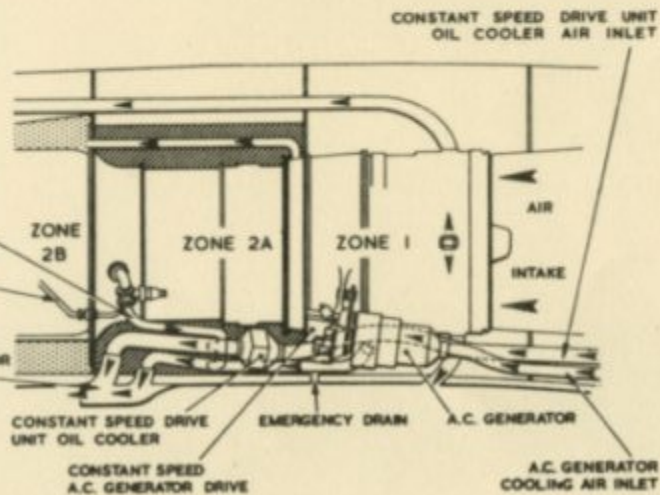
AIR OUTLETS AT B

PRESSURE AIR TO INDUCE COOLING OF CONSTANT SPEED DRIVE UNIT OIL COOLER AND A.C. GENERATOR DURING GROUND RUNNING AND TAXIING

ZONE 2B VENTILATION INDUCER

CONSTANT SPEED DRIVE UNIT OIL COOLER AND A.C. GENERATOR COOLING AIR OUTLET

EMERGENCY DRAIN



VIEW ON STARBOARD SIDE

TR 4149

ENGINE VENTILATION DIAGRAM

AIR INTAKE NOSE PAIRING
HEATED BY HOT AIR FROM
THE AIR INTAKE VANES.

ELECTRICALLY OPERATED VALVE TO CONTROL
HOT AIR BLEED FROM THE H.P. COMPRESSOR
DELIVERY CASING FOR ENGINE ANTI-ICING.
TEDDINGTON TYPE VALVE INTEGRAL WITH ENGINE.

DUCT DISCHARGING
ANTI-ICING AIR AFT
OF REAR BULKHEAD.

ENGINE BREATHER
OUTLET PIPED
OVERBOARD BY
AIRCRAFT
MANUFACTURER

OUTLET TO
ENGINE BAY

CIRCUMFERENTIAL COLLECTOR RING
THROUGH WHICH HOT AIR IS LED TO THE
L.P. COMPRESSOR ENTRY GUIDE VANES.

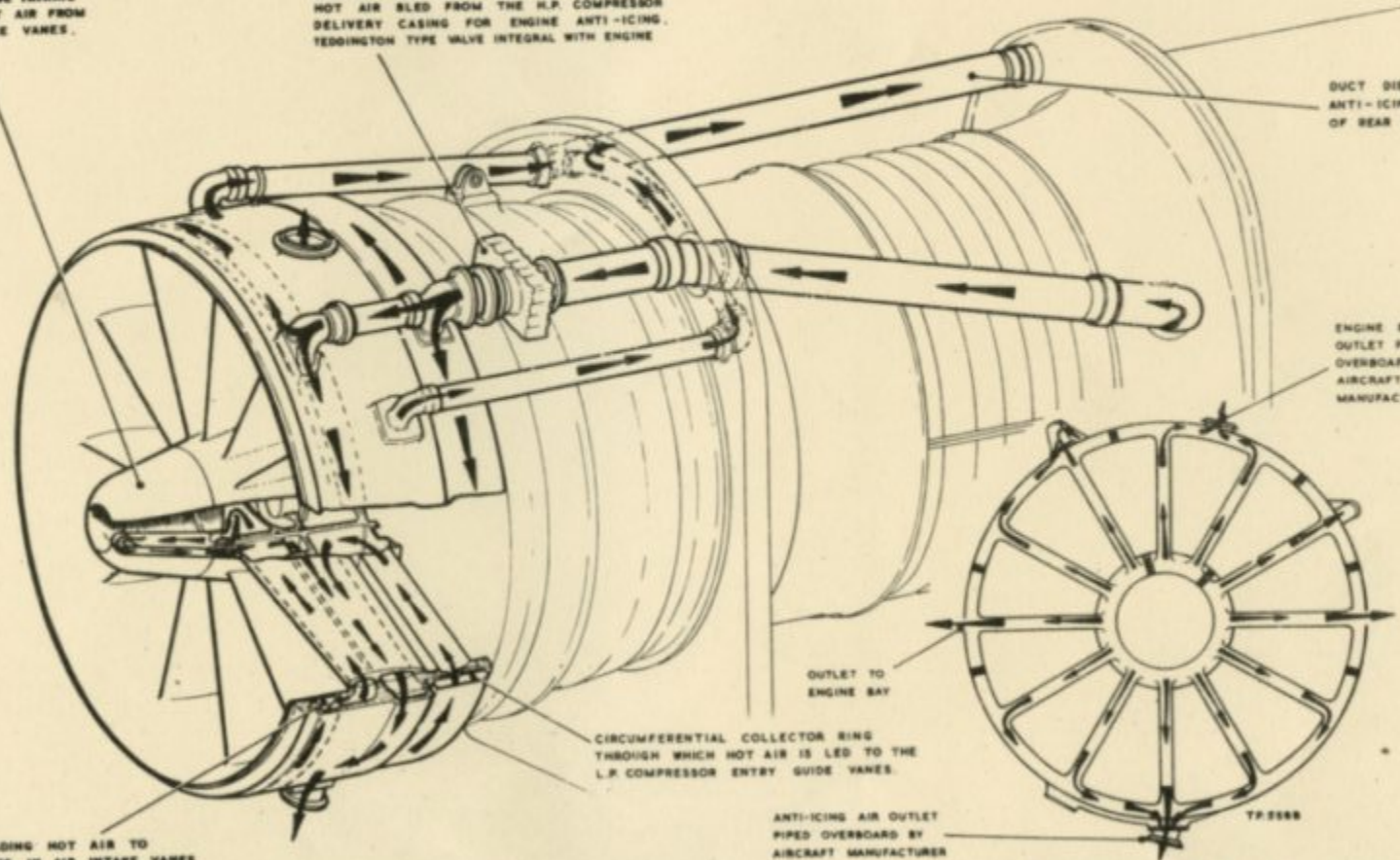
ANTI-ICING AIR OUTLET
PIPED OVERBOARD BY
AIRCRAFT MANUFACTURER

TP 2588

ANNULUS LEADING HOT AIR TO
FRONT PASSAGE IN AIR INTAKE VANES

SECTION THROUGH REAR DUCTS
OF INTAKE CASING VANES.

OLYMPUS MARK 301 ENGINE ANTI-ICING SYSTEM



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