

SECTION 10

INSTALLATION OF ENGINE AND ACCESSORIES

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AERO ENGINE SCHOOL

10.1 HYDRAULIC PUMP INSTALLATION

Drain pump of preservative fluid. Fit the Union Body with bonded seal to outlet connection of pump.

Assemble the Banjo Standard, Banjo unit with the two seals, to spill connection on pump.

Fit the Adaptor Unit and seal to inlet connection on pump.

Check "O" type seal in groove on pump spigot, ensure seal is serviceable; (Seal supplied with pump).

Remove the blanking plate from E.C.U. and fit pump quill shaft and retaining circlip.

Ensure circlip is located correctly.

Clean mating surfaces of E.C.U. and pump, and fit pump. Tighten all nuts evenly.

Fit Housing to front bulkhead then spectacle plate.

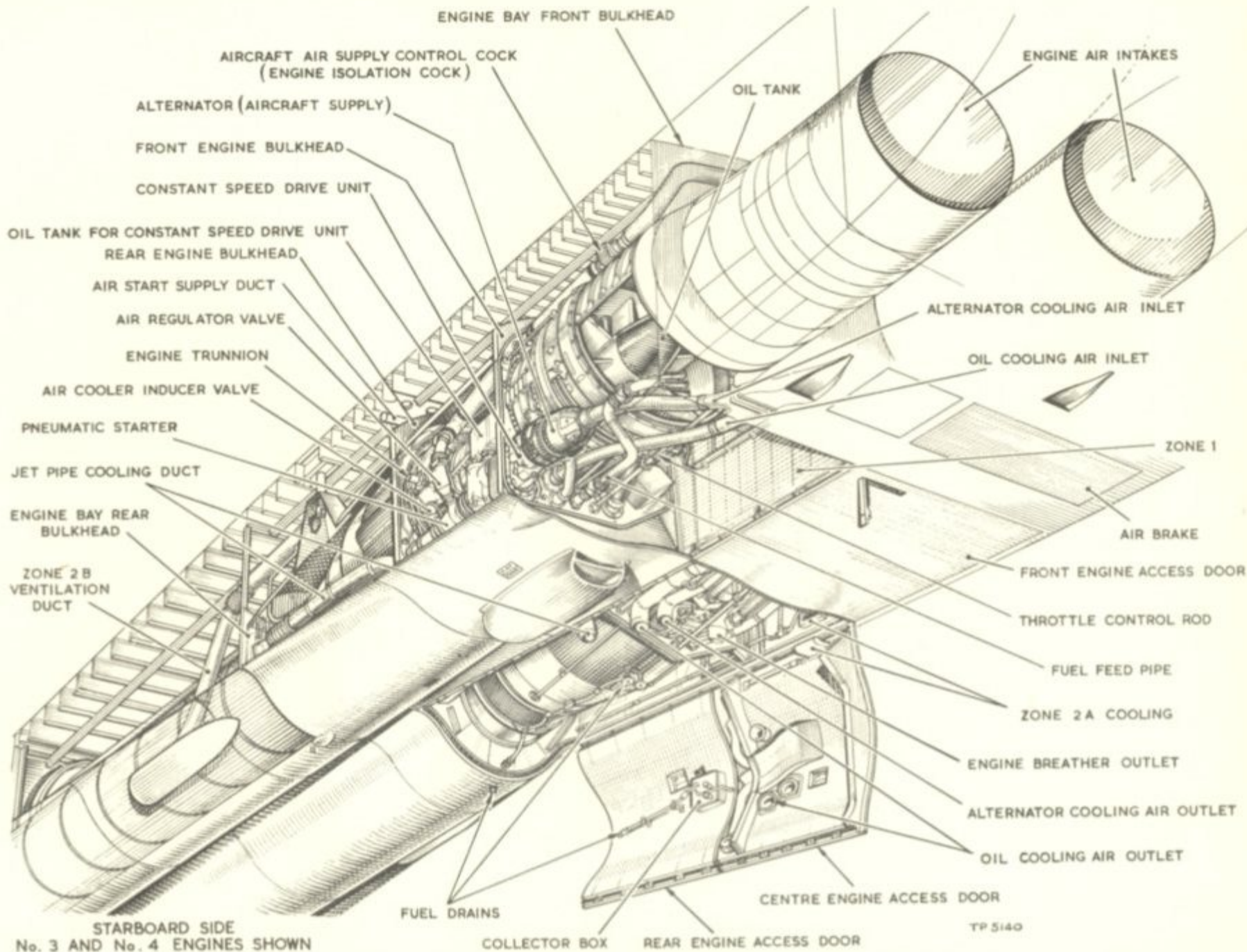
Connect up inlet and outlet connections to pump.

Connect up Flexible pipe from Banjo unit on pump to front bulkhead.

Fit retaining ring to leading edge of housing.

Wirelock all connections on Hydraulic pump and at rear side of front bulkhead.

It is advised to drain the oil sump before changing a Hydraulic pump.



Engine installation

AERO ENGINE SCHOOL

10.2 INSTALLATION OF AIR STARTER, CONTROL VALVE AND DUCTING

Generally cleanse Air Starter Type 37F 18002 of preservative etc. and prime unit with 100 c.c. of D.E.R.D. 2487 oil. Refit priming plug and ensure plug is tabbed up.

Fit Starter outlet duct to starter with the 9 retaining bolts and tabwashers supplied with starter. Tab up bolts.

Remove starter motor blank from engine, retaining the clamp unit for refitment.

Fit starter quill drive shaft and retaining circlip.

Ensure circlip is located in groove.

Clean starter adaptor face and fit locating dowel.

Fit starter motor to engine, ensuring "O" type seal on spigot is satisfactory. Fit retaining clamp and lock nuts.

Connect electrical breeze plug to starter motor and wire lock.

Remove blank from engine ducting and temporarily remove retaining ring

Place sleeve retaining cover on engine ducting, position sealing ring gaps 180° apart and fit spherical

sleeve followed by retaining ring.

Insert two dowels in Elbow unit and fit over spherical sleeve, bolt to sleeve retaining cover using eight bolts, nuts and tabwashers. Ensure all nuts are tabbed up.

Fix Starter Control Valve, locating by two dowels and retain to elbow by retaining clamp.

Fit adaptor unit to Control Valve and starter by use of clamps.

Fit link, two Pins, to Elbow unit and locating point on H.P. Compressor horizontal joint.

Connect electrical breeze plug to control valve and wire lock.

Fit sealing ring in cone flanges and fit flanges into appropriate ends of Duct unit inserting the flanges to their full depth.

With the

With the tongued cone flange to the starter motor
extend the cone flanges to the rear bulkhead and starter
outlet duct. Retain in position with clamps.

AERO ENGINE SCHOOL

10.3 INSTALLATION OF CONSTANT SPEED DRIVE UNIT.

Cleanse C.S.D.U. and dressing of preservative.

Fit Blanking plug "O" Seal and tabwasher to oil tube support bracket.

Fit support bracket to drive shaft end of C.S.U. using Bolts, Nuts and spring washer and tabwasher.

Fit two "O" Seals to oil tube units.

Assemble oil tube units to their elbows.

Remove blanks from C.S.U. and fit retaining rings to oil outlet and vent apertures.

Retaining ring and "O" seal to oil inlet aperture.

Assemble oil tubes and elbows to C.S.U. in the following sequence : Outlet, Inlet followed by the Vent tube.

Fit bonding clips, leads, and tab up tube elbow retaining bolts.

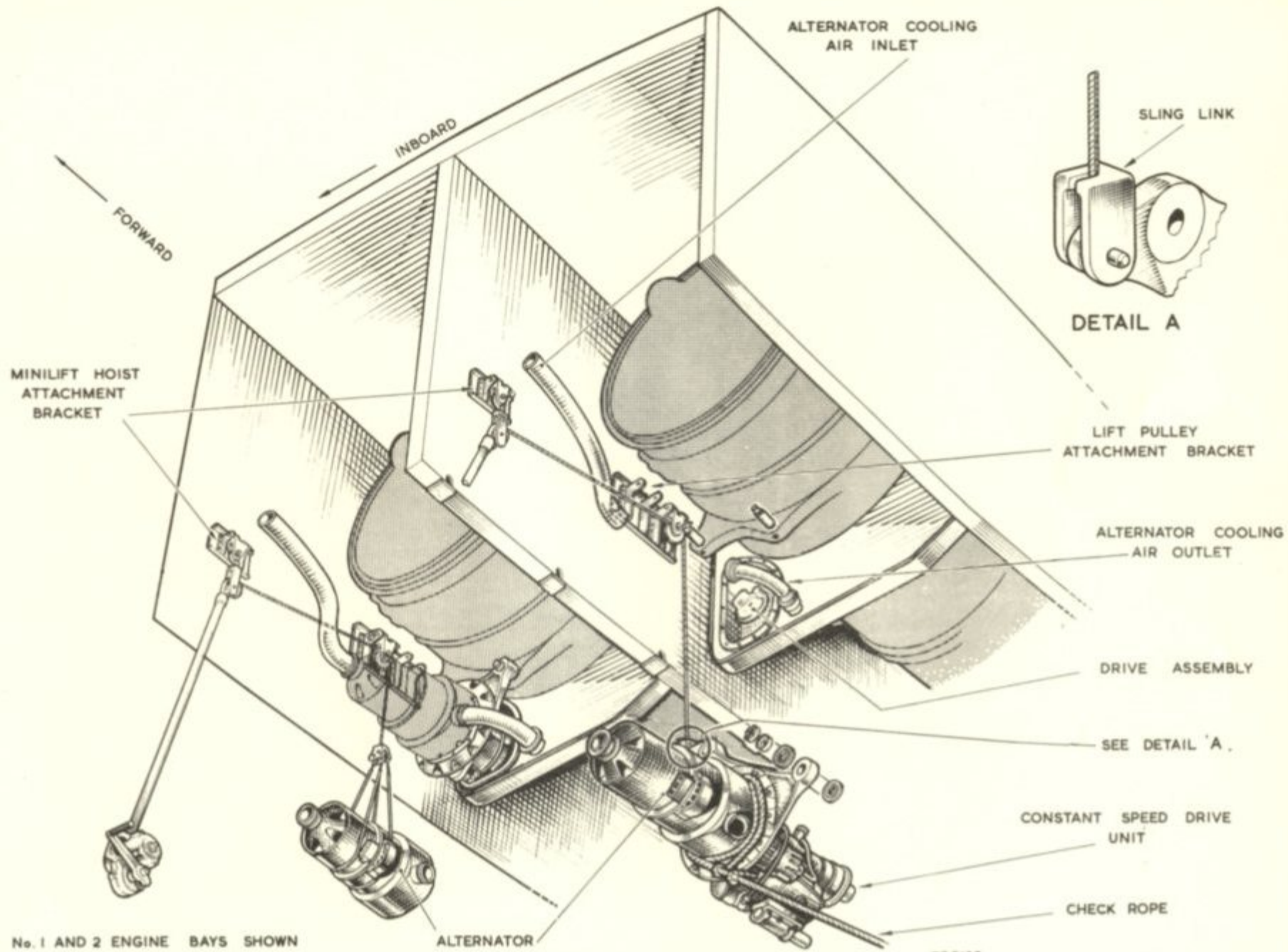
Fit dowels and bonding lead to Mounting Bracket
Assemble and secure bracket to C.S.U. using nuts and tabwashers supplied with C.S.U.

Fit mounting bracket support bolts to L.P.

Compressor casing. Retain in place by bolt and washers. Fit one spacer washer on each mounting bolt.

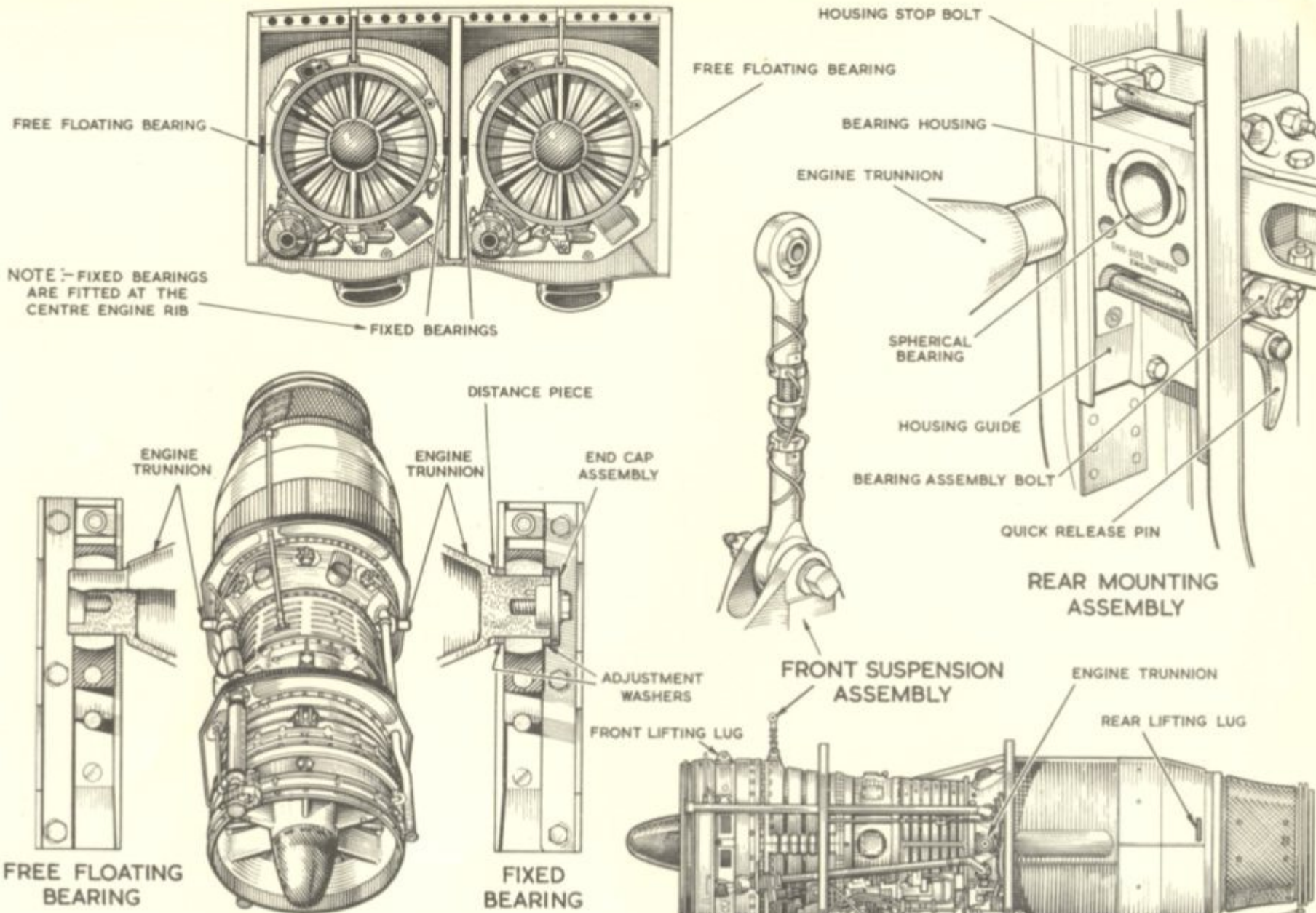
Remove C.S.U. drive blanking plate from engine and fit quill shaft and retaining circlip. Ensure circlip is located in groove.

Check "O" seals on oil tubes in engine and replace if necessary. Fit C.S.U. and mounting bracket by spacer washer, Cup washer and Nut. Tap up cup washer. Fit main bonding strip front bracket to L.P. Casing.



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Constant speed drive/alternator removal

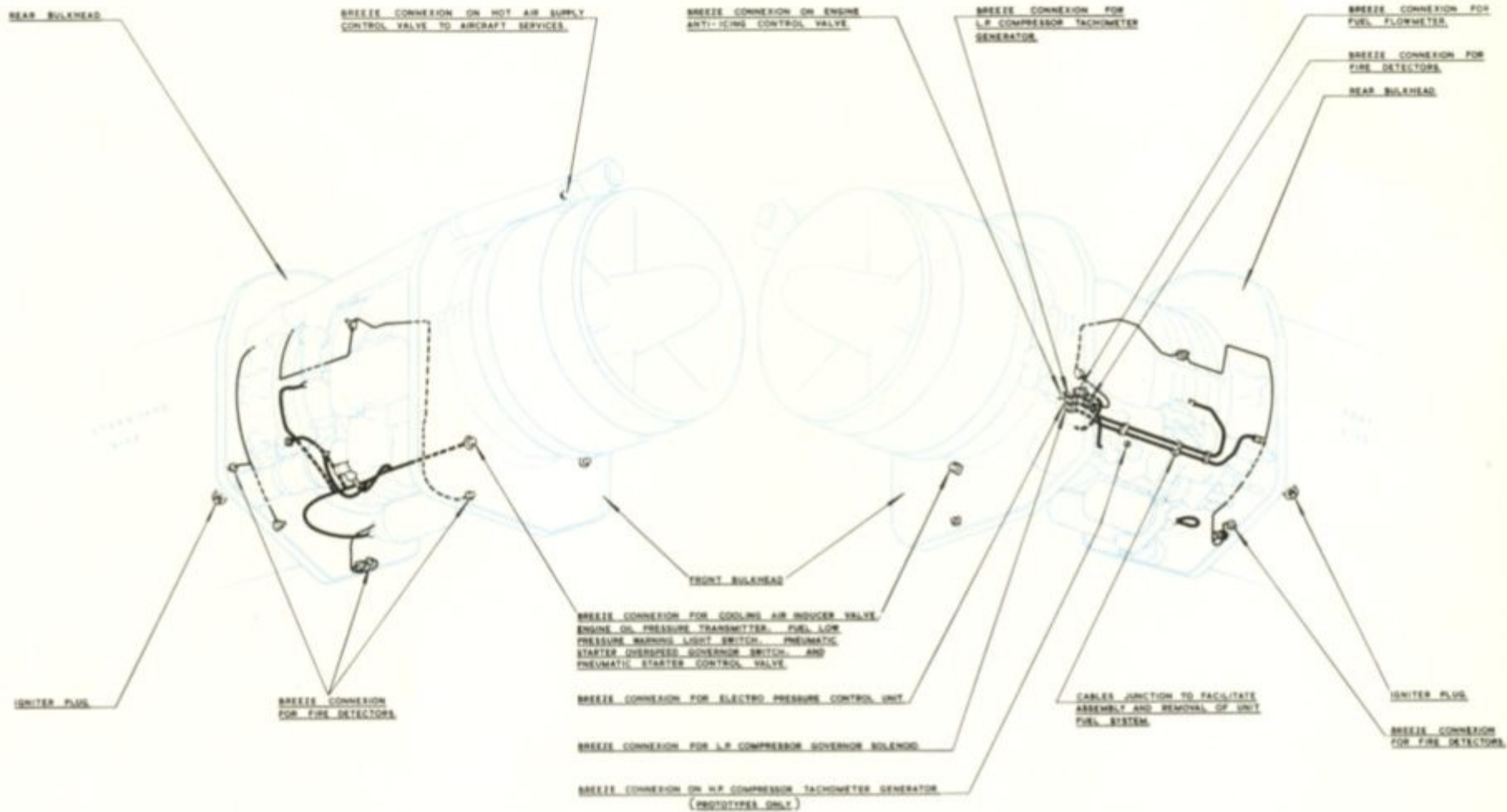


STARBOARD SIDE
 No. 3 AND No. 4 ENGINES SHOWN

TP 5141

Engine mounting

FOR FURTHER PARTICULARS OF
ELECTRICAL SYSTEM SEE B.12327A



ELECTRICAL CONNEXIONS.

AERO ENGINE SCHOOL10.4. INSTALLATION OF ALTERNATOR

Generally cleanse alternator and dressing of preservative, and apply Molycote grease to Alternator drive shaft splines. Ensure cooling air inlet remains blanked off, until inlet ducting is connected. Fit Alternator to mounting bracket, aligning dowel, and retaining in position by manacle clamp assembly.

AERO ENGINE SCHOOL

10.5 POWER UNIT REMOVAL AND ASSEMBLYPreliminary Checking of the Engine Change Unit

Before an E.C.U. is removed or installed the rigging angle of the aircraft must be checked in accordance with the following procedure :

Gain access to the main wheel bay where two $\frac{3}{8}$ " dia. holes will be found in the inboard rib.

Insert a $\frac{3}{8}$ " dia. steel rod in each hole and place a straight edge across the rods.

Using a clinometer, check the aircraft rigging angle. This angle although normally +5 deg. will now vary due to surface level, tyre pressure etc.

Record the rigging angle since, when the E.C.U. is installed, this figure +5° becomes the true engine angle.

When it is necessary to change an engine already installed, a simplified method would be to check the existing engine prior to removal and install the replacement engine in the original position.

Removal of an Engine Change UnitPreparation for Removal

Assuming that the engine access doors have been removed, the following paragraphs give the sequence for the removal of the E.C.U. beginning at the front of the installation and working rearwards.

After closing the low pressure coaks, disconnect the fuel feed pipe at the "King" coupling on the E.C.U. and at the joint on the engine bay rib.

Release the pipe from the support bracket on the front of the L.P. compressor and remove the pipe.

Disconnect the three hydraulic pump pipes at the Avery couplings on the engine bay wall.

Hydraulic pumps are fitted to Nos.1, 2 and 3 engines only.

Disconnect and ...

Disconnect and remove the air intake ducting for alternator and oil cooling.

Disconnect electric cables to alternator and secure loose cables so as not to foul the engine.

Release and remove the engine control torque shaft.

Disconnect breeze plugs for the following services:-

- A. Engine Oil Press, Starter Valve, Overspeed switch, Inducer valves, Low pressure fuel pressure switch.
- B. C.S. Drive governor
- C. Fuel Flow Meter
- D. Engine anti-icing actuator
- E. L.P. Tacho. Generator.
- F. Double Datum Governor Solenoid
- G. J.P.T. Limiter Control.
- H. Fire Detection

Release the toggle fasteners on the air intake coupling clamps and the toggle fastener on the duct, the assembly can then be removed in sections. Care must be taken to ensure that the nose cone is not damaged during this operation.

Disconnect the aircraft air supply duct at the engine isolation cock and the engine bay wall and remove the ducting, disconnect breeze plug from valve.

Remove the detachable make-up pieces from the E.C.U. bulkhead.

Disconnect and remove the lower pipes of the fire extinguisher system in zones 2A and 2B.

- A. 1. Remove rear part of Air starter exhaust ducting to gain access.
- 2. Disconnect aircraft services air feed from Inducer valve elbow.
- 3. Disconnect inducer feed pipe from rear face of engine bulkhead.
- 4. Disconnect Fire Detection breeze plugs from rear bulkhead.
- 5. Remove air intake ducting to jet pipe.
- 6. Disconnect fuel drain connections at bellows joint and aircraft rear bulkhead.

Disconnect the igniter plug cables and igniter plug brackets.

Remove Jet Pipe Nozzle Fairing.

Disconnect and remove the jet pipe limiter cables.

Disconnect the jet-pipe temperature indicator leads.

B. 1. Release

AERO ENGINE SCHOOL

- B. 1. Release the toggle on the jet pipe tunnel seal unit and remove seal.
2. Release the bellows manacle clamp and bedding strap and remove from bellows.
3. Push bellows joint rearwards and remove, jet pipe retaining channels.
(support jet pipe to ensure it does not slide back into tunnel).
4. Ease jet pipe back into tunnel at the same time easing the bellows joint forward from the jet pipe.
5. When bellows joint is free of jet pipe remove joint from bay.

Taking care not to damage the "Refrasil" blanket withdraw the jet pipe into the jet pipe tunnel and secure in this position with cords or padded wooden wedges.

Remove the bolts securing the fire detector at the bottom of the rear bulkhead and position the fire detector so that it will not foul the engine during removal.

Engine lifting hoists Ref. 26 DC/95266 can now be attached to the aircraft, one at the front, two at the rear. The method of attachment is as follows :-

Engage the forward hoist top hook with the

lifting hoist attachment assembly in the top of the engine bay, just above the E.C.U. nose cone. This hook will engage correctly only when offered with the point at the top and forward.

Remove the special terminal attachment from the end of the hoist cable.

Withdraw the pivot pin from the front lifting point pulley (engine bay roof) and remove the pulley.

Route the hoist cable through the roof intercostals; under the first guide roller and over the second, and down through the pulley housing.

Re-assemble the lifting point pulley so that the cable passes over it from front to rear and secure the pivot pin with the quick release lock pin.

Refit the

Refit the terminal attachment to the hoist cable.

Engage the attachment unit with the forward lifting point on the E.C.U.

Engage the rear lifting hoists, inboard and outboard of the E.C.U. with their appropriate hook assemblies in the aft section of the engine bay roof. The point of the hooks should face forward. Engage the terminal hook with their appropriate lifting points on the e.c.u.

Remove the safety ("Terry" type) pins from the two rear trunnion bearing housing belts, i.e. the one above the quick release pin, and the split pin from the front suspension bolt at the E.C.U. attachment bracket.

With a suitable number of personnel stationed at each hoist and another person acting in a supervisory capacity, the hoists should be operated until the cables of all three hoists are just in tension.

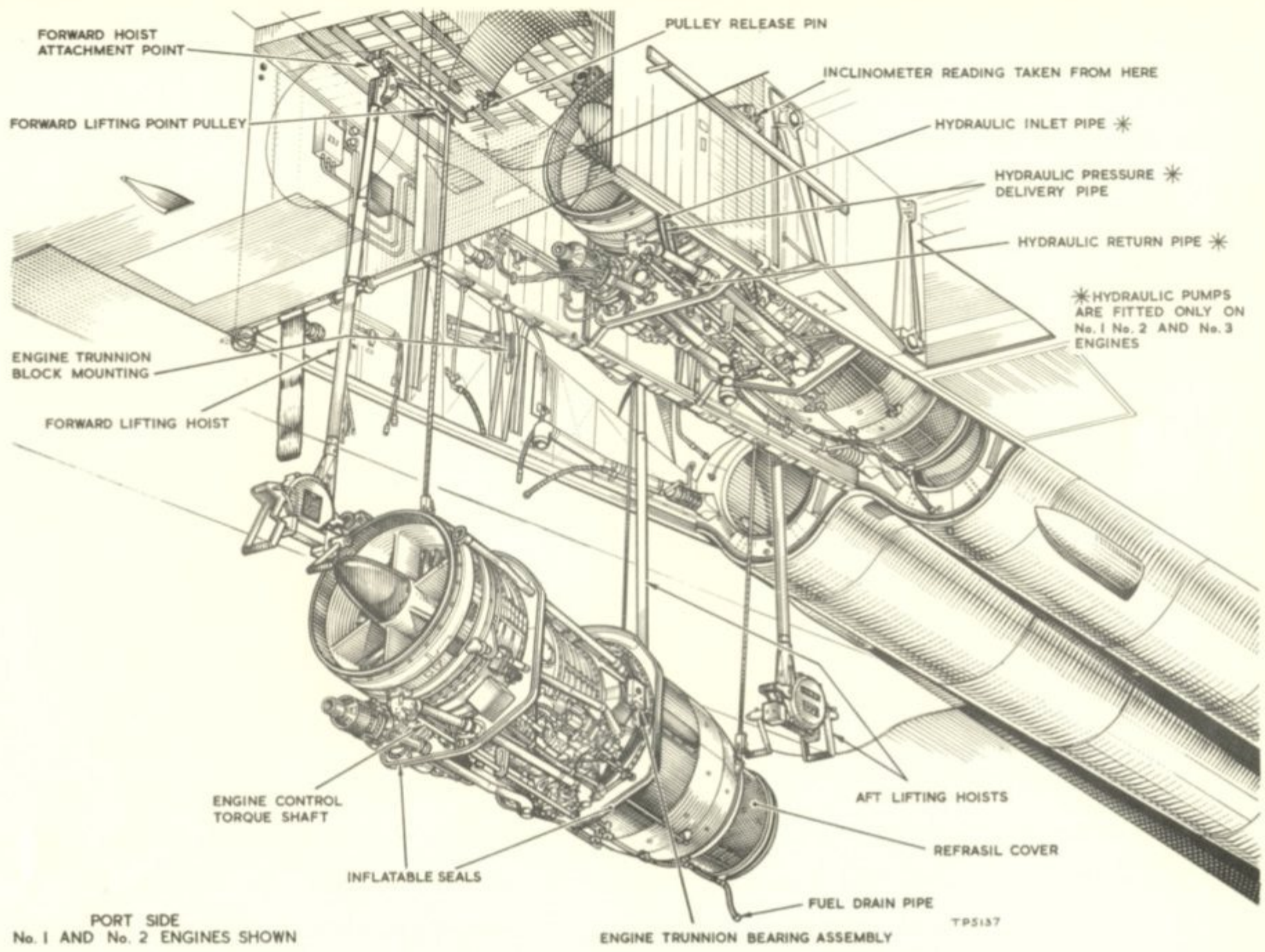
Disconnect the front suspension link and withdraw the bolt (para.4) from the rear trunnion bearing assembly.

Operate the rear hoists until the trunnion bearing housing contact the stops in the housing guides; the quick release pin can be withdrawn.

The E.C.U. may be lowered slowly, check being made to ensure that equipment and components are clear and in no danger of fouling. When the E.C.U. is approx. half way out of the engine bay the lowering should be stopped. The forward hoist should now be operated to bring the E.C.U. horizontal. Special attention should be given to ensure that the nose cone is not damaged.

An E.C.U. servicing stand/trolley can now be positioned below the engine bay ready to receive the removed E.C.U.

Remove the trunnion bearing assembly housings from the



PORT SIDE
No. 1 AND No. 2 ENGINES SHOWN

Engine removal (2)

AERO ENGINE SCHOOL

from the E.C.U. and lower with a simultaneous number of turns on each hoist until the E.C.U. rests on the stand. Remove the lifting hooks and secure the E.C.U. to the stand. The stand can now be moved away and the replacement E.C.U. positioned below the engine bay.

Installation of Engine Change Unit

An E.C.U. is installed by reversing the procedure given in the previous paragraphs. Care should be taken when assembling the trunnion bearings to ensure that the floating bearing is on the correct side of the engine.

The correct procedure is as follows :-

1. The fixed spherical bearings are fitted to the inboard side of an outboard engine and the outboard side of an inboard engine, i.e. the side adjacent to the centre engine rib.
2. On this side, fit the distance piece on the trunnion ensuring that the bore radius is nearest the engine.
3. To obtain correct engine alignment in the engine

bay fit washer or washers (.03 in. thick, Ref. No. 26DC/8543) and .06 in. thick, Ref. No. 26DC/8544).

Note:

By using various combinations of these washers an adjustment of .12 in. can be obtained in either direction.

4. Assemble the spherical bearing on to the trunnion, following the instruction "THIS SIDE TOWARDS ENGINES" etched on the face of the bearing housing. The trunnion is lubricated as assembly with oil OX-14.
5. Assemble the end plate, tab washer and bolt to the threaded portion of the trunnion, ensuring that the locating pin of the end plate is fully home in the hole provided in the trunnion.
6. Tighten the bolt on the complete end plate assembly and bend back the tap on the locking washer.

When the

When the E.C.U. is installed, place a straight edge across the front face of the air-intake casing and, with a clinometer, check the angle of the engine. To obtain the correct angle, adjustment is carried out on the front suspension link, as described in para.1.

AERO ENGINE SCHOOL

10.6 INSTALLATION OF JET PIPE

Check that Dowel is fitted and apply Dag to the bellows joint.

Fit two Jet Pipe Locating Dowels.

Fit bellows joint over jet pipe and mate jet pipe on engine.

Fit jet pipe retaining channels and pull jet pipe back as far as possible trapping retaining channels.

Fit bellows joint, aligning dowel and retail in position with manacle clamp. Torque load clamp retaining bolts to 80lbs ins.

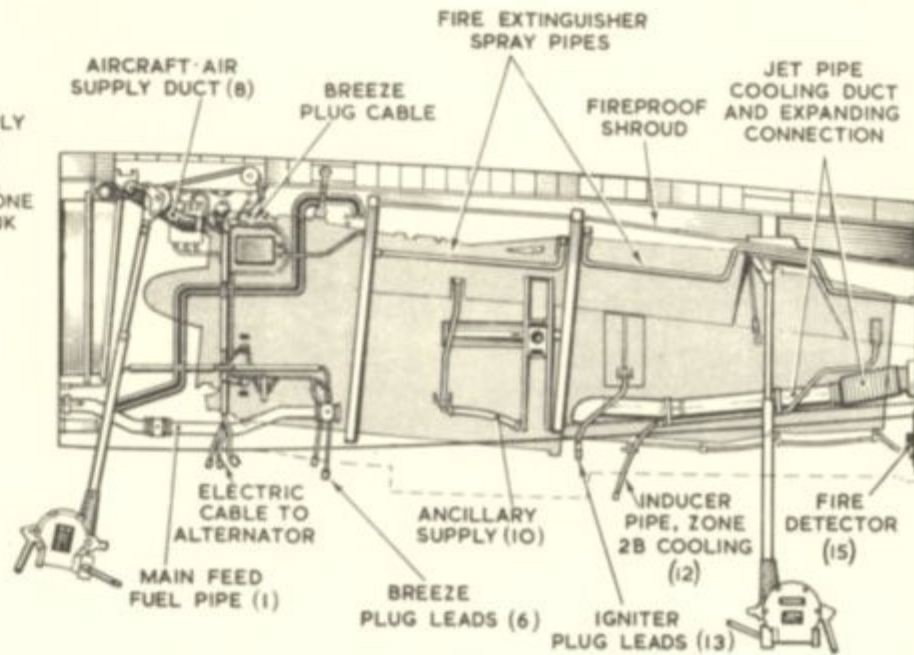
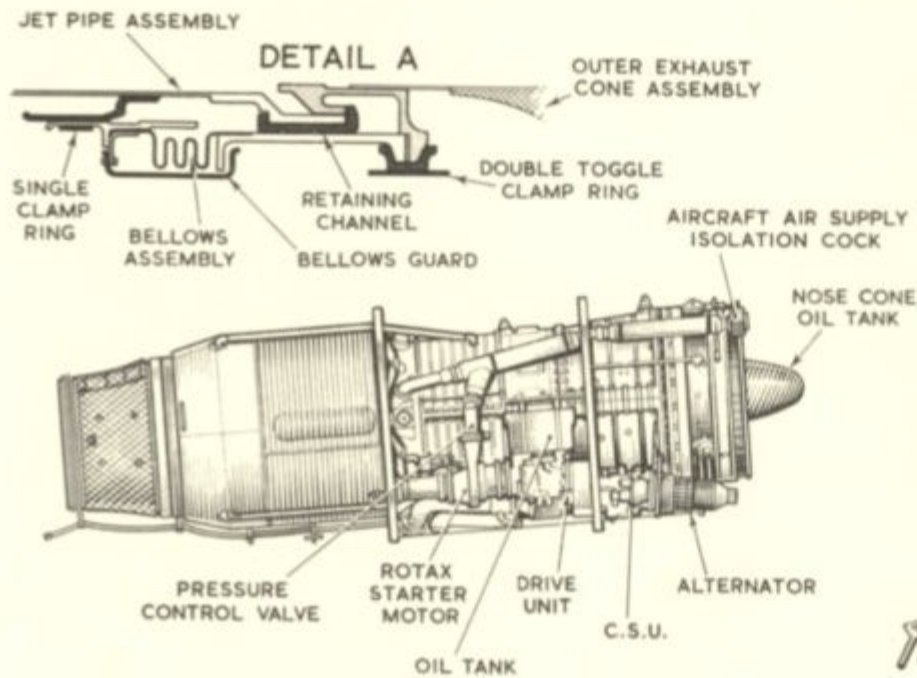
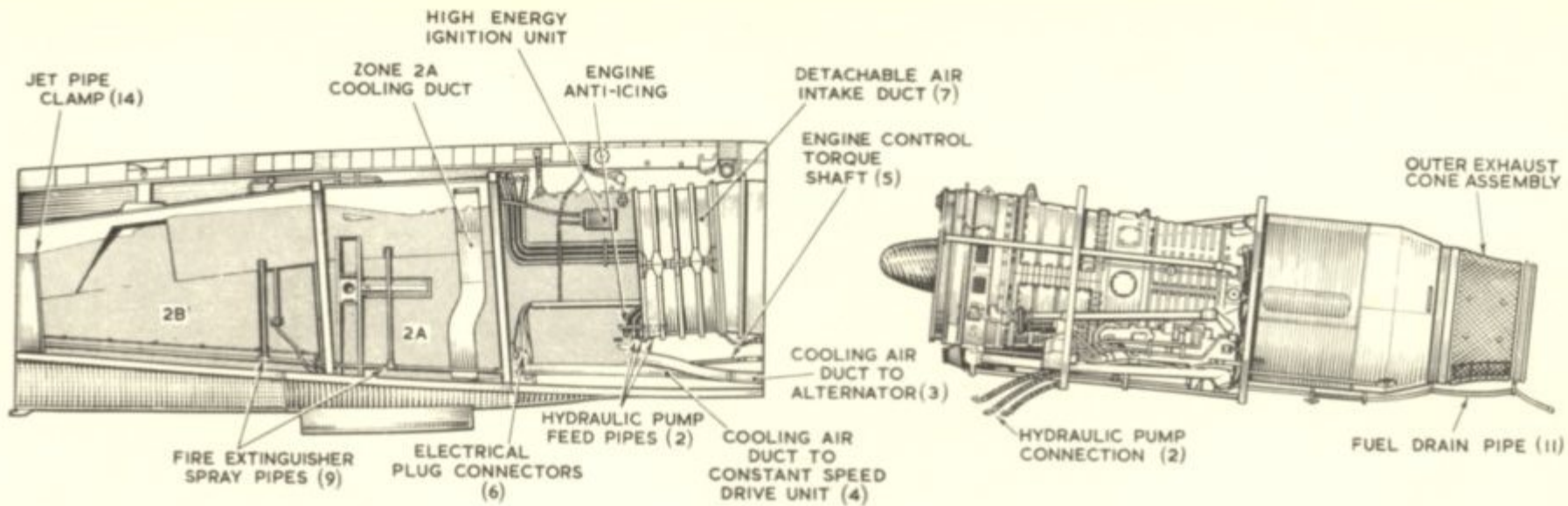
Fit bellows strap unit to rear of bellows and torque load retaining bolts to 80lbs ins.

Connect up turbine drain pipe from engine to bellows joint.

The Jet Pipe is suspended in the tunnel by the three front and three rear rollers, the former being at the 8,12 and 4 o'clock positions, the latter being at the 10, 2 and 6 o'clock positions. The lower rear roller

is located on an adjustable rail so that the jet pipe can run down as it expands.

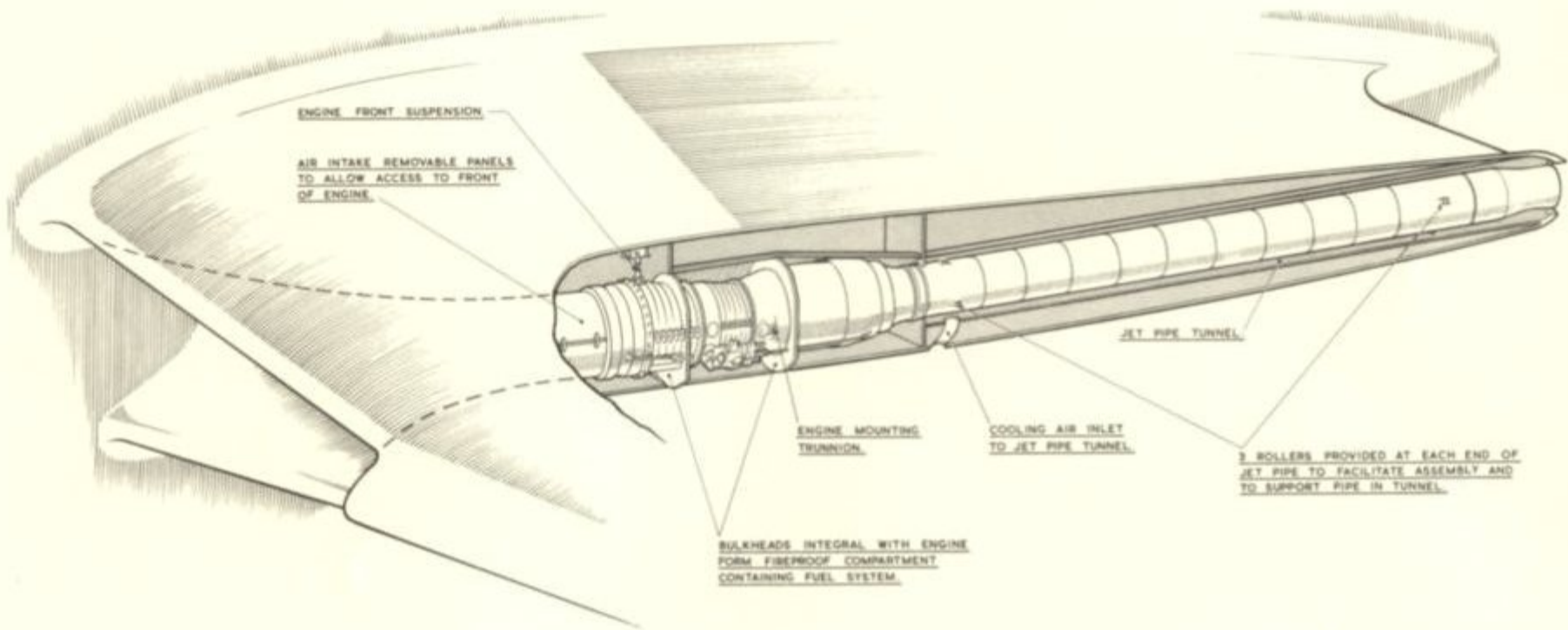
The design of this rear location is such that linear expansion of the jet pipe may take place without altering the concentricity of the pipe in the tunnel.



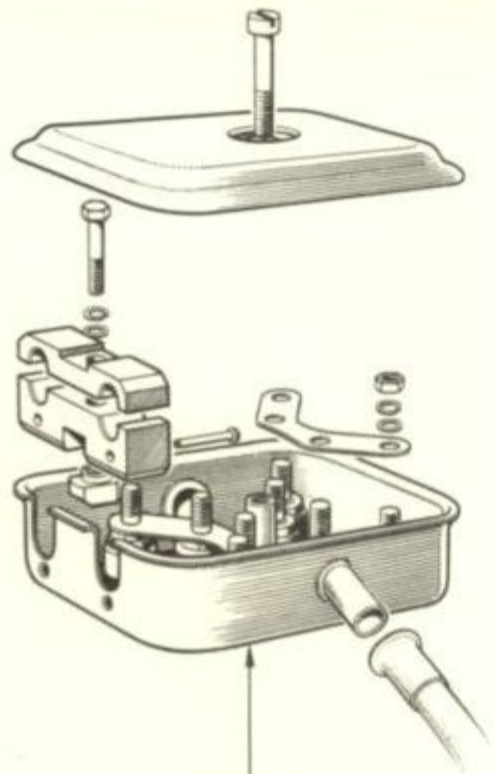
No. 2 ENGINE SHOWN

Engine removal (1)

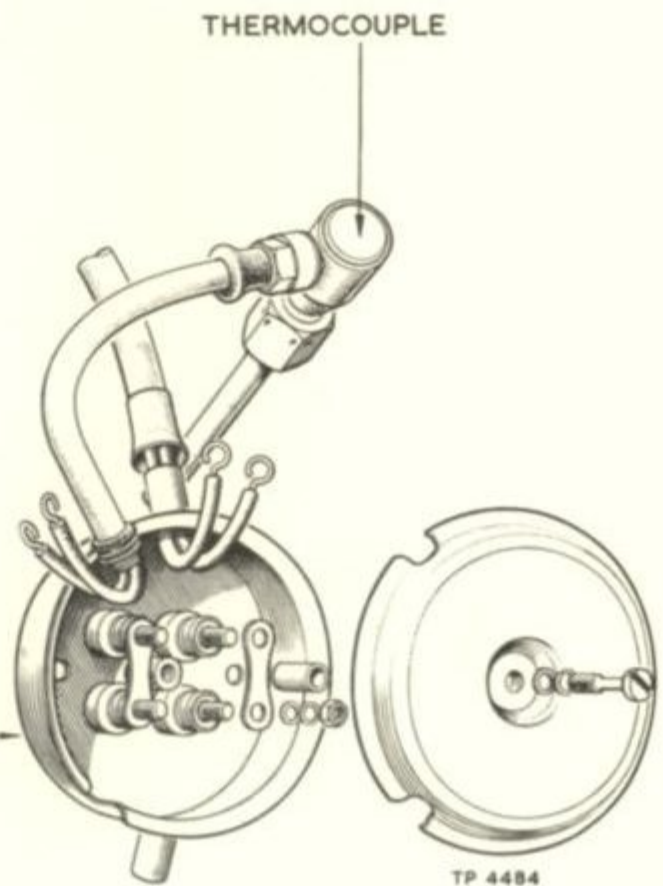
TP 5134



TYPICAL WING INSTALLATION.



THERMOCOUPLE JUNCTION BOX



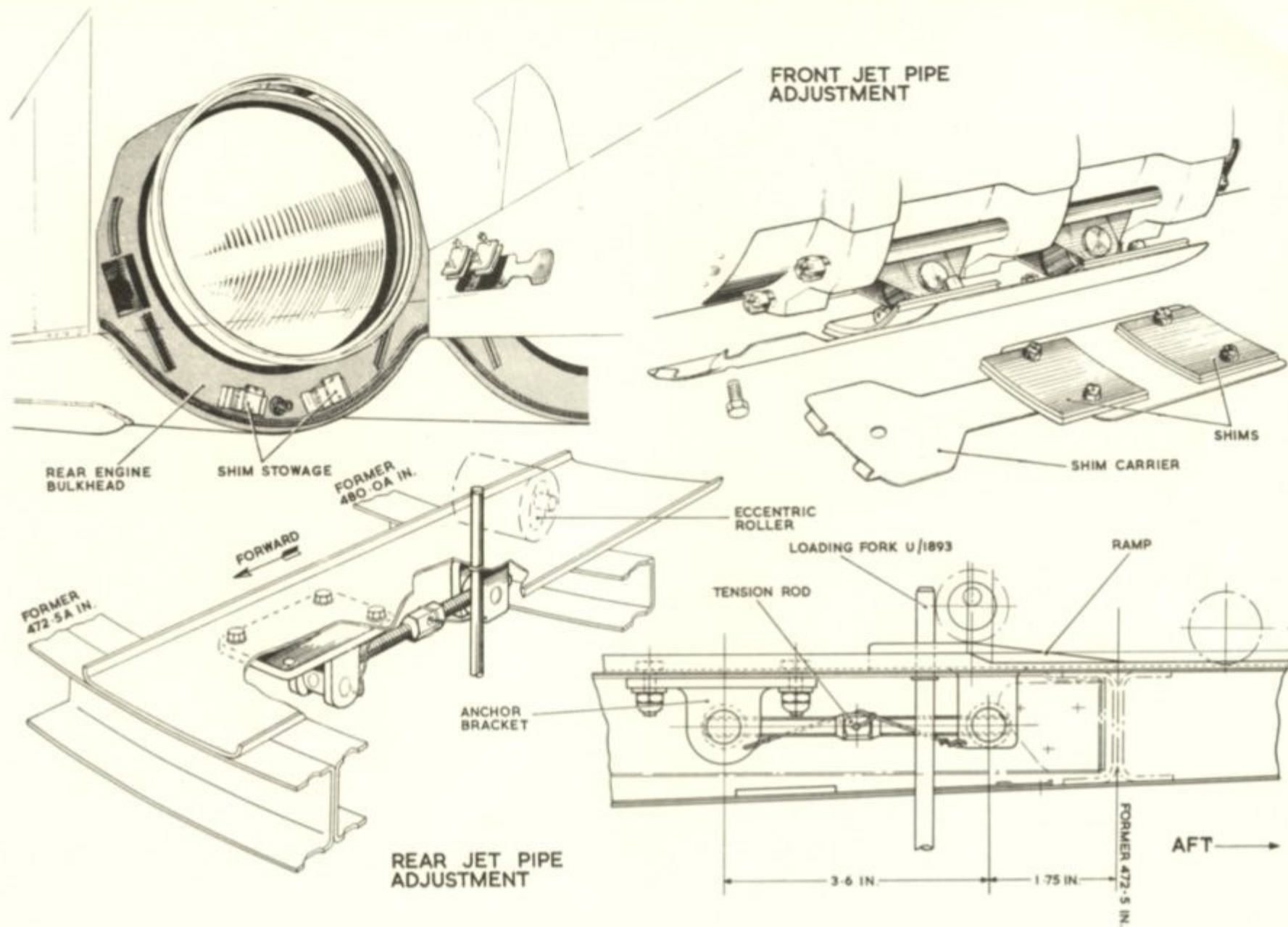
THERMOCOUPLE

THERMOCOUPLE
TERMINAL BOX

TP 4484

THERMOCOUPLE HARNESS

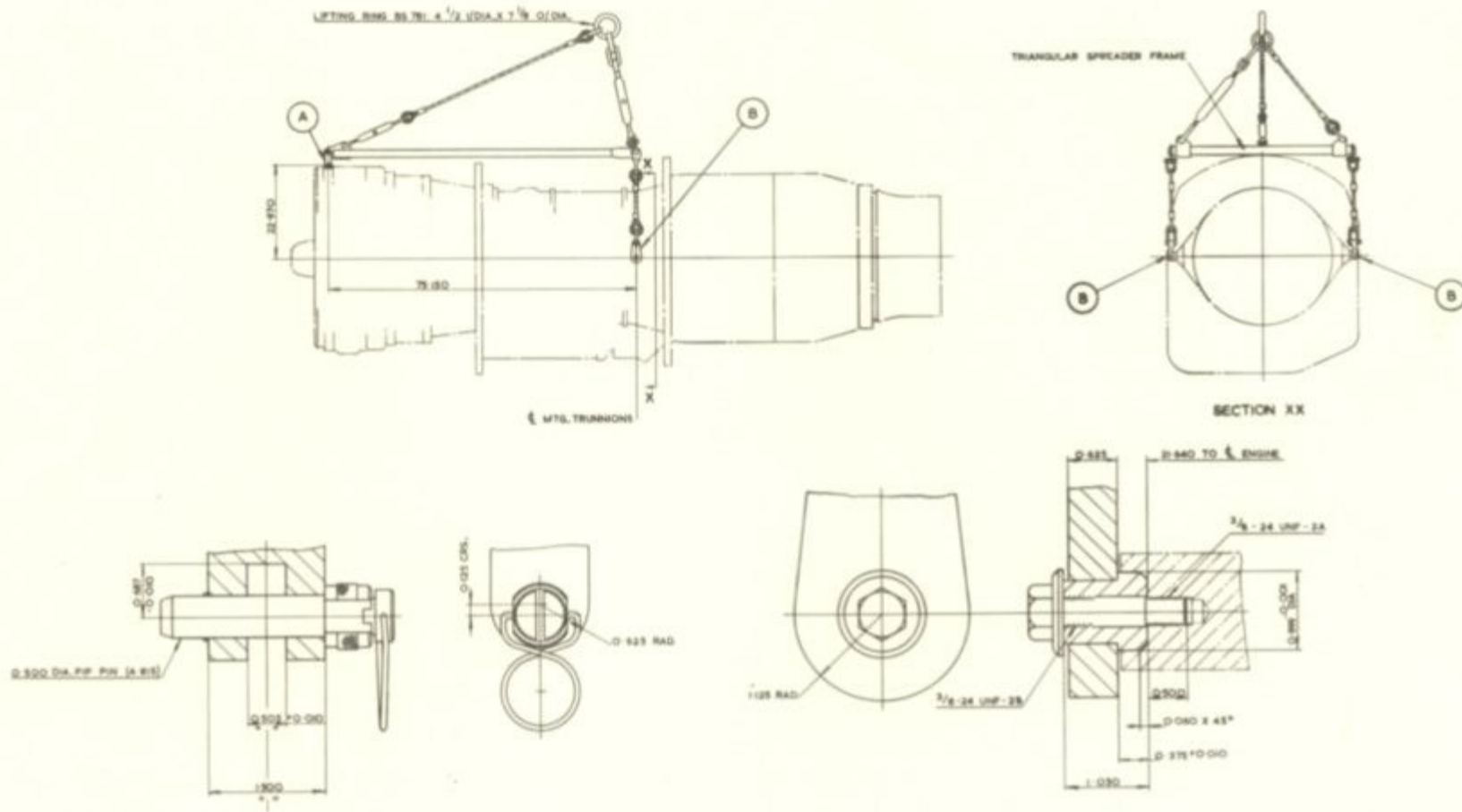
RESTRICTED.



JET PIPE ADJUSTMENT.

TP. 5892.

RESTRICTED



TYPICAL LIFTING SLING.

TP6148

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